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Title: Student and pre-registration pharmacist performance in a UK Prescribing Assessment

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Abstract

Student and pre-registration pharmacist performance in a UK Prescribing Assessment': room for improvement and need for curricular change

Background

Increasingly the global policy direction is for patient-facing pharmacist prescribers. The '*UK Prescribing Safety Assessment*' (PSA) was developed for medical graduates to demonstrate prescribing competencies in relation to the safe and effective use of medicines.

Objectives

To determine PSA performance of final year undergraduate student pharmacists (year 4) and pre-registration pharmacy graduates (year 5) and explore their opinions on its suitability.

Setting

Scotland, UK

Methods

Final year undergraduates (n= 238) and pre-registration pharmacists (n= 167) were briefed and undertook the PSA. PSA questions were mapped to specific thematic areas with 30 questions over 60 minutes. Data was analysed using descriptive statistics. A questionnaire was completed to gauge opinions on appropriateness of the PSA.

Main Outcome Measure

PSA scores

Results

Mean total PSA score for pre-registration pharmacists (64.4, SD 10) was significantly higher than for undergraduates (51.2, SD 12.0,) ($p<0.001$). Pre-registration pharmacists performed significantly better across all question areas (all $p<0.001$ other than 'adverse drug reactions', $p<0.01$). Hospital pre-registration pharmacists performed statistically significantly better than community with higher overall scores (67.4, SD 9.8 v 63.2, SD 9.8, $p<0.05$). Positive views on the appropriateness of the approach and the usability of the online interface were obtained from participants.

Conclusion

Hospital **pre-registration pharmacists** performed better than the undergraduates, but there is a need to improve prescribing skills in all, most notably in diagnostic skills. The PSA is acceptable to the participants. These results will help inform pharmacy curricula development and provides a cross-disciplinary method of assessment of prescribing competence.

Keywords: prescribing skills, competency, pharmacy education

Impacts on Practice:

- The 'UK Prescribing Safety Assessment' (PSA) shows validity and acceptability of use in final year undergraduate pharmacy students and pre-registration pharmacists.
- Results will help inform pharmacy curricula development and provides a common cross-disciplinary method of assessment of prescribing competence.
- Policy and regulatory changes mean increasingly prescribing skills will be introduced earlier in the education of pharmacists necessitating ongoing development of the PSA

Ethics approval: The study was approved by the management committee at NES and ethical review committees at each university [S128 (20/03/2018)]

Consent to participate: All participants registered on the PSA online system and were provided with full information about the PSA and the study. Consent was assumed by completion and submission of the survey.

Consent for publication: All participants registered on the PSA online system and were provided with full information about the PSA and the study. Consent was assumed by completion and submission of the survey.

1 Student and pre-registration pharmacist performance in a UK Prescribing Assessment

2 Introduction

3 There is a need for research on how services can improve patient access to, and safety of, medicines. Poor
4 medication practice causes injury and harm, and annually costs an estimated \$42 billion USD globally. The
5 WHO plans to reduce this by 50% by 2022 [1]. While there is evidence of effectiveness of non-medical
6 prescribing, there lack studies which have focused on prescribing errors and patient safety. There is a vast
7 accumulation of evidence of widespread suboptimal prescribing by doctors that increases the risk of patient
8 harm [2-5] with evidence of the costs of inappropriate prescribing in the UK [6].

9 Prescribing by non-medical health professionals (eg pharmacists, nurses, allied health professionals,
10 optometrists) has been adopted into the legislative frameworks of several countries including Canada, Ireland,
11 New Zealand, the United States (US) and the United Kingdom [7] and a global survey, on advanced practice in
12 the pharmacy workforce, has shown that nearly a fifth of the 48 countries responding had prescribing rights [8].
13 While the specific models of practice vary, the stated aims are similar: improving patient care without
14 compromising safety; enabling easier and quicker access to medicines; increasing patient choice; better using
15 the skills of healthcare professionals; and contributing to more flexible team working [9]. Non-medical
16 prescribing is most advanced in the UK, with the introduction of supplementary prescribing in 2003 [10]
17 followed by independent prescribing in 2006 [11]. Independent prescribers prescribe, within their competence,
18 the same range of medicines as physicians. Evidence derived from systematic reviews confirms that non-
19 medical prescribing is as effective as medical prescribing in a range of acute and chronic conditions [12-13], and
20 well accepted by a diverse range of key stakeholders [14].

21 To improve prescribing competence and safety of medical graduates in the UK, a '*Prescribing Safety*
22 *Assessment*' (PSA) was developed by the British Pharmacological Society and the Medical Schools Council
23 [15]. The PSA is designed to be a valid and reliable assessment of prescribing skills based on competencies
24 identified by the UK General Medical Council: writing new prescriptions; reviewing existing prescriptions;
25 calculating drug doses; identifying and avoiding both adverse drug reactions and medication errors; and
26 amending prescribing to suit individual patient circumstances [16]. It is an open book, time-limited assessment,
27 with questions across seven different clinical settings. The standard set is that expected of final year medical
28 students, in the latter stages of their final exams, who are at the peak of their preparation for practice. All

29 candidates sitting the PSA have access to an electronic British National Formulary (BNF) and a calculator
30 inbuilt into the system. Following several years of piloting, the PSA was launched across the UK in 2014. Data
31 from over seven thousand UK final year medical students across 31 medical schools who participated in the
32 PSA in 2016 gave an overall pass rate of 95% of students, with marked variation between schools [17]. In 2015,
33 a pilot group of 59 pharmacist independent prescribers in Scotland participated in the PSA. The PSA in this
34 study consisted of 30 questions which had been used in the 2014 assessments for final year medical students.
35 The mean overall PSA scores (\pm SD) were 87.5% \pm 8.7 (range 52-98) compared to 88.5% for medical students.
36 Pharmacists performed equivalently to medical students in all assessment areas, with a slightly lower
37 performance in the prescribing, drug monitoring and data interpretation questions offset by better performance
38 in prescription review and adverse drug reactions [18].

39 While medical students will prescribe (under supervision) at the point of graduation on completion of a five-
40 year undergraduate course, currently pharmacists must have at least two years of post-registration practice
41 experience in a patient-facing role prior to enrolling on the prescribing training programme [19]. Following
42 completion of a four-year undergraduate Master of Pharmacy degree in the UK, graduates must complete an
43 additional year of pre-registration training and assessment before registering as pharmacists with the General
44 Pharmaceutical Council (GPhC). Pharmacists must then be registered and practising for two years before being
45 allowed to undertake their prescribing qualification. So currently, the minimum time between graduation and
46 commencing prescribing training is therefore three years.

47 However, revised standards for the Initial Education and Training of Pharmacists, published by the GPhC in
48 January 2021, mean that pharmacy undergraduate courses will incorporate the skills, knowledge and attributes
49 for prescribing, to enable pharmacists to independently prescribe from the point of registration from August
50 2026 [20].

51 Work has been undertaken into aspects of prescribing training, practice and competence from the perspectives
52 of pharmacy students and pre-registration pharmacists. A cross-sectional survey of UK pre-registration
53 pharmacists identified that while most respondents expressed interest in prescribing training, they acknowledged
54 training needs in clinical examination, patient monitoring and medico-legal aspects of prescribing. Many cited
55 the need to first increase their confidence through experience and to demonstrate competence as a pharmacist
56 [21]. A later qualitative study with Scottish pre-registration pharmacists reported that while most expressed a
57 desire to train as prescribers, they acknowledged the need first to develop as pharmacists [22]. A more recent

58 study from England reported PSA performance of final year pharmacy students from four universities and local
59 pre-registration pharmacists. The mean scores for the pre-registration pharmacists in community (n=27) and
60 hospital (n=209) settings were 86.3% and 85.3%, respectively. For the 397 undergraduates, the mean score was
61 73% [23]. The number of candidates passing the PSA was not reported.

62 The International Pharmaceutical Federation have published a framework for the quality assurance of pharmacy
63 education with 5 'Pillars of Quality'[24]. There are differences in the context, structure and processes of
64 undergraduate and pre-registration training in Scotland. Here, there are two Schools of Pharmacy who work
65 closely together and in collaboration with NHS Education for Scotland (NES). Significantly, the initial
66 education has received Scottish Government funding to develop, implement and quality assure a comprehensive
67 programme of experiential learning placements and interprofessional learning initiatives. In addition, the pre-
68 registration training year is organised differently to other jurisdictions with NES co-ordinating all aspects. Given
69 the policy direction of pharmacist prescribing in Scotland, there is also a justifiable need for further PSA based
70 research in this context. In 2017 around 40% of pharmacists in Scotland had completed or were undertaking
71 prescribing training. The policy direction of the Scottish Government is for patient-facing pharmacists to be
72 independent prescribers managing caseloads of patients and for patients to increasingly access community
73 pharmacies as a first port of call for healthcare [25]. Furthermore, there has been significant investment to
74 employ pharmacists within general medical practices to contribute to patient care through a range of activities,
75 including prescribing [26].

76 So, to complement the previous PSA work in pharmacy student cohorts it is essential that similar confirmatory
77 research is undertaken in different educational and practice contexts within different healthcare jurisdictions so
78 we can better understand potential influences on student development and competence.

79 In this way it will be possible to continue the development of the PSA for it to be used internationally where
80 non-medical prescribing is being integrated to healthcare education and practice.

81 **Aims of the study**

82 To determine PSA performance of final year undergraduate student pharmacists (year 4) and pre-registration
83 pharmacists (year 5) in Scotland and explore their opinions on its suitability.

84 **Ethics approval**

85 The study was approved by the management committee at NES and ethical review committees at each
86 university. All participants registered on the PSA online system and were provided with full information about
87 the PSA and the study. Consent was assumed by completion and submission of the survey.

88

89 **Methods**

90 **Study design and setting**

91 This was a simple whole population non-randomised descriptive study in Scotland, UK.

92 **Study population**

93 Final year undergraduates (n= 238) and pre-registration pharmacists (n= 167) who were briefed and undertook
94 the PSA. These numbers represent all students meeting the inclusion criteria in the participating universities and
95 undertaking their pre-registration year in Scotland.

96 **Characteristics of the PSA Tool**

97 The questions in the PSA were mapped to specific thematic areas, as described in Table 1.

98 *[INSERT Table 1]*

99 The question styles in the PSA, allocation of marks and clinical settings were designed by the PSA Steering
100 Group as part of the Exam blueprint to reflect the breadth of activities required of Foundation doctors during
101 prescribing and supervising the use of medicines at a basic level in the Foundation training. This configuration
102 has proved to be remarkably robust over the 10 years of delivering the PSA both in the UK and other
103 jurisdictions. In this study, thirty questions, exactly half of the format of the medical UK PSA, had to be
104 completed over 60 minutes, questions were allocated to therapeutic areas and clinical settings (Table 2). The
105 half-length of the assessment trialled in this study was based on practical reasons for a pilot study but the mix of
106 questions, timing and mark allocations fully reflect those for the 2-hour examination. The total marks available
107 were 100. These new questions were approved in November 2016 and acknowledged by the assessment board to
108 be unintentionally more difficult and discriminating (personal communication) than the medical UK PSA. Table
109 2 shows the distribution of cases included in the PSA.

110 *[INSERT Table 2]*

111 **Recruitment**

112 NHS Education for Scotland (NES) is an education and training body within Scotland with responsibility for
113 developing and delivering education and training for the healthcare workforce post university education. As part
114 of the remit, NES recruits and manages a national structured pre-registration training year in Scotland for
115 pharmacy graduates. NES led the assessment process, with final year undergraduates at both universities
116 attending a presentation at which they were given an overview of the project and an introduction to the PSA. All
117 pre-registration pharmacists undertook the PSA as a necessary component of their training.

118 All participants were registered on the PSA online system, which allowed access to PSA information and
119 practice materials of three one-hour test papers and a presentation explaining the format of the assessment and
120 how to use the online assessment. The online assessment took place approximately one month following
121 registration, under invigilated conditions with access to the online electronic BNF and calculator.

122 **Evaluation**

123 Immediately following completion of the PSA, all participants were invited to complete an online questionnaire
124 comprising 5-point Likert scale items to gauge their views on aspects of the preparation and appropriateness of
125 the PSA. Space was provided for free text comments on any aspect of the PSA. The questionnaire used was
126 from the previous study [18] hence no need for additional face or content validity.

127

128 **Analysis**

129 Data were analysed using descriptive statistics. Free text comments were analysed using a summative content
130 analysis approach. This involved counting and comparison via keywords and content, followed by
131 interpretation and coding into themes. Analysis was undertaken independently by two researchers [27].

132 Independent sample t-tests were used to determine any significant differences in scores between groups (e.g.
133 undergraduates and pre-registration graduates), $p < 0.05$ being statistically significant. Summative content
134 analysis was performed on the responses to free text comments.

135

136 **Results**

137 *Participants*

138 Two hundred and thirty-eight undergraduates and 167 pre-registration pharmacists (44 hospital, 119 community,
139 4 modular (a mix of hospital and community)) took part in the pilot.

140 *Participant performance*

141 The mean scores (\pm SD) and range of performance for the PSA overall, and for each of the eight question areas,
142 are illustrated in Table 3. The mean total score for the pre-registration pharmacists (64.4 ± 10 , range 38-88) was
143 significantly higher than that of the undergraduates (51.2 ± 12.0 , range 14-80) ($p<0.001$). The pre-registration
144 pharmacists also performed significantly better across all question areas (all $p<0.001$ other than 'adverse drug
145 reactions', $p<0.01$). For both groups, the lowest scoring question areas were 'planning management', 'providing
146 information' and 'data interpretation'.

147 Those pre-registration pharmacists undertaking their training year in hospital settings performed statistically
148 significantly better than those in community with higher overall scores (67.4 ± 9.8 v 63.2 ± 9.8 , $p<0.05$) and in
149 question areas of 'prescription review' (12.8 ± 1.4 v 11.7 ± 1.5 , $p<0.001$) and 'adverse drug reactions' (5.4 ± 1.2 v
150 4.8 ± 1.6 , $p<0.05$). One hundred and fifty-seven pre-registration pharmacists sat the GPhC registration
151 examination to be allowed onto the GPhC register as a qualified pharmacist. Those who passed the GPhC
152 examination on the first sitting ($n=145$) had statistically significant higher overall PSA scores (65.6 ± 9.3 v
153 57.3 ± 8.7 , $p<0.05$) than those who failed ($n=12$).

154 Table 3 shows the PSA scores for the final year undergraduate student pharmacists and pre-registration
155 pharmacists

156 *[INSERT Table 3]*

157 *Participant feedback*

158 Responses to the evaluation items (Table 4), indicated positive views on the appropriateness of the approach, the
159 quality of the presentation and questions and the usability of the online interface.

160 *[INSERT Table 4]*

161 Summative content analysis, however, identified a potential issue around terminology, as described by an
162 undergraduate student,

163 *'Medical terminology was difficult to understand, there is not much focus on specific or unique*
164 *conditions in the undergraduate teaching.'*

165 Several commented on the range of topics covered in the undergraduate course and pre-registration training,

166 *'From looking at the exam and the practice papers provided, there are certainly some areas that I*
167 *never came across throughout the MPharm or during pre-reg.'*

168 *'A lot of the situations and scenarios – particularly the questions that were based around emergency*
169 *medicine and hospital scenarios were very challenging...'*

170 There were also comments that pre-registration pharmacists training in community pharmacy would find the
171 questions challenging,

172 *'All of the questions were presented in a clear way at a level to be expected of a pre-registration*
173 *pharmacist. As a community pharmacist I believe the questions would be more easily answered by*
174 *someone working in the hospital sector but the clinical knowledge is still appropriate.'*

175

176

177 Discussion*178 Statement of key findings*

179 Pre-registration pharmacists performed significantly better than final year undergraduate student pharmacists
180 overall and in each of the specific areas. For both groups, the lowest scores were in the areas of ‘planning
181 management’, ‘providing information’ and ‘data interpretation’. Pre-registration pharmacists in the hospital
182 setting performed significantly better than those in community and there was an association between PSA
183 performance and success in the GPhC registration examination. There were positive views on the preparation
184 for, and appropriateness of, the PSA.

185 Strengths and limitations

186 While this study adds to the evidence base on future pharmacists and aspects of prescribing safety, it was
187 conducted in Scotland hence there may be issues of generalisability to other settings with different
188 undergraduate and pre-registration education and training. The number of participants who took part in the study
189 is relatively small and as there was only one set of questions relative performance in different sections should be
190 interpreted with caution. Further work would be needed to refute or confirm these associations.

191 It should also be noted that the undergraduate cohort from one university was also the last to graduate prior to a
192 new curriculum being introduced.

193 Interpretation

194 Given that the pre-registration year comprises experiential training and assessment, it is not unexpected that pre-
195 registration pharmacists performed better than the undergraduates. The development of prescribing skills from
196 undergraduate to pre-registration pharmacist and better PSA performance also adds validity to the PSA itself.

197 Pre-registration pharmacists undertaking their training year in hospital generally gain more experience in
198 clinical areas, which may have influenced the better PSA performance. While noting differences in study
199 populations, these findings are similar to a recent study in England [23] although Power et al offers a more
200 comprehensive study across the whole country of Scotland with urban and rural areas rather than one localised
201 area of England and using all students and pre-registration pharmacists rather than self-selecting volunteers.

202 The findings of the evaluation questionnaire were all generally positive in terms of preparation and
203 appropriateness of the PSA. Both the undergraduates and pre-registration pharmacists were less positive that the
204 current MPharm course had prepared them for the PSA assessment. It should, however, be remembered that

205 currently pharmacists cannot prescribe until they have completed additional education and training to allow
206 them to register as a pharmacist prescriber. Furthermore, they must have at least two years of patient-facing
207 experience prior to commencing prescribing training [20]. While the pharmacy undergraduate and pre-
208 registration education and training in the UK is highly clinical, there is currently no summative assessment of
209 prescribing skills. Having parity in the assessment process for prescribing across all disciplines would be useful
210 in the future when student pharmacists become prescribers at the point of registration. One recognised
211 prescribing competency assessment sat by all disciplines would be very helpful in developing the public's trust
212 in prescribing with all prescribers (medical and non-medical) being benchmarked with one common
213 examination.

214 The PSA questions used in this study were more challenging than the previous study of pharmacy prescribers
215 and final-year medical students. Also, the high stakes, summative nature of the PSA for medical students means
216 that they were likely to have been highly motivated and are more likely to have familiarised themselves with the
217 assessment than pharmacy candidates. The five-year medical undergraduate curriculum has greater emphasis on
218 diagnosis than the pharmacy curriculum hence it is not surprising that diagnostic skills (e.g. 'planning
219 management', and 'data interpretation') were not answered well by pharmacy candidates. The PSA is not
220 primarily an assessment of diagnostic skills although candidates do have to be able to recognise very common
221 clinical presentations. While diagnosis is an important skill in medicine, and other related professions, and most
222 decisions relating to medicines rely on a diagnosis, it was felt from the outset that broadening the clinical
223 challenge in each case to include the need to achieve a clinical diagnosis (based on history, examination and
224 investigation) would detract from its primary purpose. That said, it is recognised that a proportion of prescribing
225 decisions do have to be made at a time when the diagnosis is uncertain or might be expected to be made rapidly
226 by a competent candidate (e.g. very common presentations, emergency presentations where delay in treatment
227 would be deleterious). Examples might be Prescribing or Planning Management questions where a candidate is
228 required to respond to a typical presentation of acute anaphylaxis, migrainous headache, reflux oesophagitis,
229 oral candidiasis etc.

230 Content analysis indicated that student pharmacists and pre-registration pharmacists did struggle with diagnosis,
231 interpretation of results of investigations and knowledge of medical terminology. Previously pre-registration
232 graduates in the UK identified training needs in related aspects of clinical examination and patient monitoring
233 [22].

234 There will be challenges including prescribing competencies within undergraduate pharmacy education. There is
235 a need to match strategic direction of healthcare policy makers with integration to patient-facing models of
236 pharmacy practice [8]. This all will need careful reflection and revision of all stages of education and training.
237 In the UK, the recently revised standards for the Initial Education and Training of Pharmacists stipulate that
238 pharmacy courses will incorporate the skills, knowledge and attributes for prescribing, to enable pharmacists to
239 independently prescribe from the point of registration [20]. In this context the PSA could be used to benchmark
240 prescribing competency. This could ultimately be used as a surrogate measure of the quality and effectiveness of
241 models of education and training.

242 *Further work*

243 The funding models for initial education and training of student pharmacists are being reviewed and are
244 developing globally [24, 28]. In September 2018, the Scottish Government announced funding for experiential
245 learning in quality assured sites with trained facilitators and appropriate feedback mechanisms. It may be useful
246 to help ‘measure’ the impact of the funded Experiential Learning (EL) by repeating this work once funded and
247 quality managed EL is established throughout the 5 years of initial education and training in Scotland.

248
249 The GPhC standards for pharmacist independent prescribing courses [20] now requires that the Schools of
250 Pharmacy have stricter course admission requirements. This change is to improve the selection of trainee
251 prescribers by focusing on the knowledge and skills of applicants and their suitability rather than the two-year
252 time requirement. Applicant’s ‘experience’ must be verified to ensure that they are ‘ready’ to train as a
253 prescriber. Further work could determine if the PSA has a role to play in this verification process.

254 255 **Conclusions**

256 This study has demonstrated feasibility and acceptability of the PSA to final year undergraduate pharmacy
257 students and pre-registration pharmacists. While the pre-registration pharmacists, particularly those in the
258 hospital setting, performed better than the undergraduates, there is scope for improving the prescribing skills of
259 all, most notably in diagnostic skills.

260 One prescribing assessment sat by all disciplines may be very helpful in developing the public’s trust in
261 prescribing with all prescribers being assessed and required to pass the same exam.

262

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274

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