

# Student and Foundation Year Pharmacist Performance in the 'UK Prescribing Safety Assessment'

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## Research Article

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## **Abstract**

### **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 pharmacy pre-registration graduates (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 graduates (64.4, SD 10) was significantly higher than for undergraduates (51.2, SD 12.0.) ( $p<0.001$ ). Pre-registration graduates performed significantly better across all question areas (all  $p<0.001$  other than 'adverse drug reactions',  $p<0.01$ ). Hospital pre-registration graduates 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 graduates 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.

## **Impacts On Practice**

- The '*UK Prescribing Safety Assessment*' (PSA) shows validity and acceptability of use in final year undergraduate pharmacy students and pre-registration graduates.
- 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

## **Introduction**

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

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

To improve prescribing competence and safety of medical graduates in the UK, a '*Prescribing Safety Assessment*'(PSA) was developed by the British Pharmacological Society and the Medical Schools Council [15]. The PSA is designed to be a valid and reliable assessment of prescribing skills based on competencies identified by the UK General Medical Council: writing new prescriptions; reviewing existing prescriptions; calculating drug doses; identifying and

avoiding both adverse drug reactions and medication errors; and amending prescribing to suit individual patient circumstances [16]. It is an open book, time-limited assessment, with questions across seven different clinical settings. The standard set is that expected of final year medical students, in the latter stages of their final exams, who are at the peak of their preparation for practice. All candidates sitting the PSA have access to an electronic British National Formulary (BNF) and a calculator inbuilt into the system. Following several years of piloting, the PSA was launched across the UK in 2014. Data from over seven thousand UK final year medical students across 31 medical schools who participated in the PSA in 2016 gave an overall pass rate of 95% of students, with marked variation between schools [17]. In 2015, a pilot group of 59 pharmacist independent prescribers in Scotland participated in the PSA. The PSA in this study consisted of 30 questions which had been used in the 2014 assessments for final year medical students. The mean overall PSA scores ( $\pm SD$ ) were  $87.5\%\pm8.7$  (range 52-98) compared to 88.5% for medical students. Pharmacists performed equivalently to medical students in all assessment areas, with a slightly lower performance in the prescribing, drug monitoring and data interpretation questions offset by better performance in prescription review and adverse drug reactions [18].

While medical students will prescribe (under supervision) at the point of graduation on completion of a five-year undergraduate course, currently pharmacists must have at least two years of post-registration practice experience in a patient-facing role prior to enrolling on the prescribing training programme [19]. Following completion of a four-year undergraduate Master of Pharmacy degree in the UK, graduates must complete an additional foundation year of experiential training and assessment (formerly called pre-registration training) before registering as pharmacists with the General Pharmaceutical Council (GPhC). So currently, the minimum time between graduation and commencing prescribing training is therefore three years.

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

Work has been undertaken into aspects of prescribing training, practice and competence from the perspectives of pharmacy students and graduates. A cross-sectional survey of UK pre-registration graduates identified that while most respondents expressed interest in prescribing training, they acknowledged training needs in clinical examination, patient monitoring and medico-legal aspects of prescribing. Many cited the need to first increase their confidence through experience and to demonstrate competence as a pharmacist [21]. A later qualitative study with Scottish pre-registration graduates reported that while most expressed a desire to train as prescribers, they acknowledged the need first to develop as pharmacists [22]. A more recent study from England reported PSA performance of final year pharmacy students from four universities and local pharmacy pre-registration graduates. The mean scores for the graduates in community (n=27) and hospital (n=209) settings were 86.3% and 85.3%, respectively. For the 397 undergraduates, the mean score was 73% [23]. The number of candidates passing the PSA was not reported.

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

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

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

## Aims of the study

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.

## Ethics approval

The study was approved by the management committee at NES and ethical review committees at each university. 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.

## Methods

### Study design and setting

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

### Study population

Final year undergraduates (n= 238) and pharmacy pre-registration graduates (n= 167) who were briefed and undertook the PSA.

## **Characteristics of the PSA Tool**

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

[*INSERT Table 1*]

Thirty questions, exactly half of the format of the medical UK PSA had to be completed over 60 minutes, questions were allocated to therapeutic areas and clinical settings (Table 2). The total marks available were 100. These new questions were approved by the PSA assessment board in November 2016 and acknowledged by the assessment board to be more difficult and discriminating (personal communication) than the medical UK PSA. Table 2 shows the distribution of cases included in the PSA.

[*INSERT Table 2*]

## **Recruitment**

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

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

## **Evaluation**

Immediately following completion of the PSA, all participants were invited to complete an online questionnaire comprising 5-point Likert scale items to gauge their views on aspects of the preparation and appropriateness of the PSA. Space was provided for free text comments on any aspect of the PSA.

## **Analysis**

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

## **Results**

### *Participants*

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

### *Participant performance*

The mean scores ( $\pm SD$ ) and range of performance for the PSA overall, and for each of the eight question areas, are illustrated in Table 3. The mean total score for the pre-registration graduates ( $64.4\pm10$ , range 38-88) was significantly higher than that of the undergraduates ( $51.2\pm12.0$ , range 14-80) ( $p<0.001$ ). The pre-registration graduates also performed significantly better across all question areas (all  $p<0.001$  other than 'adverse drug reactions',  $p<0.01$ ). For both groups, the lowest scoring question areas were 'planning management', 'providing information' and 'data interpretation'.

Those pre-registration graduates undertaking their training year in hospital settings performed statistically significantly better than those in community with higher overall scores ( $67.4\pm9.8$  v  $63.2\pm9.8$ ,  $p<0.05$ ) and in question areas of 'prescription review' ( $12.8\pm1.4$  v  $11.7\pm1.5$ ,  $p<0.001$ ) and 'adverse drug reactions' ( $5.4\pm1.2$  v  $4.8\pm1.6$ ,  $p<0.05$ ). One hundred and fifty-seven pre-registration graduates sat the registration examination of the GPhC. Those who passed the examination on the first sitting ( $n=145$ ) had statistically significant higher overall scores ( $65.6\pm9.3$  v  $57.3\pm8.7$ ,  $p<0.05$ ) than those who failed ( $n=12$ ).

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

[*INSERT Table 3*]

### *Participant feedback*

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

[*INSERT Table 4*]

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

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

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

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

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

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

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

## Discussion

### *Statement of key findings*

Pharmacy pre-registration graduates performed significantly better than final year undergraduate student pharmacists overall and in each of the specific areas. For both groups, the lowest scores were in the areas of 'planning management', 'providing information' and 'data interpretation'. Graduates in the hospital setting performed significantly better than those in community and there was an association between PSA performance and success in the GPhC registration examination. There were positive views on the preparation for, and appropriateness of, the PSA.

### *Strengths and limitations*

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

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

### *Interpretation*

Given that the pre-registration year comprises experiential training and assessment, it is not unexpected that pharmacy pre-registration graduates performed better than the undergraduates. The development of prescribing skills from undergraduate to pre-registration graduate and better PSA performance also adds validity to the PSA itself. Graduates undertaking their training year in hospital gain more experience in clinical areas, which may have influenced the better PSA performance. While noting differences in study populations, these findings are similar to a recent study in England [23].

The findings of the evaluation questionnaire were all generally positive in terms of preparation and appropriateness of the PSA. Both the undergraduates and pre-registration graduates were less positive that the current MPharm course had prepared them for the PSA assessment. It should, however, be remembered that currently pharmacists cannot prescribe until they have completed additional education and training to allow them to register as a pharmacist prescriber. Furthermore, they must have at least two years of patient-facing experience prior to commencing prescribing training [20]. While the pharmacy undergraduate and pre-registration education and training in the UK is highly clinical, there is currently no summative assessment of prescribing skills. Having parity in the assessment process for prescribing across all disciplines would be useful in the future when student pharmacists become prescribers at the point of registration. One recognised prescribing competency assessment sat by all disciplines would be very helpful in developing the public's trust in prescribing with all prescribers (medical and non-medical) being benchmarked with one common examination.

The PSA questions used in this study were more challenging than the previous study of pharmacy prescribers and final-year medical students [19]. Also the high stakes, summative nature of the PSA for medical students means that they were likely to have been highly motivated and are more likely to have familiarised themselves with the assessment than pharmacy candidates. The five-year medical undergraduate curriculum has greater emphasis on diagnosis than the pharmacy curriculum hence it is not surprising that diagnostic skills (e.g. 'planning management', and 'data interpretation') were not answered well by pharmacy candidates. Content analysis indicated that they struggled with diagnosis, interpretation of results of investigations and knowledge of medical terminology. Previously pharmacy pre-registration graduates in the UK identified training needs in related aspects of clinical examination and patient monitoring [22].

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

### *Further work*

The funding models for initial education and training of student pharmacists are being reviewed and are developing globally [24, 27]. In September 2018, the Scottish Government announced funding for experiential learning in quality assured sites with trained facilitators and appropriate feedback mechanisms. It

may be useful to help 'measure' the impact of the ACT funded EL by repeating this work once funded and quality managed EL is established throughout the 5 years of initial education and training in Scotland.

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

## Conclusions

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

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

## Declarations

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**Conflicts of interest:** None

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## Tables

**Table 1 – Details of PSA question areas in terms of reasoning and judgement, and measurable action (PSA blueprint)**

Question Area	Reasoning and Judgement	Measurable Action
Prescribing	Deciding on the most appropriate prescription (drug, dose, route and frequency) to write based on the clinical circumstances and supplementary information	Writing a safe, effective and legal prescription for medicines using the documentation provided to tackle specific indications highlighted by the question
Prescription review	Deciding which components of the current prescription list are inappropriate, unsafe or ineffective for a patient based on their clinical circumstances	Identifying prescriptions (drugs, doses or routes) that are inappropriate, unsafe or ineffective from amongst the current list of prescribed medicines
Planning management	Deciding which combination of therapies would be most appropriate to manage a particular clinical situation	Selecting the most appropriate combination of treatment strategies based on individual patient circumstances
Providing information	Deciding what are the important bits of information that should be provided to patients to allow them to choose whether to take the medicine and to enhance its safety and effectiveness	Selecting the information that is most appropriate
Calculation skills	Making an accurate drug dosage calculation based on numerical information	Recording the answer accurately with appropriate units of measurement
Adverse drug reactions	Identifying likely adverse reactions of specific drugs, drugs that are likely to be causing specific adverse drug reactions, potentially dangerous drug interactions and deciding on the best approach to managing a clinical presentation that results from the adverse effects of a drug	Selecting likely adverse reactions of specific drugs, selecting drugs to discontinue as likely causes of specific reactions, avoiding potential drug-interactions and providing appropriate treatment for patients suffering an adverse event
Drug monitoring	Deciding on how to monitor the beneficial and harmful effects of medicines.	Identifying the appropriate methods of assessing the success or failure of a therapeutic intervention.
Data interpretation	Deciding on the meaning of the results of investigations as they relate to decisions about on-going drug therapy	Making an appropriate change to a prescription based on those data

Table 2 - Distribution of the cases included in the PSA, according to primary diagnostic category and clinical setting

Diagnostic category	Number	Clinical setting	Number
Gastroenterology	2	Medicine	8
Cardiovascular	6	Surgery	2
Respiratory	3	Elderly care	2
Neurology	3	Paediatrics	4
Psychiatry	2	Psychiatry	2
Infection	3	Obstetrics & Gynaecology	4
Endocrinology	3	General practice	8
Rheumatology	2	<b>Total</b>	<b>30</b>
Anaemia	1		
Contraception	1		
Pregnancy	1		
Dermatology	1		
Metabolic	1		
Overdose	1		
<b>Total</b>	<b>30</b>		

Table 3 – PSA scores for final year undergraduate pharmacy students and pharmacy pre-registration graduates

Question areas	Available marks	Undergraduate pharmacy students (n=238)		Pharmacy pre-registration graduates (n=167)		p-value (t-test)
		Mean scores (± SD)	Range	Mean scores + SD	Range	
Prescription writing	40	19.3 (7.5)	0-39	24.5 (6.7)	4-39	<0.001
Prescription review	16	10.7 (2.1)	0-15	12.0 (1.6)	8-16	<0.001
Planning management	8	2.5 (1.7)	0-8	3.6 (1.6)	0-8	<0.001
Providing information	6	2.2 (1.7)	0-6	3.8 (1.8)	0-6	<0.001
Dose calculations	8	5.9 (2.2)	0-8	7.0 (1.5)	0-8	<0.001
Adverse drug reactions	8	4.5 (1.9)	0-8	5.0 (1.6)	0-8	<0.01
Drug monitoring	8	3.9 (2.2)	0-8	5.2 (1.9)	0-8	<0.001
Data interpretation	6	2.2 (1.9)	0-6	3.1 (1.7)	0-6	<0.001
<b>Total</b>	<b>100</b>	<b>51.2 (12.0)</b>	<b>14-80</b>	<b>64.4 (10.0)</b>	<b>38-88</b>	<b>&lt;0.001</b>

Table 4 – Response to Evaluation Item

Items	Strongly disagree (=1), % (n)	Disagree (=2), % (n)	Neutral (=3), % (n)	Agree (=4), % (n)	Strongly agree (=5) % (n)	Median	Strongly disagree (=1), % (n)	Disagree (=2), % (n)	Neutral (=3), % (n)	Agree (=4), % (n)	Strongly agree (=5) % (n)	Median
<b>Undergraduate pharmacy students (n=238)</b>							<b>Pharmacy pre-registration pharmacy graduates (n=167)</b>					
The questions in the assessment were clear and unambiguous	0.4 (1)	5.5 (13)	20.4 (48)	50.6 (119)	23.0 (54)	4	1.2 (2)	11.2 (19)	15.4 (26)	52.7 (89)	19.5 (33)	4
The layout and presentation of the questions was easy to follow	0.4 (1)	6.0 (14)	15.3 (36)	49.8 (117)	28.5 (67)	4	0	1.2 (2)	4.1 (7)	57.4 (97)	37.3 (63)	4
The time provided for answering questions was sufficient	8.5 (20)	23.8 (56)	20.9 (49)	31.9 (75)	14.9 (35)	3	4.7 (8)	23.7 (40)	20.1 (34)	39.6 (67)	11.8 (20)	4
The online interface was easy to use	1.3 (3)	5.5 (13)	17.4 (41)	46.0 (108)	29.8 (70)	4	0.6 (1)	1.8 (3)	5.3 (9)	50.9 (86)	41.1 (70)	4
The information about the PSA (available prior to the event) was helpful	0.9 (2)	6.4 (15)	19.6 (46)	51.5 (121)	21.7 (51)	4	0	1.8 (3)	3.6 (6)	59.8 (101)	34.9 (59)	4
My course prepared me for the content of the questions in this assessment	4.3 (10)	21.3 (50)	34.0 (80)	34.9 (82)	5.5 (13)	3	3.0 (5)	14.8 (25)	34.9 (59)	43.8 (74)	3.6 (6)	3
The assessment was an appropriate test of prescribing competence expected of pharmacist undergraduates and preregistration trainees	3.0 (7)	8.9 (21)	20.9 (49)	40.4 (95)	26.8 (63)	4	1.2 (2)	10.7 (18)	23.7 (40)	57.4 (97)	7.1 (12)	4