



RESEARCH ARTICLE

REVISED Professional qualifications of medical affairs

pharmaceutical physicians and other internal stakeholders in the pharmaceutical industry [version 2; peer review: 2 approved]

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V2 First published: 22 Jul 2022, 11:813
<https://doi.org/10.12688/f1000research.123182.1>
 Latest published: 07 Nov 2022, 11:813
<https://doi.org/10.12688/f1000research.123182.2>

Abstract

Background: Medical affairs pharmaceutical physicians (MAPPs) have unique value to pharmaceutical companies due to their accountability for activities that benefit regulators, payors, prescribers and patients. This study assessed whether MAPPs' specialist training and education in pharmaceutical medicine could account for this level of value by determining whether there was significant variation in education and training between MAPPs and other internal stakeholders of pharmaceutical companies.

Methods: A systematic search of LinkedIn profiles from the 10 pharmaceutical companies by revenue was conducted between June and October 2021. Job title and type and year of undergraduate and postgraduate qualifications were extracted. A one-sided Mann-Whitney test assessed for differences in the total number of qualifications between MAPPs and other internal stakeholders involved in medical affairs using MAPPs as the reference group. Other internal stakeholders included medical affairs pharmacists (MAPharm), other medical affairs professionals (MAOth), and market access (MAcc), commercial (COmm) and sales professionals. Sub-group analysis determined differences in undergraduate and postgraduate education.

Results: In total, 524 profiles were included. Compared to all other internal stakeholders, MAPPs had a significantly higher number of undergraduate ($p < 0.001$) and postgraduate (MAPharm, $p = 0.003$; MAOth, $p = 0.004$; MAcc, COmm and Sales, $p < 0.001$) qualifications. Additionally, MAPPs had a significantly longer time to industry than other internal stakeholders apart from MAPharm. Of those with clinical qualifications, MAPPs were almost twice as likely to have business qualifications.

Conclusions: Of all internal stakeholders, MAPPs had the highest

Open Peer Review**Approval Status**

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version 2 (revision) 07 Nov 2022	 view	 view
version 1 22 Jul 2022	 view	 view

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number of qualifications and the best match between expertise and the contextual demands of decision-makers in the pharmaceutical industry. Pharmaceutical companies in the UK can use these findings to clarify role boundaries and decision-making power based on the nature and level of expertise of each internal stakeholder.

Keywords

Medical affairs, pharmaceutical physicians, degree qualifications, decision-making

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Author roles: Jandhyala R: Conceptualization, Formal Analysis, Investigation, Methodology, Project Administration, Resources, Validation, Writing – Original Draft Preparation, Writing – Review & Editing

Competing interests: The author is a visiting senior lecturer at the Centre for Pharmaceutical Medicine Research at King's College London and is responsible for research into real-world evidence approaches. He is also the founder and CEO of Medialis Ltd, a medical affairs consultancy and contract research organisation involved in the design and delivery of real-world evidence in the pharmaceutical industry.

Grant information: The author(s) declared that no grants were involved in supporting this work.

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How to cite this article: Jandhyala R. **Professional qualifications of medical affairs pharmaceutical physicians and other internal stakeholders in the pharmaceutical industry [version 2; peer review: 2 approved]** F1000Research 2022, 11:813 <https://doi.org/10.12688/f1000research.123182.2>

First published: 22 Jul 2022, 11:813 <https://doi.org/10.12688/f1000research.123182.1>

REVISED Amendments from Version 1

This version has addressed reviewers' comments, which included a comment on the low resolution of Figure 1 and points on skills of other internal stakeholders in the pharmaceutical industry and entry-level qualifications in the context of leadership ability.

In this version, we have replaced Figure 1 with a higher resolution version. We have also emphasised the point in our discussion addressing the fact that our analysis did not capture the highly specialised skills of other internal stakeholders in the pharmaceutical industry. Additionally, we added a point to the discussion section to include the fact that entry-level qualifications may also contribute to leadership skills and decision-maker influence, in line with the reviewer's comment.

Any further responses from the reviewers can be found at the end of the article

Introduction

The pharmaceutical industry is a unique context due to the need to balance both commercial and patient interests. The idea that organisational survival is predicated on commercial success is a well-established business principle within and beyond the pharmaceutical industry; however, the nature and importance of pharmaceutical medicine expertise is less well-recognised,¹ which may have problematic implications for interprofessional collaboration² and patient-centricity.³ The International Federation of Associations of Pharmaceutical Physicians and Pharmaceutical Medicine and other leading experts^{4,5} have advocated for the role of medical affairs pharmaceutical physicians (MAPPs) and defined its competencies, activities and importance to drug development, adoption and post-adoption and launch processes.^{6,7} MAPPs aim to identify gaps between practice and evidence-based guidelines,^{8–13} improve patient outcomes and decrease healthcare costs.^{14–16} Additionally, MAPPs optimise medicine adoption by facilitating engagements between pharmaceutical companies and regulators, payors and prescribers¹⁷ and may hold greater weight with prescribers than those in non-medically qualified roles.¹⁸

Collaboration between stakeholders in the pharmaceutical industry^{17,19} is necessary for optimal medicine prescribing and to improve patients' health,²⁰ so engagement with regulators, payors and prescribers is vital to pharmaceutical company success. The value of medical affairs pharmaceutical physicians (MAPPs) to pharmaceutical companies has been established as distinct from that of other internal stakeholders due to their unique accountability for activities that benefit all external stakeholders (regulators, payors, prescribers, and patients).²¹ However, the reasons why they are able to make such a unique contribution have not been characterised. Medical affairs pharmaceutical physicians (MAPPs) have education and training in competencies that cover the entire scope of medical affairs practice and medicine adoption,^{21–25} while other stakeholders may have more general educational backgrounds supporting competencies that cover a smaller number of specialist domains (Table 1).^{26–29} Therefore, it was hypothesised that variation in educational background may account for MAPPs' unique value to pharmaceutical companies.

The aim of this study was to determine whether significant variation in qualifications existed between MAPPs and internal stakeholders in the pharmaceutical industry, which could explain their unique value to pharmaceutical companies.

Table 1. Role scope and competencies of physician and non-physician specialists in medical affairs.

Title	Qualifications/skills	Competencies
Medical affairs pharmaceutical physician	Medical degree plus post-graduate pharmaceutical medicine specialty training. ²⁵ Specialist training in medical affairs is available.	Drug discovery and development, clinical trials, medicines regulation, pharmacovigilance, ethics, healthcare marketplace, communication and management. ²⁵
Medical information specialist	Undergraduate degree in medicine, pharmacy or the life sciences; postgraduate degree in medical information or drug information (not essential). ²⁶ Communication skills, medical writing skills, and literature evaluation skills are needed. ²⁷	Answering medical information questions, collecting adverse events and product complaints, ²⁷ reviewing promotional materials. ²⁶
Medical science liaison	Advanced degree (often medical, pharmacy or scientific PhD), scientific and technical expertise, business acumen, communication and interpersonal skills are needed. ²⁸	Scientific engagement with key opinion leaders, evidence generation, insight gathering. ²⁹

Table 2. Search strings.

Search string	Number of hits
Medical affairs AND United Kingdom (Location) AND Company	1900
Medical affairs pharmaceutical physician AND United Kingdom (Location) AND Company	135
Medical affairs MSL AND United Kingdom (Location) AND Company	97
Medical affairs Pharmacist AND United Kingdom (Location) AND Company	499
Medical affairs medical science Liaison AND United Kingdom (Location) AND Company	213
Medical affairs Pharmacy AND United Kingdom (Location) AND Company	355
Medical sales representative AND United Kingdom (Location) AND Company	1000
Pharmaceutical sales representative AND United Kingdom (Location) AND Company	1100
Pharmaceutical market access AND United Kingdom (Location) AND Company	1900
Pharmaceutical commercial AND United Kingdom (Location) AND Company	2100

Note: For company, each of the pharmaceutical companies included in the sample were included consecutively in the search string.

Methods

A systematic search and comparative quantitative analysis of social media data was conducted prospectively according to a predefined protocol. No specific guidelines were consulted. LinkedIn was searched between June and October 2021 for profiles of professionals in the pharmaceutical industry, including MAPPs, medical affairs pharmacists (MAPharms), other medical affairs professionals (MAOths) and market access (MAcc), commercial (COmm) and sales professionals (for search strings, see [Table 2](#)). As with all self-report data, consideration was given to the likely correctness and completeness of information provided on LinkedIn profiles. In the absence of data suggesting potential skew, we assumed that self-reported data quality would fall within a normal distribution, with the majority within acceptable limits and comparable to other self-report data. Additionally, a study assessing the criterion validity of LinkedIn profile elements suggested that it can be used as an accurate source of data on professionals' qualifications.³⁰ LinkedIn has also been reported as more accurate than other forms of biodata, such as resumes,³¹ possibly due to the group regulation of individual behaviour according to expectations of adherence to social norms, such as honesty.³²

To be included, profiles needed to belong to a professional who was employed at one of the 10 largest pharmaceutical companies by revenue at the time of study, in particular Pfizer, GlaxoSmithKline, Merck & Co., Bayer Pharmaceuticals, Roche, Abbvie, Johnson & Johnson, Sanofi, Gilead Sciences and Novartis. It was assumed that these pharmaceutical companies would have sufficient organisational similarity as to ensure a broad likeness of job descriptions, person specifications and educational requirements for employment within the study sample. The sample of profiles was limited to those whose qualifications were recognised by UK employers to ensure a baseline level of comparability. Data on their undergraduate and postgraduate education (type of degree and year of qualification), date of entry into the pharmaceutical industry, relative age, and research experience were extracted by two research analysts and reviewed by an experienced systematic reviewer to provide outcome data, using MS Excel, comprising the number of degrees and years to first employment in the pharmaceutical industry.

Statistical analysis

The research hypothesis was tested using a one-sided Mann-Whitney test to assess whether the total number of degrees varied significantly between MAPPs and the other internal stakeholders, using MAPPs as the reference group. Sub-group analysis was performed to determine differences in the level of education (undergraduate and postgraduate) of MAPPs versus other internal stakeholders. The analysis was extended to determine the number of years taken by professionals to gain entry into the pharmaceutical industry, which was taken as a measure of how well the industry recognised their expertise. This was calculated by subtracting the year in which a professional graduated from their first degree/qualification from the year in which professionals took their first job at a pharmaceutical company. If obtained values were negative, then they were statistically adjusted by replacing the year at graduation with the year of entry to ensure that all values were above zero. All statistical analyses were performed using R v4.1.1, and p-values < 0.05 were considered statistically significant.

Results

Systematic search of LinkedIn profiles

The search yielded 9299 profiles with 1209 unique profiles meeting inclusion criteria for review. Of these, 685 were excluded due to missing educational data, unavailability of profiles, professionals not being in primary employment at a

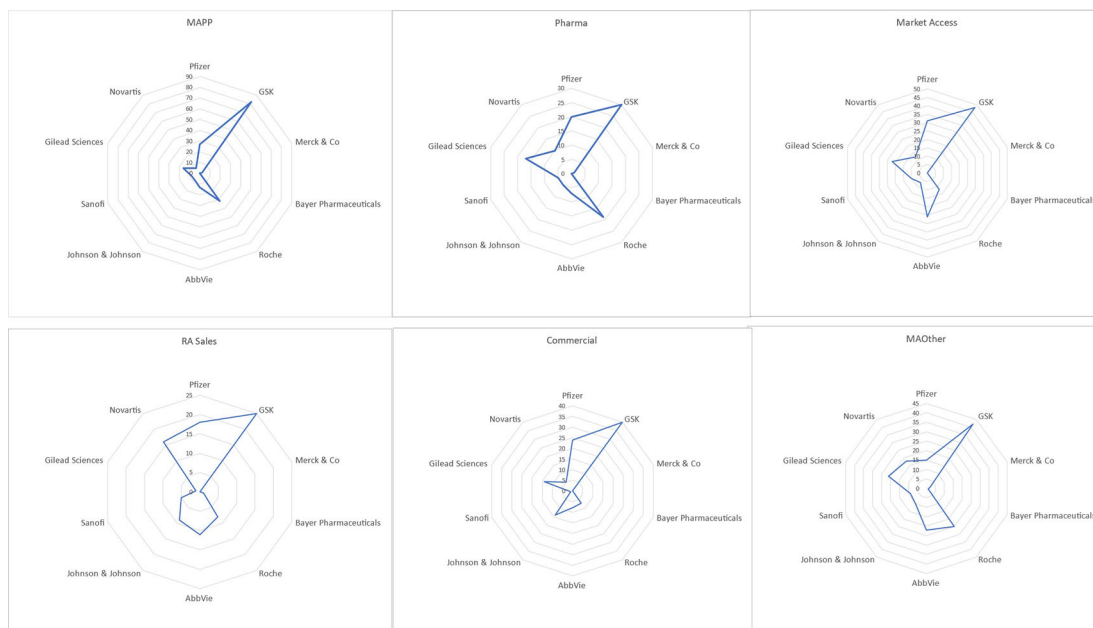


Figure 1. Number of internal stakeholders in each group from the 10 pharmaceutical companies with the highest market share in the UK at the time of study.

pharmaceutical company and professionals being employed in non-medical affairs functions, such as clinical development, regulatory affairs and so on. In total, 524 profiles were included across MAPPs (88), MAPHarm (66), MAOth (86), MAcc (97), COmm (94) and sales (93). GlaxoSmithKline was the most represented employer, followed by Abbvie and Roche, with fewest participants being employed by Bayer Pharmaceuticals (Figure 1).

As shown in Table 3, most qualifications were in the area of science and scientific research (BSc, $n = 261$; MSc, $n = 150$; PhD, $n = 80$), followed by pharmacy (BPharm, $n = 40$; MPharm, $n = 58$; PharmD, $n = 9$), medicine (MBBS/MBChB/BMCh, $n = 68$; MD, $n = 34$) and business (MBA, $n = 60$). Business and either science, medical or pharmacy qualifications were found in all study groups, but of those with clinical qualifications, MAPPs were almost twice as likely to have business qualifications in the form of MBAs. Of all groups, professionals in the MAOth group were about twice as likely as MAPPs and MPharms and three times as likely as MAcc professionals to have scientific research expertise. Sales and COmm professionals had the least amount of clinical and research expertise, although the COmm group had one of the highest frequencies of business qualifications.

Difference in number of qualifications and years to industry after first degree between MAPPs and other internal stakeholders

Of all internal stakeholders, MAPPs had the highest median number of degree qualifications, followed by MAPHarms, MAOth and MAcc. Commercial and sales had the lowest. MAPPs had a significantly higher number of total degrees than all other stakeholders (Table 4, Figure 2A). Subgroup analysis showed that MAPPs had significantly more undergraduate and postgraduate degrees than all other internal stakeholders, but the difference between MAPPs and MAPHarm and MAOth was at a lower significance level (Table 4, Figure 2B). It took MAPPs significantly longer after their first degree to enter the pharmaceutical industry than all other internal stakeholders, but the difference from MAPHarm was at a lower significance level (Figure 3).

Discussion

Historical tensions between commercial and scientific interests in the pharmaceutical industry have created interprofessional working conditions that may have a negative impact on patient and organisational outcomes. Matching human capital with contextual demands for expertise and ensuring that decision-making is carried out by appropriately qualified employees may improve outcomes in domains where both clinical and business factors must be taken into account, such as the pharmaceutical industry. To achieve this, it is first necessary to understand the human capital contributed by each internal stakeholder employed by pharmaceutical companies. This study assessed the expertise of internal stakeholders in the pharmaceutical industry and showed that while MAPPs had significantly more total, undergraduate and postgraduate degree qualifications than all other internal stakeholders, non-MAPP stakeholder groups tended to be characterised by

Table 3. Frequency of qualifications among all internal stakeholders.

Study group	Frequency of qualification															
	Undergraduate							Postgraduate								
	BTech	BSc	Ba	BSc Nurse	BPharm	MBBS	BMBCh	MBChB	PgDip	PgCert	MSc	MBA	MPharm	PharmD	MD	PhD
MAPP	0	27	1	0	1	40	3	24	31	8	22	12	0	0	28	14
MAPharm	0	11	0	0	19	0	0	0	18	12	22	7	43	3	0	19
MAOth	0	63	1	1	5	0	0	0	1	4	40	7	7	0	2	36
MAcc	0	57	9	2	12	0	0	1	11	6	39	17	6	3	3	9
COmm	0	47	16	0	3	0	0	0	6	3	30	16	0	3	0	2
Sales	2	60	6	1	0	0	0	0	2	6	8	1	2	0	1	0
Total	2	261	33	4	40	40	3	25	63	36	150	60	58	9	34	80

Table 4. Difference in number of degree qualifications between MAPPs and other internal stakeholders.

Stakeholder	Median	All/total	Undergraduate	Postgraduate
MAPP	3	-	-	-
MA Pharm	2	<0.001*	<0.001*	0.004**
MA Other	2	<0.001*	<0.001*	0.003**
MALAcc	2	<0.001*	<0.001*	<0.001*
COMm	1	<0.001*	<0.001*	<0.001*
Sales	1	<0.001*	<0.001*	<0.001*

*p < 0.001.
**p ≤ 0.005.

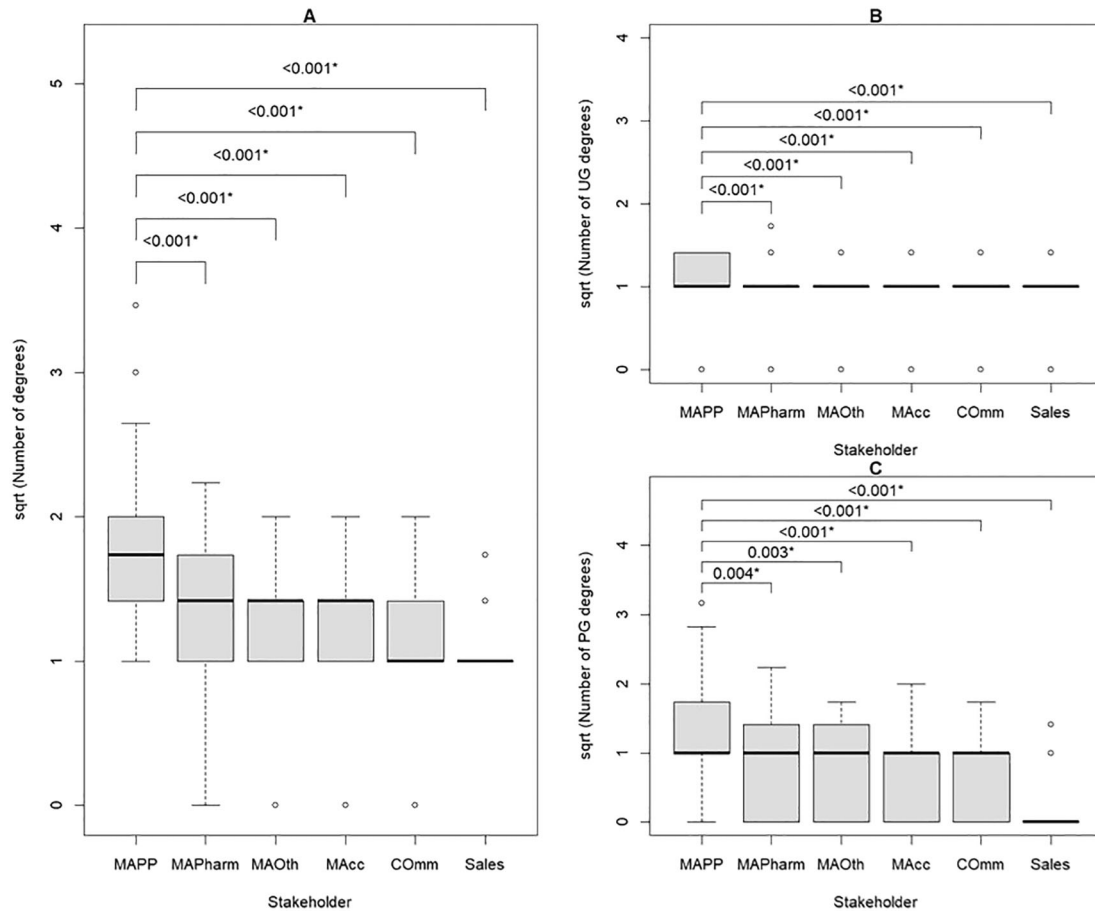


Figure 2. Number of degrees held by internal stakeholders in the pharmaceutical industry; number of degrees transformed using square root to overcome right skewness.

specific types of expertise. Of those with clinical expertise, MAPPs were twice as likely to have business expertise in the form of MBAs, making their training most likely to result in competencies that cover all domains necessary for pharmaceutical company success.

MAPPs had significantly more total, undergraduate and postgraduate degree qualifications than all other internal stakeholders although the latter was at a higher significance level for MALAcc, COMm and Sales professionals than for MAPharm and MAOth. There is little previous research comparing the number of qualifications of those in the pharmaceutical industry. However, the results were largely in line with previous findings suggesting that of those with an education in healthcare, physicians were by far most likely to seek out postgraduate study.³³ The proportion of physicians with management training

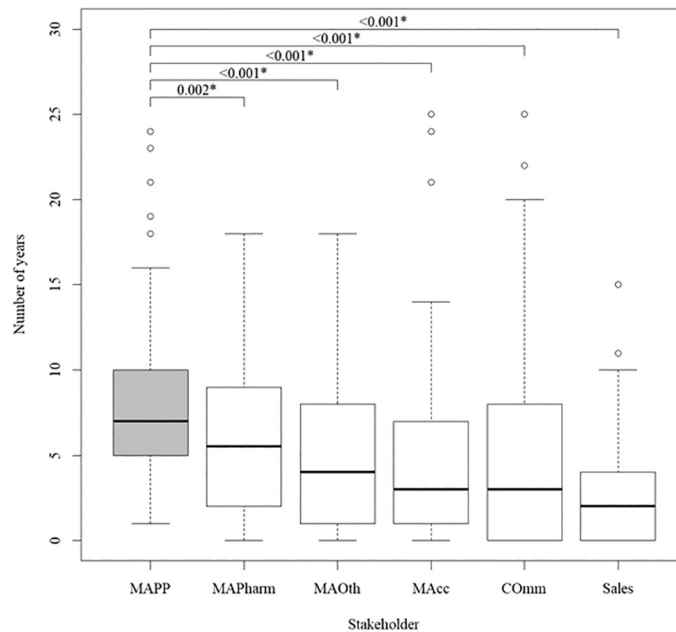


Figure 3. Number of years after completion of first degree for internal stakeholders to gain entry into the pharmaceutical industry, with MAPPs as the reference group.

in this study (13.6%) also reflected earlier findings.³⁴ The qualifications of physicians have not often been compared to those in non-clinical roles, except in the context of hospital leadership. About twice as many professionals in this study had undergraduate degrees and twice as many had master’s or PhD degrees as those in a previous study in a hospital context.³⁵ This may reflect the comparatively greater need for specialist knowledge in the pharmaceutical industry.

Additionally, MAPPs took significantly longer than all other internal stakeholders apart from MAPHarm to enter the pharmaceutical industry after the completion of their first degree. The obvious explanation for this is that MAPPs took longer because they spent more years in education and training. For this to be true, it would be expected that the pattern of differences in qualifications of internal stakeholders compared to MAPPs would reflect the pattern of differences in time to industry. However, all but MAOth and MAPHarm had significantly fewer degree qualifications than MAPPs at a significance level of $p < 0.001$, whereas all but MAPHarm had significantly less time to industry than MAPPs at a significance level of $p < 0.001$. The variation could be explained by the higher number of postgraduate diplomas and certificates completed by MAPPs and MAPHarms, assuming they were full time courses. As specialist training in pharmaceutical medicine is in the format of postgraduate diplomas and certificates, the data suggests that while MAOth may accrue a higher number of years of experience in the pharmaceutical industry earlier in their careers, MAPPs may be spending this time developing domain-specific expertise applicable to the pharmaceutical industry in specialist training.

A certain number of years of experience is a common entry requirement for job roles in pharmaceutical companies, especially those in leadership, which reflects the assumption that time spent working within a specific industry allows for the development of domain-specific skills and knowledge. This is in line with human capital theory, which suggests that number of years of experience is a measure of expertise.³⁶ However, evidence suggests that it is not just the number of years of experience that matters but what those years are spent doing. For example, job tenure alone was unrelated to four domains of work performance³⁶ and clinical skills,^{37,38} with talent alone³⁷ and training alone³⁸ explaining variation in expertise in clinical contexts. Clinical expertise only seems to be related to years of experience when there is access to the necessary learning experiences.³⁹ Thus, there is a need to assess what constitutes valuable learning experiences within medical affairs practice to understand how expertise can best be developed through both experience and training. Additionally, the pharmaceutical industry may consider developing postgraduate on-the-job training programs to attract MAPPs and facilitate the match between training, expertise and role demands.

Despite differences in time to industry, the difference in postgraduate degree qualifications between MAPPs and MPharm/MOth was at a lower significance level than that of other internal stakeholders, which suggested that MAPHarm and MOth also held meaningful specialist expertise. In this study, MOth professionals were about twice as likely to have research expertise than MAPPs and MAPHarms. This is to be expected, as entry requirements for medical leads, medical

science liaisons and medical information specialists often include a PhD qualification. Of the three groups, MAPPs were about twice as likely to have business expertise at postgraduate level. Therefore, they were the most likely to have expertise that covers the domains necessary for pharmaceutical company success, followed by MAPharms. Additionally, physicians trained in both medicine and management may be better leaders,^{34,40} which supports the value of this type of dual expertise to the pharmaceutical industry. However, entry-level qualifications and competencies not captured here that are not necessarily unique to the pharmaceutical industry are also likely to inform an individual's degree of influence and success as a decision maker.

The study did not collect data on the subject of internal stakeholders' PhD qualifications, but it may be interesting to do so in further research to determine the value of these qualifications to role competencies as well as organisational and patient outcomes given the need for a scientific-medical approach in the pharmaceutical industry.⁴¹ While COmm and sales had fewest qualifications over the least number of domains, the skills most important for success for these groups may be measured differently. This may reflect the different nature of their expertise and role competencies. For example, psychosocial skills,⁴² rather than academic and clinical certifications may be among some of the highly specialist skills developed by these groups that were not captured in this study. Additionally, training for some roles, such as medical information specialists and medical science liaisons may be appropriately matched to their specific role scope. In any case, it may be helpful to clarify and define role boundaries and organisational decision-making power within pharmaceutical companies to reflect the specific types of expertise of each internal stakeholder.

It is estimated that about 50% of the study population were likely to have profiles on LinkedIn,^{43,44} so the sample could not be said to be fully representative. Despite this, our findings are sufficient to fulfil the aim of the study to evidence MAPP expertise in the context of expertise in the pharmaceutical industry. Further research using a wider range of recruitment strategies that examines in more detail the comparative qualitative aspects of pharmaceutical professionals' education may be useful, especially with regards to scope and match to medical affairs competencies and impact on patient, research and organisational outcomes. Although many profiles, especially those of professionals in older age groups, were excluded on the basis of missing data, this limitation is likely to have affected all professional groups similarly, mitigating its impact on findings. However, there has been a general trend towards younger professionals having a greater number of degrees in recent years,⁴⁵ so the total number of degrees in all groups may be overestimated given the potential skew towards lower ages in this sample. While self-reported education and experience on LinkedIn is generally more accurate than other forms of self-report in this context,⁴⁶ it is possible that profiles were not up-to-date, and the attainment of a degree qualification does not necessarily denote quality scholarship or the amount of time spent studying.

Conclusions

Of all internal stakeholders, MAPPs had the highest number of qualifications and the longest time to industry as well as the best match between expertise and the contextual demands of decision-makers in the pharmaceutical industry. Pharmaceutical companies can use these findings to clarify role boundaries and decision-making power based on the nature and level of expertise of each internal stakeholder. These findings have provided some explanation for MAPPs' unique value by suggesting that their educational background is a significant factor distinguishing them from other internal stakeholders. Further study is needed to understand how this education and training may develop expertise that accounts for their unique value, that is, how competencies developed during education and training may be relevant to their work with all external stakeholders. Understanding what constitutes useful learning experiences for developing expertise in medical affairs may be beneficial and could facilitate the development of specialised on-the-job training programs to ensure a match between training, expertise and role demands.

Ethical approval

This study was exempt from requiring ethical approval under the King's College of London research ethics guidelines, as no human participants were recruited and unidentifiable human data were collected for this study.

Data availability

Underlying data

The underlying data to this research cannot be shared due to the ethical and copyright restrictions surrounding social media data. The Methods section contains detailed information to allow replication of the study. Any queries about the methodology should be directed to the corresponding author.

Author contributions

RJ conducted the study and developed and approved the manuscript. The author affirms that the manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted, and any discrepancies from the study as planned (and, if relevant, registered) have been explained.

Acknowledgements

The author wishes to thank Medialis staff for their support in running the study, analysing the data and writing the manuscript.

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Open Peer Review

Current Peer Review Status:  

Version 2

Reviewer Report 09 November 2022

<https://doi.org/10.5256/f1000research.140405.r155174>

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Jonathan Day 

BioMarin Pharmaceutical Inc, London, UK

Many thanks to the author for responding to and addressing the comments raised during my primary review. I have no further suggestions and consider my original comments resolved.

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Clinical Development Physician working in Rare Disease Drug development (Skeletal Dysplasia, Gene Therapy, Bleeding Disorders, Thrombosis and Inflammation). Original background in cardiovascular medicine.

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.

Reviewer Report 08 November 2022

<https://doi.org/10.5256/f1000research.140405.r155175>

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Domenico Criscuolo

Genovax, Turin, Italy

I have read the amended version, and approved it for indexing.

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: I have 47 years' experience in drug development, with a special focus on Medical Affairs

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.

Version 1

Reviewer Report 26 October 2022

<https://doi.org/10.5256/f1000research.135265.r145143>

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Domenico Criscuolo

Genovax, Turin, Italy

Very interesting paper, underlining the importance of high level qualifications for physicians working in the Medical Affairs department of the pharmaceutical industry.

The author made a careful search via LinkedIn of profiles of professionals in the pharmaceutical industry, and finally selected 524 profiles with full educational details.

The analysis of these data demonstrate that physicians are the professional group with higher postgraduate education, and this finding is relevant for the role Medical Affairs physicians must cover.

The manuscript is well written, has a few tables and several references and does not need any revision.

Is the work clearly and accurately presented and does it cite the current literature?

Yes

Is the study design appropriate and is the work technically sound?

Yes

Are sufficient details of methods and analysis provided to allow replication by others?

Yes

If applicable, is the statistical analysis and its interpretation appropriate?

Yes

Are all the source data underlying the results available to ensure full reproducibility?

Yes

Are the conclusions drawn adequately supported by the results?

Yes

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: I have 47 years' experience in drug development, with a special focus on Medical Affairs

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.

Author Response 26 Oct 2022

Ravi Jandhyala, Medialis Ltd, London, UK

Dear Domenico Criscuolo,

Thank you for the outstanding and positive review of this manuscript.

Best wishes,
Ravi

Competing Interests: No competing interests were disclosed.

Reviewer Report 12 September 2022

<https://doi.org/10.5256/f1000research.135265.r148656>

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Jonathan Day 

BioMarin Pharmaceutical Inc, London, UK

The author analyzed professional qualifications (using a well-known professional social media platform) across different types of employees (Medical Affairs Physicians, Market Access, Commercial, Sales) at pharmaceutical companies across the UK and reports on the significant variation in the number and type of qualifications as well as time taken in education prior to joining the pharmaceutical industry. Those working in Medical Affairs positions tended to have spent more time in education and therefore had a larger number of undergraduate and postgraduate qualifications, including business qualifications (MBA). The author concludes that those with greater levels of education, more qualifications and more relevant experience might be better placed to make decisions that impact clinical as well as business factors across the

pharmaceutical industry.

Suggestions:

Figure 1 is not very high resolution (at least in the PDF I have access to) and is therefore difficult to interpret easily. A higher resolution Figure or one with larger font size would be helpful.

The Discussion does address some of the limitations of this study. The link between qualifications and business impact is somewhat subjective and could do with some statements to this effect. For instance, Medical Affairs professionals might spend more time in education prior to joining the Industry but those who join other functions (such as commercial and sales) will arguably develop other highly relevant skills and experience through their work experience. These competencies would not be captured in the current analysis. Different entry level qualifications at the time of starting a job in the Industry will also likely inform on an employee's seniority level (and thus decision maker influence) within the organization. Additionally, beyond seniority and qualifications many other competencies will inform on an individual's degree of influence and success as a decision maker. Attainment of these attributes is not a unique challenge in the pharmaceutical industry and something likely relevant to all sectors.

Is the work clearly and accurately presented and does it cite the current literature?

Yes

Is the study design appropriate and is the work technically sound?

Yes

Are sufficient details of methods and analysis provided to allow replication by others?

Yes

If applicable, is the statistical analysis and its interpretation appropriate?

Yes

Are all the source data underlying the results available to ensure full reproducibility?

No

Are the conclusions drawn adequately supported by the results?

Yes

Competing Interests: I am a physician working in the Pharmaceutical Industry.

Reviewer Expertise: Clinical Development Physician working in Rare Disease Drug development (Skeletal Dysplasia, Gene Therapy, Bleeding Disorders, Thrombosis and Inflammation). Original background in cardiovascular medicine.

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Author Response 27 Oct 2022

Ravi Jandhyala, Medialis Ltd, London, UK

Firstly, we would like to take this time to thank the reviewer for their efforts and positive review. A detailed response to the reviewer comments is provided below.

Comment: Figure 1 is not very high resolution (at least in the PDF I have access to) and is therefore difficult to interpret easily. A higher resolution Figure or one with larger font size would be helpful.

Answer: Thank you for bringing this to our attention. We have revised the image and submitted a higher resolution and more detailed copy alongside this revised manuscript.

Comment: Medical Affairs professionals might spend more time in education prior to joining the Industry but those who join other functions (such as commercial and sales) will arguably develop other highly relevant skills and experience through their work experience. These competencies would not be captured in the current analysis. Different entry level qualifications at the time of starting a job in the Industry will also likely inform on an employee's seniority level (and thus decision maker influence) within the organization. Additionally, beyond seniority and qualifications many other competencies will inform on an individual's degree of influence and success as a decision maker. Attainment of these attributes is not a unique challenge in the pharmaceutical industry and something likely relevant to all sectors.

Answer: Thank you for the excellent suggestion. We have revised the discussion to address the concerns raised and have included further insights into the qualification and experience attained by MAPPs.

Competing Interests: No competing interests were disclosed.

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