

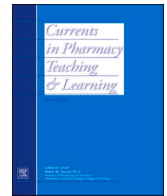
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## Exploring career choices of pharmacy graduates over 15 years: A cross-sectional evaluation

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### ABSTRACT

**Introduction:** Career opportunities for pharmacists beyond those commonly associated with the degree continue to emerge. A paucity of literature regarding evaluation of pharmacy graduate career paths over extended periods is apparent. Considering international pharmacy workforce capacity pressures, the primary study aim was to evaluate trends in career paths of pharmacy graduates.

**Methods:** This study utilised a multimethod approach to access graduate career data using publicly accessible information from LinkedIn® profiles and an online survey. The survey was distributed to all pharmacy graduates of a university (2007–2022). Data from both methods was combined, cross-checked, coded and analysed quantitatively using descriptive and inferential statistics.

**Results:** Data from 69.7% of the university's pharmacy graduates was collected. Community pharmacy was the most prevalent employment sector (47.7%), followed by industry (21.5%) and hospital (17.7%). A higher proportion of more recent graduates ( $\leq 5$  years post-graduation) work in a community or hospital pharmacy role versus those who graduated greater than five years ago ( $\chi^2 = 8.44$ ,  $df = 2$ ,  $p < 0.05$ ). Post-graduate education was undertaken by 41.3% of graduates. Career satisfaction was high (88.2%) but was lower ( $\chi^2 = 11.31$ ,  $df = 1$ ,  $p < 0.05$ ) for those in community and hospital (82%) versus other sectors (97.5%).

**Conclusion:** This study provides the first analysis of graduate career paths over an extended period, highlighting a novel approach to track pharmacist workforce. While almost two thirds of pharmacy graduates occupy community or hospital roles, a trend of leaving these settings five years post-graduation was evident. Accordingly, this work represents a springboard for additional research to inform future pharmacist workforce planning worldwide.

### Introduction

The pharmacy profession has evolved over time and continually adapted to the needs of society and the everchanging healthcare system.<sup>1,2</sup> Within clinical settings, this has comprised a more patient-centred, rather than a product-orientated role, as provision of patient counselling, drug monitoring, and advanced practices have led to improved treatment outcomes for patients.<sup>1,3</sup> In 1997, the World Health Organisation (WHO) introduced the concept of the '7-star pharmacist'<sup>2,4,5</sup>, which detailed the roles which pharmacists

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should perform – namely: ‘caregiver’, ‘communicator’, ‘decision-maker’, ‘manager’, ‘teacher’, ‘lifelong learner’, and ‘leader’. Later, three additional roles were added, including ‘researcher’, ‘entrepreneur’, and ‘agent of positive change’, resulting in the ‘*ten-star pharmacist*’.<sup>6,7</sup> Owing to the diversity and transferability of many of these roles, pharmacy graduates, now more than ever, appear fully equipped to work in multidisciplinary roles across both patient and non-patient-facing settings.

Increased recognition of the highly educated pharmacy graduate workforce across the wider employment landscape has significantly expanded graduate career prospects. The broad set of technical skills and expertise obtained through a pharmacy degree enables graduates to thrive professionally within both an integrated healthcare sector and the global employment marketplace.<sup>8</sup> Typically, careers outside of the clinically focused or “patient-facing” settings of community or hospital pharmacy have been associated with a career within pharmaceutical manufacturing. However, increasingly diverse employment opportunities are now also arising in other nonconventional “non-patient facing” settings, such as drug regulatory authorities, academia, public bodies, consulting, and beyond. This has resulted in an increase in varied employment prospects for pharmacy graduates in different areas like never before – thus providing a golden opportunity for pharmacists to diversify their career paths and professional aspirations. While these nonconventional opportunities are certainly welcomed, the increasing numbers of pharmacists employed in non-patient facing sectors has meant a decrease in the proportion of pharmacy graduates choosing employment in patient-facing roles, of which pharmacists are the only healthcare professionals licensed to hold. This has resulted in an increased global demand and significant international pressures on the patient-facing pharmacy workforce worldwide. A 2021 report by the International Pharmaceutical Federation (FIP) raised concerns over access to pharmacists,<sup>9</sup> while their 2018 report also anticipated increasing capacity challenges in the future, predicting a 40% growth of the global pharmacy workforce over the next 15 years.<sup>10,11</sup> Similarly, the World Health Organisation estimates a projected shortfall of 10 million health workers by 2030.<sup>12</sup> Therefore, considering continued pressures on the patient-facing workforce and the ever-evolving pharmacy landscape, it appears pertinent to create more accurate predictors of where pharmacy graduates are working. In doing so, helping to create increasingly accurate projections of workforce capacity to inform pharmacy workforce models.

Numerous international studies have examined career intentions or aspirations of pharmacy students, including countries such as Australia,<sup>13</sup> Jordan,<sup>14</sup> Malaysia,<sup>15</sup> Northern Ireland,<sup>16</sup> Nigeria,<sup>17</sup> Qatar,<sup>18</sup> Saudi Arabia,<sup>19,20</sup> Sudan,<sup>2</sup> and the United States of America (USA).<sup>21–25</sup> While a previous study did examine the career choices of pharmacy graduates in the early career stage (<3 years post-graduation) in Japan,<sup>26</sup> the authors believe the present study is novel as it provides the first cross-sectional analysis of pharmacy graduate career paths over a 15-year time frame. Furthermore, given the current landscape of patient-facing workforce capacity problems internationally, the ever-widening graduate employment opportunities, and apparent paucity of robust European data, this study presents a timely opportunity to investigate the career paths of graduates from a pharmacy training programme in Ireland.

Using an online survey and publicly accessible LinkedIn® profile data, this study primarily aimed to provide an overview of the career paths of pharmacy graduates from University College Cork (UCC) School of Pharmacy since its establishment in 2004. Secondary aims included identifying the proportions of graduates per employment sector across both patient-facing and non-patient-facing roles, those who have completed post-graduate education, along with graduate satisfaction with the pharmacy programme and their chosen career paths. This research should help inform key stakeholders of trends in Irish trained pharmacy graduate employment over the past fifteen years, guide strategic development of pharmacy programmes and future policy-making, while also informing current pharmacy students of potential employment opportunities through data-driven analysis of graduate career paths.

## Methods

### Study context

First established in 2004, UCC School of Pharmacy is currently one of only three schools in the Republic of Ireland (ROI) accredited by the Pharmaceutical Society of Ireland (PSI) and entry to the UCC undergraduate pharmacy programme is competitive. A pharmacy degree is unique in delivering both a healthcare and pharmaceutical science curriculum, providing students with a strong education in the main areas of pharmaceutical chemistry, biochemistry, pharmaceuticals, sterile manufacturing, microbiology, pharmacology, and clinical pharmacy practice.

Prior to 2015, ROI pharmacy students undertook a ‘4 year plus 1 year’ pharmacy programme: a 4 years Bachelor’s degree in UCC plus a 1 year Masters. The final year comprised a 1-year work placement (with a minimum of 6 months in a patient-facing setting) and academic modules completed via the Royal College of Surgeons in Ireland. Since 2015, all incoming pharmacy students undertake an integrated five-year Master of Pharmacy (MPharm) degree, all completed with UCC. Students undertake a 4-month experiential work placement in the fourth year in either a patient-facing setting or a non-patient facing (such as in pharmaceutical industry, academia, or a public body etc.).

### Study design and participants

The population eligible for inclusion were graduates of UCC pharmacy programmes (BPharm and MPharm) from 2007 to 2022 ( $n = 798$ ). As student contact email information becomes inaccessible upon graduation from UCC, this study utilised two approaches to collect data on graduates’ career paths: an online survey and analysis of publicly accessible information from LinkedIn® profiles. Ethics approval for this study was granted by UCC’s Social Research Ethics Committee. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Statement was used to guide study reporting.<sup>27</sup>

## Data collection

### Survey design

The survey (Supplementary Material 1) was created based on previous literature<sup>2,3,13,14,22</sup> by the research team, consisting of pharmacist academics based in UCC, some of whom are current students or previously graduated from UCC's pharmacy programme. The survey used a combination of multiple-choice questions, yes/no questions, and Likert-scale ratings. Participant names and year of graduation were required to avoid duplication of graduates during the cross-check process described below. An information sheet preceding the survey highlighted that any identifying information would be removed prior to data analysis.

### Survey distribution

School of Pharmacy staff contacted one class representative from each graduating year from 2007 to 2022 with whom they had a professional or personal connection via email, phone, or social media between the 15th of May and 25th of June 2023 (date of survey closure). To ensure consistency representatives were contacted using a pre-determined body of text containing the study aims. They were also provided with a participant information sheet and asked to distribute the online survey link via email, phone, or social media. The survey link was also posted to the "UCC Pharmacy Alumni" LinkedIn® page on the 9th of June. Participation was voluntary and participants could withdraw from the survey up until the point of data submission. Efforts to maximise the response rate involved a reminder message sent to the class representatives two weeks after initial contact. Data was extracted from the survey platform (Microsoft® Forms, Microsoft Office, 2016).

### LinkedIn® profiles and PSI register

Publicly accessible LinkedIn® profile information of graduates was searched online. Information like that obtained from the online survey was collected (current role, employment sector, and postgraduate training enrolment/completion). Graduates who were currently undertaking postgraduate education were classified similarly to those who had completed postgraduate education. Finally, the PSI register of registered pharmacists was used to attain graduates' registration status (which is required to legally practise as a

**Table 1**

Graduate Characteristics, Postgraduate Education and Patient-Facing versus Non-Patient-Facing Roles.

| Descriptor                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Overall Frequency<br>n (%) | Patient-Facing Frequency<br>n (%) <sup>a</sup> | Non-Patient-Facing Frequency<br>n (%) <sup>a</sup> | Completed/Completing Postgraduate Education Frequency<br>n (%) <sup>b</sup> |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|------------------------------------------------|----------------------------------------------------|-----------------------------------------------------------------------------|
| <b>Gender:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                            |                                                |                                                    |                                                                             |
| <b>Man</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 168 (30.2%)                | 102 (60.8%)                                    | 65 (39.2%)                                         | 71 (45.8%)                                                                  |
| <b>Woman</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 388 (69.8%)                | 260 (67.2%)                                    | 127 (32.8%)                                        | 152 (41.9%)                                                                 |
| <ul style="list-style-type: none"> <li>Similar proportions of men and women undertook postgraduate degrees (<math>\chi^2 = 0.69</math>, <math>df = 1</math>, <math>p &gt; 0.05</math>).</li> </ul>                                                                                                                                                                                                                                                                                                                        |                            |                                                |                                                    |                                                                             |
| <b>Year of Graduation:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                            |                                                |                                                    |                                                                             |
| <b>2007–2011</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 157 (28.2%)                | 94 (60.6%)                                     | 61 (39.4%)                                         | 87 (59.6%)                                                                  |
| <b>2012–2016</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 192 (34.5%)                | 117 (60.9%)                                    | 75 (39.1%)                                         | 87 (52.1%)                                                                  |
| <b>2017–2022</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 207 (37.2%)                | 151 (72.9%)                                    | 56 (27.1%)                                         | 49 (23.9%)                                                                  |
| <ul style="list-style-type: none"> <li>A higher proportion of 2017–2022 graduates were in a patient-facing role versus 2007–2011 and 2012–2016 graduates (<math>\chi^2 = 8.44</math>, <math>df = 2</math>, <math>p &lt; 0.05</math>).</li> <li>A smaller proportion of graduates from 2017–2022 had undertaken postgraduate degrees compared to 2007–2011 and 2012–2016 graduates (<math>\chi^2 = 52.52</math>, <math>df = 2</math>, <math>p &lt; 0.05</math>).</li> </ul>                                                |                            |                                                |                                                    |                                                                             |
| <b>Pharmaceutical Society of Ireland (PSI) Registration Status:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                            |                                                |                                                    |                                                                             |
| <b>Yes</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 512 (92.1%)                | 356 (98.3%)                                    | 154 (80.2%)                                        | 195 (87.4%)                                                                 |
| <b>No</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 44 (7.9%)                  | 6 (1.7%) <sup>c</sup>                          | 38 (19.8%)                                         | 28 (12.6%)                                                                  |
| <ul style="list-style-type: none"> <li>A higher proportion of those in patient-facing roles were named on the PSI register versus graduates in non-patient-facing roles (98.3% versus 80.2%; <math>\chi^2 = 56.43</math>, <math>df = 1</math>, <math>p &lt; 0.05</math>).</li> <li>Graduates not PSI registered displayed higher preference to undertake postgraduate degrees versus PSI-registered graduates (65.1% versus 41.1%; <math>\chi^2 = 9.31</math>, <math>df = 1</math>, <math>p &lt; 0.05</math>).</li> </ul> |                            |                                                |                                                    |                                                                             |

<sup>a</sup> For columns "Patient-Facing Frequency (%)" and "Non-Patient-Facing Frequency (%)", the denominator for percentage calculations equals 554 due to missing data.

<sup>b</sup> For column "Completed/Completing Postgraduate Education Frequency (%)", the denominator refers to the total number of graduates in each category/group.

<sup>c</sup> The remaining 1.7% of those in patient-facing roles who were not PSI registered most likely reflect registration outside of the Republic of Ireland.

pharmacist in ROI).

### Data analysis

A valid survey response was achieved when a participant clicked ‘submit’ at the end of the survey. Three duplicate responses from one participant were identified, deemed invalid, and removed. All survey questions were answered by all respondents (i.e., no incomplete surveys). Graduate LinkedIn® profile information was cross-checked with the survey responses to avoid any duplication. The final information was imputed into a master Microsoft® Excel (Microsoft Office 2016) spreadsheet. Any discrepancies between LinkedIn® information and survey answers were resolved on a case-by-case basis.

Data remediation was performed both manually and using Microsoft® Excel (Microsoft Office 2016) functions to reduce the chance of human error, and thereafter analysed using descriptive and inferential statistics in Statistical Package for Social Sciences (SPSS), Version 27. Chi-squared ( $\chi^2$ ) tests were conducted to examine the association between graduate demographics and their responses. As part of the analysis on time since graduation, the year groups were categorised into 2007–2011, 2012–2016, and 2017–2022 cohorts representing those 0–5, 6–10, and 11–15 years after graduation. Post-hoc analysis was conducted using the z-test to compare column proportions; adjustment for multiple testing using the Bonferroni method was also performed.

### Results

Since the inception of the school of pharmacy, there have been 798 graduates over a 15-year period; in this study, data from 556 of these were obtained (69.7%), with graduate characteristics shown in Table 1. This included 203 valid survey responses (25.4%), 148 of whom had a corresponding LinkedIn® profile (18.6%), with data from LinkedIn® only from 353 graduates (44.2%) (Supplementary Material 2). Over 90% (92.1%) of graduates are currently named on the PSI pharmacy regulator list of registered pharmacists. Entering on this register and maintaining registration to practice as a pharmacist in Ireland was more commonly observed ( $\chi^2 = 9.59$ ,  $df = 2$ ,  $p < 0.05$ ) for those who graduated in the last 5 years (2017–2022) at 96.6% versus those from the years 2012–2016 (90.1%) and 2007–2011 (88.5%) - highlighting an attrition rate of deregistering as time from pharmacy graduation increases.

#### Patient-facing versus non-patient-facing roles

Approximately two thirds ( $n = 362$ ; 65.4%) of graduates were working primarily in pharmacy-based patient-facing roles at the time of the study i.e., in community or hospital pharmacy settings (Fig. 1). The percentage working in patient-facing settings ranged from 79.5% for 2022 graduates to 36.7% for 2010 graduates (Fig. 2). Factors which appeared to affect differences in patient-facing employment prevalence are seen in Table 1 (year of graduation, PSI registration status).

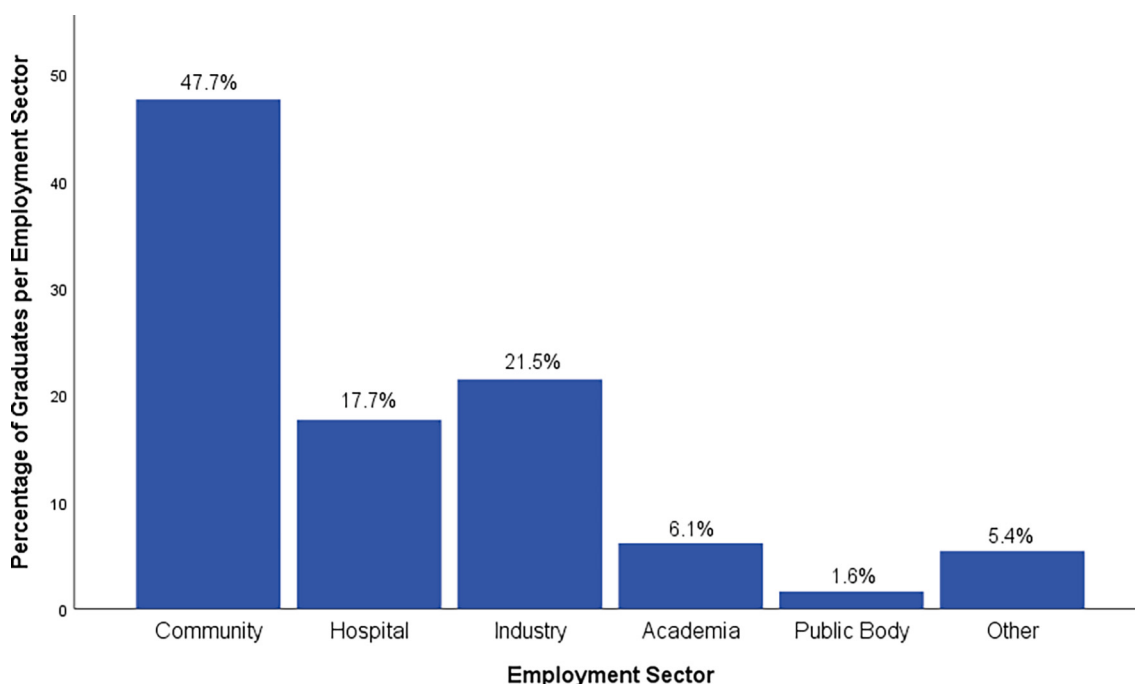
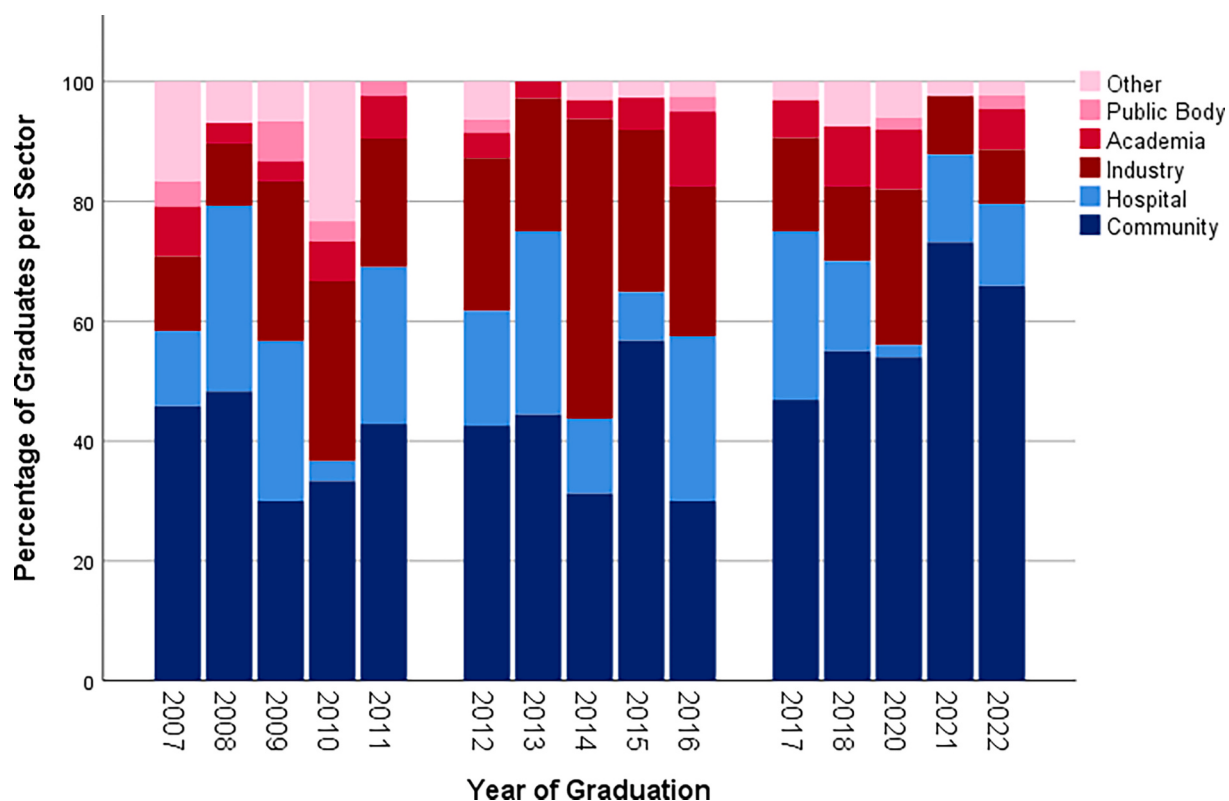


Fig. 1. Total percentage of pharmacy graduates per employment sector ( $n = 554$ ).

Women were significantly more likely to be working in a hospital pharmacy setting compared to men (20.9% versus 10.2%;  $p < 0.05$ ), whereas a significantly higher proportion of men were working in academia (12% versus 3.6%;  $p < 0.05$ ).



**Fig. 2.** Percentage of pharmacy graduates per employment sector in each graduating year from 2007 to 2022. Blue shades represent patient-facing pharmacy roles, whereas red shades represent non-patient-facing roles ( $n = 554$ ). (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

#### Patient-facing roles

A higher proportion ( $\chi^2 = 18.94$ ,  $df = 2$ ,  $p < 0.05$ ) of 2017–2022 graduates were primarily employed in community pharmacy (59.4%) versus 2012–2016 (41.1%) and 2007–2011 (39.5%) graduates (Fig. 3). Table 2 shows that the variety of community pharmacy roles included pharmacy owner, superintendent pharmacist, supervising pharmacist, support pharmacist, locum pharmacist, and pharmacy manager. Practising as a locum pharmacist was more prevalent among the 2017–2022 cohort of community pharmacists (25.2%) versus those in the 2012–2016 (12.8%) and 2007–2011 (6.5%) groups ( $\chi^2 = 11.66$ ,  $df = 2$ ,  $p < 0.05$ ). Of those not primarily working in community pharmacy at the time of the study, 61.1% had previously worked full time as a pharmacist in community pharmacy.

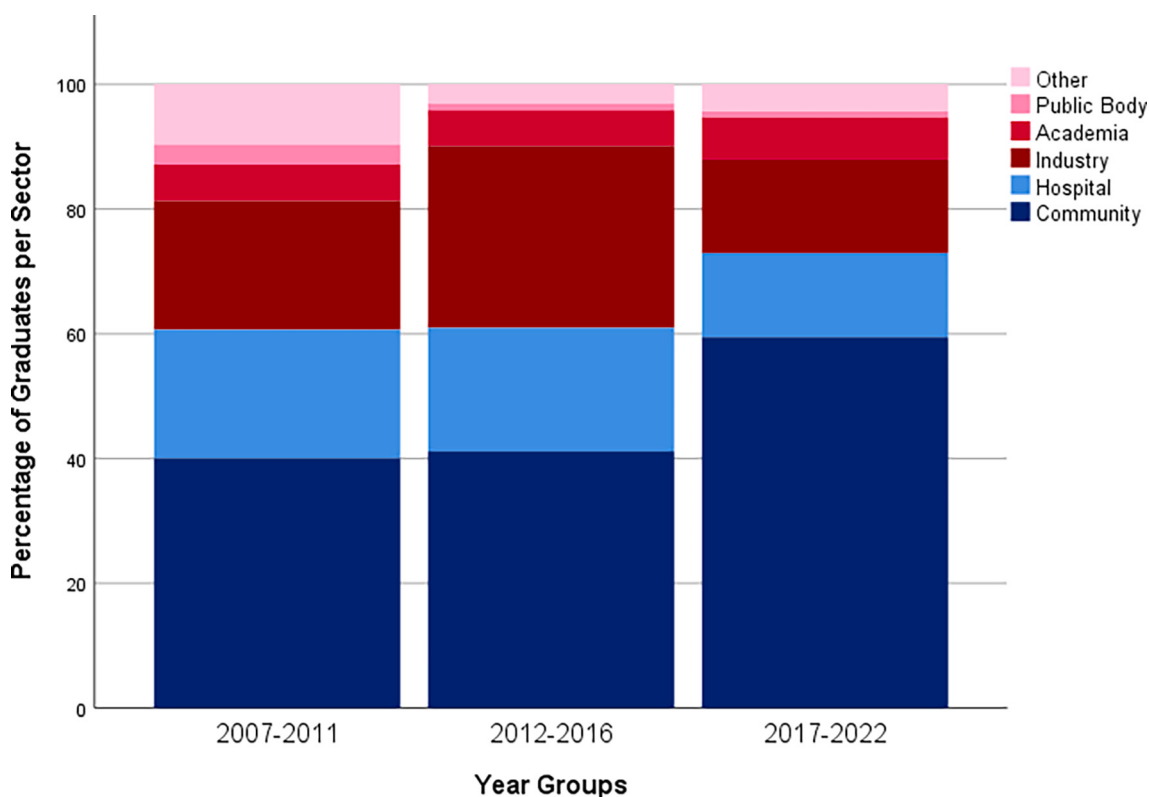
At the time of the study, 17.7% of graduates were primarily working in hospital pharmacy, where roles included basic grade hospital pharmacist, senior hospital pharmacist, and chief hospital pharmacist; these roles refer to different grades of pharmacist within the ROI hospital system. Of these graduates working in hospital pharmacy, 65.2% had previously worked full time as a pharmacist in community pharmacy.

#### Non-patient-facing roles

Of the 192 graduates (34.7%) working in non-patient-facing pharmacy roles, the highest proportion (62.2%) worked in the pharmaceutical industry (21.5% of total). There were a wide variety of roles in industry-based graduates, as displayed in Table 2. A higher proportion of 2012–2016 graduates (29.2%) were employed in the pharmaceutical industry versus the 2007–2011 (20.7%) and 2017–2022 (15.5%) respectively ( $\chi^2 = 12.06$ ,  $df = 2$ ,  $p < 0.05$ ). Most graduates in pharmaceutical industry were PSI registered (85.7%). Working primarily in academia, a public body, or another workplace collectively accounted for the remaining 13.1% of graduates. Of graduates primarily working in academia, 81.8% were working in ROI.

#### Postgraduate education

Postgraduate education uptake and related demographics (including year of graduation and PSI registration status) are shown in Table 1 and Fig. 4. Over two-fifths (43.1%) of graduates had either completed a postgraduate degree since their pharmacy graduation or were undertaking one at the time of the study. Of these, 38.4% undertook a postgraduate degree in UCC. Over one fifth of these have undertaken a Doctor of Philosophy (PhD) ( $n = 49$ ; 22.0%). Other than a PhD, the range of postgraduate degrees undertaken by



**Fig. 3.** Visual representation of the grouped analysis of graduate career sectors (i.e. 2007–2011, 2012–2016, and 2017–2022). 2017–2022 graduates were significantly more likely ( $p < 0.05$ ) to be in a patient-facing role versus 2007–2011 and 2012–2016 graduates ( $n = 554$ ).

graduates included: Master of Science (38.1%), Postgraduate Diploma (17.5%), Postgraduate Certificate (8.7%), Postgraduate Entry Medicine (7.6%) Master of Business Administration (2.2%). Of those who undertook a Master of Science programme, 41.2% did so in clinical pharmacy or hospital pharmacy. No substantial difference was seen between men (45.8%) and women (41.9%) in undertaking postgraduate degrees (Table 1). Graduates not PSI registered displayed a higher preference ( $\chi^2 = 9.31$ ,  $df = 1$ ,  $p < 0.05$ ) to undertake postgraduate degrees (65.1%) versus PSI-registered graduates (41.1%). Higher numbers of graduates primarily in non-patient-facing roles ( $\chi^2 = 67.62$ ,  $df = 1$ ,  $p < 0.05$ ) had undertaken a postgraduate degree (66.5%) versus those primarily in patient-facing roles (29.3%).

Within patient-facing roles, a higher proportion ( $\chi^2 = 95.89$ ,  $df = 1$ ,  $p < 0.05$ ) of graduates working in hospital pharmacy have undertaken postgraduate degrees (68.1%) versus graduates in community pharmacy (13.7%). As seen in Fig. 4, graduates primarily working in community pharmacy represented the lowest rate in undertaking postgraduate degrees, which was lower ( $\chi^2 = 150.22$ ,  $df = 1$ ,  $p < 0.05$ ) than graduates primarily working in other sectors (65.2%). Graduates primarily working in hospital pharmacy (68.1%) ( $\chi^2 = 29.94$ ,  $df = 1$ ,  $p < 0.05$ ) or the pharmaceutical industry (53.0%) ( $\chi^2 = 6.01$ ,  $df = 1$ ,  $p < 0.05$ ) displayed a higher prevalence for completing/undertaking a postgraduate degree compared to others.

#### Satisfaction with career path

The satisfaction of graduates with their career path is shown in Table 3, along with factors affecting satisfaction, i.e. patient-facing role or current employment sector. Overall, 88.2% either agreed or strongly agreed that they were satisfied with their career path.

#### Pharmacy degree satisfaction

84.7% either agreed (41.1%) or strongly agreed (43.6%) that they were satisfied with the pharmacy degree programme, while 15.3% of graduates selected either neutral (8.9%), disagree (5.9%), or strongly disagree (0.5%). Pharmacy degree satisfaction was quite similar between year groups, all with satisfaction rates  $>80\%$ : 2007–2011 (85.1%), 2012–2016 (88.1%), and 2017–2022 (80.9%). Gender, or current employment sector were also not seen to influence satisfaction.

**Table 2**  
Breakdown of Current Employment Sector by Year Group.

| Role                                   | Frequency<br>n (%) |                  |                  |
|----------------------------------------|--------------------|------------------|------------------|
| <b>Community</b>                       | <b>2007–2011</b>   | <b>2012–2016</b> | <b>2017–2022</b> |
| Overall (% of year group)              | 62 (40.0%)         | 79 (41.2%)       | 123 (59.4%)      |
| Supervising Pharmacist <sup>a</sup>    | 19 (30.7%)         | 24 (30.4%)       | 3 (2.4%)         |
| Community Pharmacist (unspecified)     | 26 (41.9%)         | 34 (43.0%)       | 43 (35.0%)       |
| Support Pharmacist <sup>b</sup>        | 7 (11.3%)          | 5 (6.3%)         | 44 (35.8%)       |
| Locum Pharmacist                       | 4 (6.5%)           | 10 (12.7%)       | 32 (26.0%)       |
| Pharmacy Owner                         | 2 (3.2%)           | 2 (2.5%)         | 0 (0%)           |
| Superintendent Pharmacist <sup>c</sup> | 2 (3.2%)           | 0 (0.0%)         | 1 (0.8%)         |
| Managing Pharmacist                    | 2 (3.2%)           | 4 (5.1%)         | 0 (0%)           |
| <b>Hospital</b>                        | <b>2007–2011</b>   | <b>2012–2016</b> | <b>2017–2022</b> |
| Overall (% of year group)              | 32 (20.6%)         | 38 (19.7%)       | 28 (13.5%)       |
| Senior Hospital Pharmacist             | 13 (40.6%)         | 17 (44.7%)       | 6 (21.4%)        |
| Hospital Pharmacist (unspecified)      | 12 (37.5%)         | 17 (44.7%)       | 20 (71.4%)       |
| Chief Hospital Pharmacist              | 6 (18.8%)          | 2 (5.3%)         | 0 (0.0%)         |
| Antimicrobial Pharmacist               | 1 (3.1%)           | 1 (2.6%)         | 1 (3.6%)         |
| Locum Hospital Pharmacist              | 0 (0.0%)           | 1 (2.6%)         | 1 (3.6%)         |
| <b>Industry</b>                        | <b>2007–2011</b>   | <b>2012–2016</b> | <b>2017–2022</b> |
| Overall (% of year group)              | 32 (20.7%)         | 56 (29.2%)       | 32 (15.5%)       |
| Quality                                | 11 (34.4%)         | 20 (35.7%)       | 18 (56.3%)       |
| Medical Affairs                        | 8 (25.0%)          | 12 (21.4%)       | 2 (6.3%)         |
| Regulatory                             | 5 (15.6%)          | 10 (17.9%)       | 6 (18.8%)        |
| Commercial                             | 3 (9.4%)           | 2 (3.6%)         | 1 (3.1%)         |
| Consulting                             | 2 (6.3%)           | 2 (3.6%)         | 0 (0.0%)         |
| Technical                              | 2 (6.3%)           | 4 (7.1%)         | 3 (9.4%)         |
| Operations                             | 1 (3.1%)           | 4 (7.1%)         | 1 (3.1%)         |
| Unspecified                            | 0 (0.0%)           | 2 (3.6%)         | 1 (3.1%)         |
| <b>Academia</b>                        | <b>2007–2011</b>   | <b>2012–2016</b> | <b>2017–2022</b> |
| Overall (% of year group)              | 9 (5.8%)           | 11 (5.7%)        | 14 (6.8%)        |
| Lecturer                               | 6 (66.7%)          | 5 (45.5)         | 0 (0.0%)         |
| Doctor of Philosophy Student           | 2 (22.2%)          | 4 (36.4%)        | 12 (85.7%)       |
| Researcher                             | 1 (11.1%)          | 2 (18.2%)        | 2 (14.3%)        |
| <b>Public Body</b>                     | <b>2007–2011</b>   | <b>2012–2016</b> | <b>2017–2022</b> |
| Overall (% of year group)              | 5 (3.2%)           | 2 (1.0%)         | 2 (1.0%)         |
| <b>Other</b>                           | <b>2007–2011</b>   | <b>2012–2016</b> | <b>2017–2022</b> |
| Overall (% of year group)              | 15 (9.7%)          | 6 (3.1%)         | 9 (4.4%)         |

<sup>a</sup> A supervising pharmacist can only act in respect of one community pharmacy premises. They must have a minimum of three years' post-registration experience and is responsible for the day-to-day operation of a community pharmacy. <sup>41</sup>

<sup>b</sup> A support pharmacist works under the supervising pharmacist. They are responsible for the safe and effective running of the pharmacy in the absence of the supervising pharmacist. <sup>41</sup>

<sup>c</sup> A superintendent pharmacist is in overall control of the management of a pharmacy, including management of the administration of the sale and supply of medicines, as well as professional and clinical management. They must have a minimum of three years' post-registration experience, and can act in respect of more than one pharmacy. <sup>42</sup>

## Discussion

The study findings provide a unique insight into trends in career pathways of pharmacy graduates over a 15-year period. Results will be of interest to pharmacy educators, potential employers, policymakers, and prospective students alike. While international pharmacy education structures may differ from Ireland, the roles filled by pharmacists are often generalisable across regions. Thus, this research provides a universal mechanism to track career progression and may be used to inform improved methods of pharmacy workforce capacity prediction. Considering the diverse employment opportunities increasingly available to pharmacy graduates,

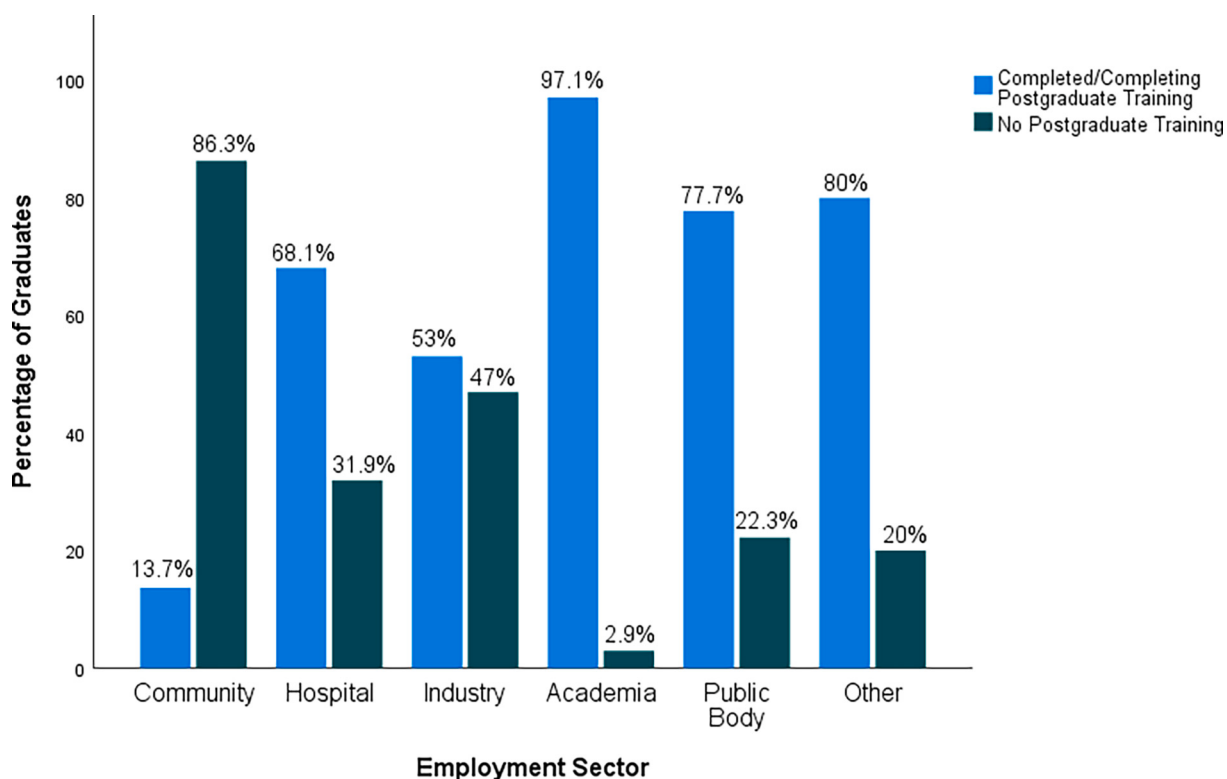


Fig. 4. Percentage of graduates per employment sector who have completed/are completing postgraduate training versus those who have not undertaken any postgraduate training ( $n = 518$ ).

rebalanced workforce analyses which account for nonconventional and emerging pharmacy career paths will provide a truer representation of the workforce available to the patient-facing pharmacy sector. The timing of future pharmacy workforce planning analyses by educators or regulators is also significant according to results obtained in this study. Here, approximately two-thirds of graduates (65.4%) were primarily working in patient-facing settings (community or hospital pharmacy). However, differences in preferences for patient-facing versus non-patient facing settings, as well as likelihood of registration with the Irish pharmacist regulator, between graduates when grouped  $\leq 5$  years graduated versus graduated  $> 5$  years were identified. In line with previous findings that the median time for pharmacists to change their primary practice setting is seven years post qualification,<sup>28</sup> this study suggests to obtain a more reflective estimate of long-term practice setting choices, future pharmacy workforce analyses involving data collection from graduates should be undertaken  $> 5$  years post-graduation. By this period, it is more likely that graduates will have chosen their long-term practice setting, thereby providing educators and regulators with increasingly accurate patient-facing workforce data to fulfil the global demand.

Within patient-facing settings, nearly half of the graduates (47.7%) worked in community pharmacy at the time of the study. A career as a community pharmacist is considered a respected career choice in Ireland, as 'local pharmacists' have been found the most trusted group of professionals by the Irish public.<sup>29</sup> During their pharmacy education, it is common for students to be heavily exposed to community practice due to weekend work or experiential placement, which may influence career choices.<sup>30</sup> Accordingly, this higher preference for community pharmacy seen in this study is in line with previous studies of pharmacy students' career intentions and preferences where higher preferences for this sector were also seen in Australia (50.42%),<sup>13</sup> Northern Ireland (57%),<sup>16</sup> and USA (50.9%).<sup>23</sup> However, despite this prevalence rate, trends of decreased preference for working primarily in community pharmacy as time post-graduation progressed were observed in this study. Our findings also highlighted the greater appeal of locum community pharmacist positions for newer graduates. Within the Irish pharmacy context, these results align with a previous workforce survey finding that preference for locum work decreases with age, as 52% of pharmacists surveyed aged  $< 35$  years had worked as locum pharmacists, while this dropped to 25% in those  $> 46$  years.<sup>28</sup> Such positions offer perceived advantages like less responsibility, improved remuneration, and flexible hours, while the wide availability of locum positions upon graduation may be attractive to newer graduates.<sup>28</sup> In comparison, further from graduation, those in community roles appear to have switched to more classical fixed roles of supervising pharmacist, superintendent pharmacist, or pharmacy owner.<sup>31</sup>

This apparent trend of graduates beginning their careers in community pharmacy but migrating away from this sector over time is reinforced by our finding that 61.1% of graduates not primarily working in community pharmacy had previously held a full-time community pharmacy role. This aligns to previous findings that 1 in 5 pharmacists in Ireland have changed their primary practice area since registration, where the biggest reason for changing was 'looking for enhanced professional satisfaction'.<sup>28</sup> A recent Irish

**Table 3**Graduate agreement ratings with statement “*I am satisfied with my career path*” according to graduate characteristics.

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Strongly Agree<br>n (%) | Agree<br>n (%) | Neutral<br>n (%) | Disagree<br>n (%) | Strongly Disagree<br>n (%) |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|----------------|------------------|-------------------|----------------------------|
| <b>Total</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 107 (52.7%)             | 72 (35.5%)     | 14 (6.9%)        | 8 (3.9%)          | 2 (1.0%)                   |
| <b>Patient-Facing Role</b>                                                                                                                                                                                                                                                                                                                                                                                                                                       |                         |                |                  |                   |                            |
| Yes                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 47 (38.5%)              | 53 (43.4%)     | 14 (11.5%)       | 6 (4.9%)          | 2 (1.6%)                   |
| No                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 60 (74.1%)              | 19 (23.5%)     | 0 (0%)           | 2 (2.5%)          | 0 (0%)                     |
| <ul style="list-style-type: none"> <li>Graduates in non-patient-facing roles were significantly more likely to be satisfied with their career path versus those in patient-facing roles (97.5% versus 82%; <math>\chi^2 = 11.31</math>, <math>df = 1</math>, <math>p &lt; 0.05</math>).</li> </ul>                                                                                                                                                               |                         |                |                  |                   |                            |
| <b>Gender</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                         |                |                  |                   |                            |
| Man                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 34 (57.6%)              | 18 (30.5%)     | 5 (8.5%)         | 1 (1.7%)          | 1 (1.7%)                   |
| Woman                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 73 (50.7%)              | 54 (37.5%)     | 9 (6.3%)         | 7 (4.9%)          | 1 (0.7%)                   |
| <ul style="list-style-type: none"> <li>Gender did not influence career path satisfaction (<math>\chi^2 = 0.00</math>, <math>df = 1</math>, <math>p &gt; 0.05</math>)</li> </ul>                                                                                                                                                                                                                                                                                  |                         |                |                  |                   |                            |
| <b>Year of Graduation</b>                                                                                                                                                                                                                                                                                                                                                                                                                                        |                         |                |                  |                   |                            |
| 2007–2011                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 41 (61.2%)              | 17 (25.4%)     | 4 (6%)           | 4 (6%)            | 1 (1.5%)                   |
| 2012–2016                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 33 (48.5%)              | 28 (41.2%)     | 5 (7.4%)         | 1 (1.5%)          | 1 (1.5%)                   |
| 2017–2022                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 33 (48.5%)              | 27 (39.7%)     | 5 (7.4%)         | 3 (4.4%)          | 0 (0%)                     |
| <ul style="list-style-type: none"> <li>Year of graduation did not influence career path satisfaction (<math>\chi^2 = 0.32</math>, <math>df = 2</math>, <math>p &gt; 0.05</math>)</li> </ul>                                                                                                                                                                                                                                                                      |                         |                |                  |                   |                            |
| <b>Current Employment Sector</b>                                                                                                                                                                                                                                                                                                                                                                                                                                 |                         |                |                  |                   |                            |
| Community                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 31 (38.8%)              | 32 (40%)       | 11 (13.8%)       | 4 (5%)            | 2 (2.5%)                   |
| Hospital                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 16 (38.1%)              | 21 (50%)       | 3 (7.1%)         | 2 (4.8%)          | 0 (0%)                     |
| Industry                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 37 (78.7%)              | 9 (19.2%)      | 0 (0%)           | 1 (2.1%)          | 0 (0%)                     |
| Academia                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 13 (61.9%)              | 8 (38.1%)      | 0 (0%)           | 0 (0%)            | 0 (0%)                     |
| Public Body                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 3 (100%)                | 0 (0%)         | 0 (0%)           | 0 (0%)            | 0 (0%)                     |
| Other                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 7 (70.0%)               | 2 (20.0%)      | 0 (0%)           | 1 (10.0%)         | 0 (0%)                     |
| <ul style="list-style-type: none"> <li>Graduates in community pharmacy displayed lower satisfaction versus those primarily working in all other employment sectors (<math>\chi^2 = 11.26</math>, <math>df = 1</math>, <math>p &lt; 0.05</math>).</li> <li>Career satisfaction was higher for those in industry (97.9%) compared to those in all other employment sectors (<math>\chi^2 = 5.51</math>, <math>df = 1</math>, <math>p &lt; 0.05</math>).</li> </ul> |                         |                |                  |                   |                            |

qualitative study of pharmacists identified six categories affecting community pharmacy retention in Ireland based on the views of 23 interviewees. These included working conditions, limited career fulfilment, and professional progression opportunities.<sup>31</sup> Similar themes were also highlighted in a similar Northern Irish qualitative study,<sup>32</sup> as well as in a recent Irish workforce survey of 1272 PSI registered pharmacists (September 2023). There, 70% of respondents in community pharmacy strongly agreed that job stress is a feature of the role and 73% had experienced burnout.<sup>33</sup> Within the Irish pharmacy context, these reports arise in the backdrop of significant workforce capacity shortages in the community pharmacy sector. Previous research in 2022 found that 57% of pharmacist respondents were 'concerned' or 'extremely concerned' about the patient-facing workforce capacity issues<sup>28</sup>, where a heavy reliance on the transient locum pharmacist workforce and high prevalence of vacancies nationwide were also highlighted. Meanwhile, a 2023 PSI workforce survey has worryingly revealed that over one quarter of respondents (27%) intend to leave the profession.<sup>33</sup>

Reasoning why almost two thirds of those in hospital pharmacy previously worked in community pharmacy is likely multifaceted related to the factors negatively affecting community retention in addition to a combination of skill utilisation, specialisation potential, and job security factors.<sup>8,12,27</sup> More broadly speaking, factors influencing primary practice choice setting by pharmacists are varied and have also previously been explored internationally.<sup>15,23,34–36</sup> In relation to community pharmacy however, while graduates in community expressed lower career path satisfaction ratings versus those in other sectors, it must be remembered that overall satisfaction in the sector was still very positive (78.8%). Furthermore, the ability of students to move career sector can also be seen as a positive reflection of the wide applicability of the skillset attained through a degree in pharmacy. Recommendations recently highlighted by the Irish pharmacy regulator and beyond<sup>33,37</sup> aim to initiate the process of addressing concerns among community pharmacists and incentivise more graduates to remain in community pharmacy settings long-term.

In this study, the proportion of graduates primarily in non-patient-facing settings lies at greater than one third (34.6%), where almost 20% of these have relinquished their ability to be named on the PSI register of registered pharmacists. This substantial proportion of graduates occupying non-patient facing roles, highlights the significant current underestimation of the non-patient-facing cohort according to Irish pharmacy regulator statistics, which stand at only 10.4% (i.e., three times lower, as of November 2023). Therefore, our findings highlight discrepancies associated with the use of this register as a predictor of pharmacist career paths, most definitely in this cohort of graduates. In reality, the present study's results are more comparable to statistics from Scandinavia, where the percentage of pharmacists in non-patient-facing roles in Sweden and Denmark have risen to 50% or more.<sup>30,38</sup> While multifaceted, one reason for this increase could be due to higher career path satisfaction, as found in this study. Furthermore, as previously mentioned, Irish pharmacy students are now also being exposed to more non-patient-facing placement opportunities at an earlier stage in their education.

Over one fifth of Irish pharmacy graduates (21.5%) were primarily working in the pharmaceutical industry at the time of the study. This may have been aided by the fact that Ireland represents one of the leading locations for pharmaceutical industry in Europe.<sup>39</sup> The proximity of many pharmaceutical employment may in some way account for the large proportion of pharmacy graduates working in this sector, while the pharmacy degree also remains sole degree which meets all criteria to act as a 'Qualified Person' in the European pharmaceutical industry.<sup>40</sup> Furthermore, pharmacy represents a clinical and pharmaceutical science degree, and as a result pharmacy graduates represent a unique cohort of students, attractive to potential industry employers and equipped with real world communication skills developed through clinical practice. This draw to the pharmaceutical industry for Irish graduates can be contrasted to other countries, such as Saudi Arabia,<sup>19</sup> Sudan<sup>2</sup> and Malaysia<sup>15</sup> where the percentage of undergraduate pharmacy students that wished to pursue a role in industry ranged from 7%<sup>19</sup> to 17.8%<sup>15</sup>. The importance of proximity to pharmaceutical companies was also previously highlighted in a Nigerian study, where a significantly higher percentage of students in a Nigerian university situated in a highly industrialised environment (36.5%) chose industry as their career preference versus other Nigerian universities (22.5% and 20% respectively)<sup>17</sup>.

In terms of postgraduate education, completion or undertaking of such was less prevalent among those in patient-facing versus non-patient-facing roles. However, stark differences were seen in undertaking a postgraduate degree between those in community (13.1%) and hospital pharmacy (68.1%). These differences were echoed in a workforce survey where 34% of respondents in community had undertaken additional formal higher education compared to 86% of respondents in hospital.<sup>33</sup> Such differences could be linked to the fact that experiential learning and standard continuous professional development (CPD) are more commonly crucial elements of community pharmacy skills enhancement, while no postgraduate education is required to progress to more senior roles in the sector. The relevance of micro-credentials versus traditional postgraduate qualifications may also need to be considered. Comparatively, undertaking a clinical pharmacy master's degree is a common desirable criterion of progression for hospital-based pharmacists in Ireland (albeit not essential), and is at times even funded by the employer. For non-patient-facing roles, a possible explanation behind the high rates of postgraduate study uptake may be that these graduates are competing with non-pharmacists for employment. Depending on the sector, they may either require a postgraduate qualification or perhaps be financially supported by an employer to undertake studies to upskill and aid progression to more senior positions. This in turn may aid pharmacist retention within these sectors due to clear career progression opportunities. This is further supported by 2018 research which revealed that nearly half (45%) of pharmacists in industry roles believed that postgraduate education is essential for such roles.<sup>30</sup> It was suggested that responses may have been influenced by the individual's own entry pathway to pharmaceutical industry, as 22% of those respondents entered non-patient-facing settings following a postgraduate qualification.

Along with overall high career path satisfaction, high satisfaction rates with the pharmacy training programme among graduates from all career sectors highlights the applicability of the programme to support varied career pathways over a 15-year period since the school's inception. The variance in career sectors across all graduating years also suggests that changes to the MPharm degree have not limited nor dissuaded Irish Pharmacy graduates from taking up employment across varied sectors. Moving forward, this study provides capacity to inform potential strategic adjustments to the delivery of the pharmacy programme to meet the needs and skillsets of the

graduates' prospective employment sectors, while also providing useful information to prospective and current pharmacy students and associated employers. The advantages of more precise mechanisms for maintaining contact with graduates and tracking career progression by universities was also highlighted.

Regarding study strengths and limitations, it is recognised that 30% of graduates were not accounted for in this study and data is representative of one pharmacy training programme. Secondly, at the time of data collection, graduates who were currently undertaking postgraduate education were classified similarly to those who had completed postgraduate education, as exact timing of programme completion was not available from LinkedIn® profiles. It is recognised that this method of data collection does not facilitate a quantitative comparison of those undertaking versus those who have completed a postgraduate degree. It is also not possible to say that all LinkedIn® data was up to date, as some users may have been more frequent users of the platform than others. While the use of two data collection methods allowed for a greater number of graduate data to be identified, this meant the survey was not anonymous and may have influenced answers provided. It is also acknowledged that this study is limited by providing *p*-values above or below the 0.05 level, rather than reporting specific values. However, this study provides an impetus for potential further research comparing results to those obtained both internationally and across other pharmacy training programmes in Ireland.

## Conclusion

This study has successfully analysed career paths of pharmacy graduates from a school of pharmacy over a 15-year period. Impacts of this research include the revelation that although nearly two thirds of graduates currently occupy patient-facing roles, this proportion has decreased as time from graduation increased. Consequently, future workforce capacity data collection initiatives may be optimised by considering the growing non-patient-facing pharmacy workforce and undertaking analyses of graduate career choice at least >5 years post-graduation. Then, a more precise estimate of graduates occupying the patient-facing workforce in the long term will likely be achieved. In this study graduates in non-patient facing roles were shown to display a higher degree of career path satisfaction along with higher rates of postgraduate degrees versus graduates in community pharmacy. This study indicates that future research should more closely examine the motivators for pharmacy graduates in choosing a given career sector. Given the increasingly multimorbid ageing population, while the increasingly diverse professional opportunities for pharmacists are welcomed, it is vital that we have sufficient pharmacists in patient-facing roles to provide pharmaceutical care. The present study demonstrates the importance of evaluating pharmacist career paths and represents a springboard for further research to inform future pharmacist workforce planning worldwide to avoid potentially significant implications of shortages in patient-facing pharmacy workforce.

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## Contribution to literature

This research provides the first longitudinal analysis of pharmacy graduate career pathways.

It provides evidence of a novel method of tracking graduate career paths to inform future pharmacist workforce planning worldwide through career path evaluation.

## CRediT authorship contribution statement

**Katie L. Fitzpatrick:** Writing – original draft, Formal analysis, Data curation. **Evin A. Allen:** Writing – review & editing. **Brendan T. Griffin:** Writing – review & editing. **Joseph P. O'Shea:** Writing – review & editing. **Kieran Dalton:** Conceptualization, Methodology, Writing – review & editing. **Harriet Bennett-Lenane:** Conceptualization, Methodology, Supervision, Formal analysis, Writing – review & editing.

## Declaration of competing interest

The authors declare no conflict of interest.

## Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.cptl.2024.02.010>.

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