

**Improved awareness of national genomic initiatives is needed to facilitate genomic education
and training in Wales for pharmacists**

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Abstract

Wales has placed itself at the centre of the genomics revolution with the ambitious aim of improving patient outcomes and encouraging new discoveries. Whilst pharmacists play a key role in precision medicine; linking patients and their medication, there is a paucity of research pertaining to their genomic literacy and educational training needs. This study sought to explore Welsh pharmacists' genomic awareness, knowledge, and educational needs through an online questionnaire.

Over 88% of respondents (n=94) reported no awareness of key genomic initiatives and services. Furthermore 27.7% of respondents believe genomics is not relevant to their profession. This in turn has a detrimental impact on their perceptions of genomic educational and training needs.

We conclude that there is a disconnect between national policy rhetoric and the reality of pharmacists, highlighting the need for greater engagement with the healthcare workforce if Wales is to become a key player in genomic medicine.

Keywords

Education, Genomics, Genomic Literacy, Pharmacists, Training

Introduction

The completion of the Human Genome Project (HGP) in 2001 has changed genomics and clinical practice, heralding a new era of precision medicine, customising diagnosis, and treatment (Carrasco-Ramiro et al, 2017). Thus, genomics is becoming a term that Healthcare Professionals (HCPs) are using more frequently and is no longer isolated to the vocabulary of the specialist. Investment, to the value of £20 million by Health Education England (HEE) in 2014, to form the Genomics Education Programme (GEP) indicated that the UK NHS workforce had to take note of the emergence of genomics and its impact on healthcare. The focus on genomics education, training, and upskilling of the NHS workforce, signified there was a clear direction of what future healthcare could look like; for example, according to the Topol Review (2018) “as practice in genomics evolves, individual workforce training needs will depend less on traditional role demarcations and more on specific responsibilities related to ‘real-world’ implementation based on genomic information”.

One area where genomics is set to play a key role is pharmacy (Ferreri et al., 2014). The pharmacist role has become pivotal in the community setting and they have emerged as being core deliverers of healthcare, even more so in times of crisis (The Kings Fund, 2020). They are uniquely placed on the front line, interacting with thousands of people daily (Welsh Government, 2020) and provide an important gateway which bridges the gap between medicine and patients. Since 2006 pharmacists, who are appropriately trained, can prescribe medication, except for opiates for drug addiction treatment, based on their competence (Weeks et al, 2016). Currently, UK Pharmacists rely on patient characteristics that are observable, e.g., comorbidities, concurrent medication, and age. Yet, genetic factors are reported to contribute to between 25% and 50% of inappropriate drug responses (Spear, Heath-Chiozzi & Huff, 2001). Thus, pharmacogenomics, which is the field of genomics concerned with how an individual's genetic makeup affects their response to medication, and pharmacogenetic testing (PGx) are set to revolutionise the way HCPs treat individuals. Administering medication through a personalised genomic approach could reduce the risk of adverse drug reaction (ADR) and, the number of deaths associated with ADRs (Phillips et al., 2001). To date, there are prescribing

guidelines for more than 50 medicines where pharmacogenomic biomarkers are predicted to be of clinical relevance (Youssef, Mostafa & Wright, 2020).

The 2017 Welsh Genomics for Precision Medicine Strategy (GfPMS) identified the potential benefits that genomics in mainstream healthcare could bring to patients in Wales, and the opportunities that PGx testing could provide, especially in relation to improved management of medications and reduced hospitalisation (David et. al., 2021). The pharmacy workforce has been identified as one of the HCPs needing to engage with genomics and upskill their knowledge around personalised medicine. It indicates pharmacists will be crucial to the continuation and progression of delivering personalised medicine. Likewise, the Topol review (2018) identified pharmacogenetics will become mainstream.

Yet to upskill HCPs in genomics we also need to understand how best to educate them. Investigations into understanding the genomics education needs of the NHS workforce have been undertaken, both on specific disciplines such as Nursing by Genomics Partnership Wales (2021) and a wider workforce survey by Simpson et al. (2019) and the Genomics Education Programme (2020). Given the size of the healthcare workforce in the UK, topping almost 1.2 million, (NHS digital, 2020), the differences in learning needs of individuals, targeting specific disciplines would appear beneficial.

Research focusing on the pharmacy workforce has mostly been undertaken outside of the UK (McMahon & Tucci, 2011, McCullough et al., 2011 and Albassam et al., 2018), or completed nearly a decade ago (Jamie, 2013 and Farndon & Bennett, 2008). Wales has more than 6000 people working in the Pharmacy profession (Health Education Improvement Wales (HEIW), 2020). With the rise of investment into Genetics in Wales in the form of education initiatives, such as the HEIW funded MSc (Swansea University, 2021), and the GfPMS (Welsh Government, 2018), there is a clear need to undertake an investigation into this workforce to ascertain their needs, to ensure they have the relevant tools as at their disposal, as precision medicine emerges.

According to Knowels (1984), adults need to be involved in their learning and tend to be more engaged if they understand the relevance of the content in relation to their working or personal life. Trying to

enforce learning without contextualisation, in a workforce that is already under pressure, will not enhance engagement or life-long learning. Bain et al. (2018) analysed the successful implementation of a 'Pharmacist-led PGx testing service'. They highlighted the key leadership role pharmacists played in developing the resources, processes and implementing the service. Any education or training frameworks that are developed must lead to positive patient outcomes in line with the healthcare agenda for Wales. Therefore, it is important to gather this data to provide an evidence-based approach for this profession. Within this context, the aim of the present study was to investigate potential challenges and barriers to genomics education and training within the Welsh pharmacy workforce. The specific objectives of the study were to:

1. Explore Welsh pharmacist's awareness of national genomic strategies, education, and training initiatives
2. Assess learning style preferences among Welsh pharmacists
3. Identify perceived challenges and barriers facing genomics education and training amongst Welsh pharmacists.

Methods

A cross-sectional, online questionnaire survey of the Welsh pharmacy workforce was undertaken in July 2021. The survey instrument was informed by existing literature on genomics education (e.g., Simpson et al. 2019; Albassam et al. 2018) and genomics resources (e.g., Calzone et al. 2018). Customised questions pertaining to genomics strategies and initiatives were also included. The questionnaire sought to explore four main themes: 1) awareness of national genomic strategies/initiatives; 2) impact of genomics on the pharmacy profession; 3) learning style preferences; 4) challenges/barriers to genomics education and training. Demographics including job title, work setting, years of experience in practice and previous genomics experiences were also gathered. Responses were logged through a mix of multiple choice, selection list, rank, and free text questions. The Online Surveys platform (<https://www.onlinesurveys.ac.uk/>) was used to host the questionnaire. Simple random sampling was performed with all pharmacists (including pre-registered pharmacists) and pharmacy technicians working in Wales eligible for inclusion, with no exclusions. At survey launch, the link to the participation information sheet, questionnaire and consent form were sent by email to 45 key organisations and networks across Wales, including Community Pharmacy Wales, Health Boards and Pharmacy academics from Higher Education Institutions. The emails included a request to distribute the study information to Welsh pharmacists to encourage further participation. Respondents were asked to provide consent electronically prior to commencing the online survey. Data collection took place for a period of 20 days in July 2021. Data obtained were sorted and entered into Microsoft Excel spreadsheet file for ease of data management, and subsequently the computed data were exported into IBM SPSS version 28 for analysis. Descriptive and inferential statistics were used for data analysis of survey data, and summative content analysis was undertaken on responses to free text questions.

Ethics

Following completion of the Health Research Authority (HRA) decision tool (<http://www.hra-decisiontools.org.uk/research/>), the project was deemed not to require HRA approval or an NHS research ethics committee review. All participants completed the questionnaire voluntarily and were asked to provide electronic consent. All answers were anonymous.

Results

A total number of 94 responses were analysed. Responses were out of a potential of approximately 6607 working in the Pharmacy profession. Therefore, the response rate, in terms of the entire population was approximately 2.1%. For registered pharmacists, 64 responded out of a total of 1084 population, resulting in a 6% response rate for this role.

Demographics of respondents

Most respondents came from within the Cardiff and Vale University Health Board (UHB) locality (N=39) 41.5%. No responses were received from Hywel Dda UHB and only one from both Betsi Cadwaladr UHB and Swansea Bay UHB (N=1), 1.1%. Most respondents were Registered Pharmacists 64 (68.1%). Those who listed 'other', described their roles as prescribing advisors, pharmacy assistant or pre-registration pharmacy technician. Four listed themselves as working in Primary care but did not specify their role. A full breakdown of roles and locality are provided in Table 1.

(insert table 1)

Most respondents were based in a hospital setting, 54 (57.4%), with 19 (20.2%) from a community setting. Twenty (20.2%) respondents indicated 'other' which was not in the pre-defined list with 17 (18.1%) of those mentioning Primary care or General Practice as their setting.

Most respondents 51 (57.3%) registered as a pharmacist over 10 years ago, with 14 respondents (15.7%) having 6-10 years, and 16 respondents (18%) having 1-5 years post-registration experience respectively. Only 2 respondents (2.2%) had under a year of post-registration experience.

Pharmacists' awareness of national genomic strategies/initiatives

Respondents were asked to rate their awareness of genomics initiatives and resources in Wales. Responses were recorded on a 5-point Likert scale. As can be seen from Figure 1 the majority of respondents were unaware of key genomic initiatives such as GfPMS (86%), GEP (91%) and the

Genomic Medicine MSc at Swansea University (84%). Furthermore, responses also highlighted that the pharmacy workforce was also unaware of key genomics services such as the Wales Gene Park (83%), the All Wales Medical Genomics service (72%) and Genomics Partnership Wales (91%).

(insert figure 1).

Pharmacists' perceptions of the impact of genomics on their profession

Almost eighty percent of respondents (79.8%) (N=76) believed that genomics will have an impact on their profession. However, when asked when they perceived genomics would impact their profession the response was less clear cut with 28% (N =26) stating that genomics was already impacting their profession, 29.8% (N=27) responding it would impact their profession within the next 10 years, 38.3 % (N=36) did not know and 4.3% (N=4) selecting that genomics would not impact their profession. All the respondents were registered pharmacists.

Learning style preferences of pharmacists

Within the survey, participants were asked to choose their preferred learning style. Participants could tick all options that applied. Options included online learning, self-directed learning such as reading journals, articles etc, attending conferences or seminars or formal taught education. The most popular method of learning was e-learning with 78.5% (N=73) of respondents selecting this option regardless of when they qualified. In fact, a greater proportion of the respondents who qualified >10 years ago selected online learning as their preferred method of learning (76.7%), compared to only 63.6% for those who qualified between 1 and 5 years ago. The second most popular learning format was attendance at conferences and seminars, with 57% (N=53) selecting this option. Only 38.7% (N=36) of respondents chose an academic setting as one of their preferred formats for learning making this the least favourite option

Respondents also had the option to comment on their own preferred learning style. The responses given were:

“Experiential”

“Mainly discursive learning in a group meeting/seminar”

“Using bite-sized webinars”

Challenges and barriers to genomics education and training

Respondents were also asked to identify what they perceived to be the main challenges and barriers to learning. Options included, “not relevant”, “difficult subject to understand”, “not time to engage”, “financial barriers” or “no barriers”. Again, respondents could choose all options that applied. The most common barrier to learning about genetics or genomics, reported by the respondents, was no time to engage (45.2%) with more respondents in the hospital setting (50%) reporting this reason as the main barrier to learning compared to those working in the community (36.8%). The second most chosen option was “not relevant to me”, with 27.7% of respondents choosing this as a barrier or challenge to undertaking genomics education or training. It was also noted that a slightly larger number of the respondents in the community setting appeared to believe that genomics was not relevant to them (31.6%) compared to the hospital setting (24.1%).

Seven respondents, when asked to identify barriers to learning, selected “others”. When asked to specify what these other barriers were, free text comments included:

“Lack of support for learning from the health board”

“Not aware of opportunities”

“Prioritised learning for subjects more relevant to my day to day. I don’t see much promotion for genomics learning”.

“Not directly relevant to my clinical area”

“Availability of courses”

Interestingly, 24.5% of respondents reported that they had no barriers to learning. Whilst this opinion was lower in respondents working in the clinical setting (24.1%), the opinions of those working in the community setting were similar (31.6%) and may support the earlier finding that a greater number of community pharmacists do not see genomics as relevant to their profession.

Discussion

Although the future potential of genomics as a means to transform healthcare and the healthcare system more broadly is well documented (Hassan et al, 2022)

This study is the first national survey that addresses the level of awareness of key genomic initiatives in Wales within the pharmacy profession. Given the increased activity around genomics in Wales such as the GfPMS (2018), new whole exome testing (AWMGS, 2021), and on a wider scale the GEP (2018), one could be forgiven for assuming that pharmacists or the pharmacy workforce would be well aware and informed of national and UK wide genomic strategies. However, a large majority of respondents reported that they had no awareness of these key initiatives. For example, 86% of respondents reported a lack of awareness of the GfPMS, 91% had no awareness of GPW, 96% reported no awareness of GEP and 84% were unaware of the Genomic Medicine MSc delivered at Swansea University that provides NHS commissioned places. Furthermore, length of time since registration did not have an impact on the levels of awareness. This contrasts with Jamie (2013) who reported that pharmacists who were educated more recently, 5 years prior to their study, had more advanced awareness of genomics.

Interestingly a higher percentage within the community setting (50%) stated genomics is not relevant to them, compared to 36.8% working in a hospital setting. This indicates that those working in this setting have a stronger need for a more in-depth engagement strategy. This supports Rogers' (2003) 'Diffusion of innovations theory' and has been demonstrated by the work of Andrews et al (2014) to analyse the pattern and speed at which genomic ideas and practices spread through a population. The main players in this theory are innovators, early adopters, early majority, late majority, and laggards. In the context of this work, this group of respondents would be termed either 'late- majority or laggards' where they are the last group to adapt to new ideas or concepts and require more effort in order to 'sell' the concept (Kaminski, 2011).

However, encouragingly most (79.8%) respondents believed genomics will impact their profession. These finding highlights that whilst there is little genomic awareness, the majority of the workforce

understand that genomics will have an impact; yet they are unsure of the timescale for implementation. This is supported by the finding that overall, 38.7% of the sample said they did not know when genomics would impact their profession.

The shared commitment of the NHS for all four devolved nations in the UK is to integrate pharmacogenomics into routine practice (Gov.UK, 2022). Furthermore, around 90% of NHS activity takes place within the primary care setting, in turn giving rise to 1.1 billion prescription items (Hayward et al, 2021). Thus, pharmacists are centrally placed to implement PGx. However, pharmacists and other allied HCPs understanding and experience of genomics and PGx have been found to be trailing behind genomic advances (Elewa & Awaisu, 2019). Our study lends support to this statement and highlights that there is still a considerable amount of work to be undertaken to raise awareness of genomics, the future direction of mainstreaming genomics in Wales and the key role pharmacists will play.

Preferred learning methods

With a lack of genomic knowledge and awareness evident, it is imperative that Welsh pharmacists are educated in genomics to equip them with the skills and knowledge required for the changing landscape of their work in the genomics era. However, in order to engage a workforce in continued professional development (CPD) requires effective teaching strategies. Ascertaining how working individuals would prefer to learn will allow for the development of courses and educational resources that will attract, encourage, and engage them.

From our survey we found that the most preferred method for learning was an online e-learning format (78.5%.) A study carried out by Zlotos & Stewart (2022), looking at online CPD programmes for pharmacists in Scotland identified that attendance at face-to- face courses had declined, whereas utilisation of e-learning resources had seen an increase in recent years. The authors also stated that asynchronous e-learning had become a popular CPD method for the pharmacy profession long before the COVID-19 pandemic.

Previous literature has also identified that pharmacists who have qualified over a decade ago may require a different learning approach to those who have qualified more recently. For example, Formea et al. (2018) found that 64% of their older participants preferred to learn through face-to-face lecture format. However, a study by Albassam et al, (2018) showed that whilst pharmacists preferred to study by face-to-face workshops or seminars (82.1%), this preferred format was irrespective of age.

In our study, we also found that whilst online learning was the preferred educational format, age had no bearing. In fact, a greater proportion of the respondents who qualified >10 years ago selected online learning as their preferred method (76.7%), compared to those who qualified between 1 and 5 years ago (63.6%).

A preference for online learning amongst working individuals is not necessarily surprising (Chakraborty et al, 2020). The number of online courses has significantly increased over the last decade and prior to the pandemic the online education market had a projected value of \$350 billion by 2025 (Koskal, 2020).

Advantages to learning online combine flexibility, convenience, and accessibility (Wu et al, 2018) with lower tuition costs (Yuhanna et al, 2020). Online learning has also been reported to increase student engagement and participation through discussion forums; resulting in improved learning (Panigrahi et al, 2018).

Barriers to learning

Understanding barriers to learning helps provide an informed approach to education development and can enhance the learning experience;” time to engage” was listed as the most common barrier to learning with 45.2% of respondents reporting this as the main reason. Most of those who selected this barrier were registered pharmacists, within a hospital setting. Coinciding with specific individual time being a barrier to learning, is the need for work related support. This was one of the answers provided in our survey as to a barrier to learning. This is also a finding echoed by Simpson et al (2019) whose results of a cross-professional training needs analysis revealed that the most common barrier to

learning was protected time to participate in CPD courses. Responses from their study highlighted that even if the individual has a desire to undertake CPD, hospital settings do not provide study leave or time to train due to understaffing and lack of resources.

The second most cited challenge/barrier to undertaking genomics education, was lack of relevance to their role; 27.7% of respondents cited this as a barrier to undertaking genomics training. A study by Bwanga (2020), called this an “attitudinal” barrier. Thus, highlighting the importance of genomics to current and future practice is imperative as a means to engage pharmacists with this topic. In addition, encouraging pharmacists the opportunity to actively participate in curriculum design (whether that be a module, learning material, style of learning etc) could lead to a greater uptake as well as improved levels of confidence and motivation with a resultant impact on improved student performance (Bovill, 2010).

Study limitations

It is worth noting that this study was a pilot study targeted at the pharmacy profession in Wales. A total number of 94 responses were analysed. Responses were out of a potential of approximately 6607 working in the Pharmacy profession. Therefore, the response rate, in terms of the entire population was approximately only 2.1% and of these 64 were pharmacists out of a total of 1084 population (6%). Thus, drawing conclusions based only on 94 responses, is a key limitation for this study, and should be undertaken cautiously.

The data suggests there are still geographical areas in Wales that need to be engaged with, as there was little or no responses from certain localities. It has also been noted that not all NHS staff have access to email and those that do, often do not have time to read them in such a pressured environment (Hughes, 2021), unless the email is relatable to direct patient care. Given the questionnaire was only issued via email, this may have contributed to the small number of respondents.

Conclusion

Whilst this was a preliminary study with a small sample size, we identified there are currently poor levels of awareness, amongst the pharmacy profession in Wales, of key genomic initiatives in Wales and the UK. As a result of this, there is a lack of understanding regarding the impact genomics will have on the pharmacy profession. This highlights that further research is now needed, with a larger response rate, in order to obtain a better understanding of the pharmacy profession's genomic awareness and literacy.

Ensuring the profession is aware of the key role they play in understanding and implementing genomics and pharmacogenomic testing, is critical, especially if we are to achieve the shared commitment to UK wide implementation of genomics. Through collaboration with the profession and policy makers, suitable and appropriate education and training packages should be designed that meets the needs of the current and future pharmacy profession in the genomics era.

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Conflict of interest

The authors declare no conflict of interest

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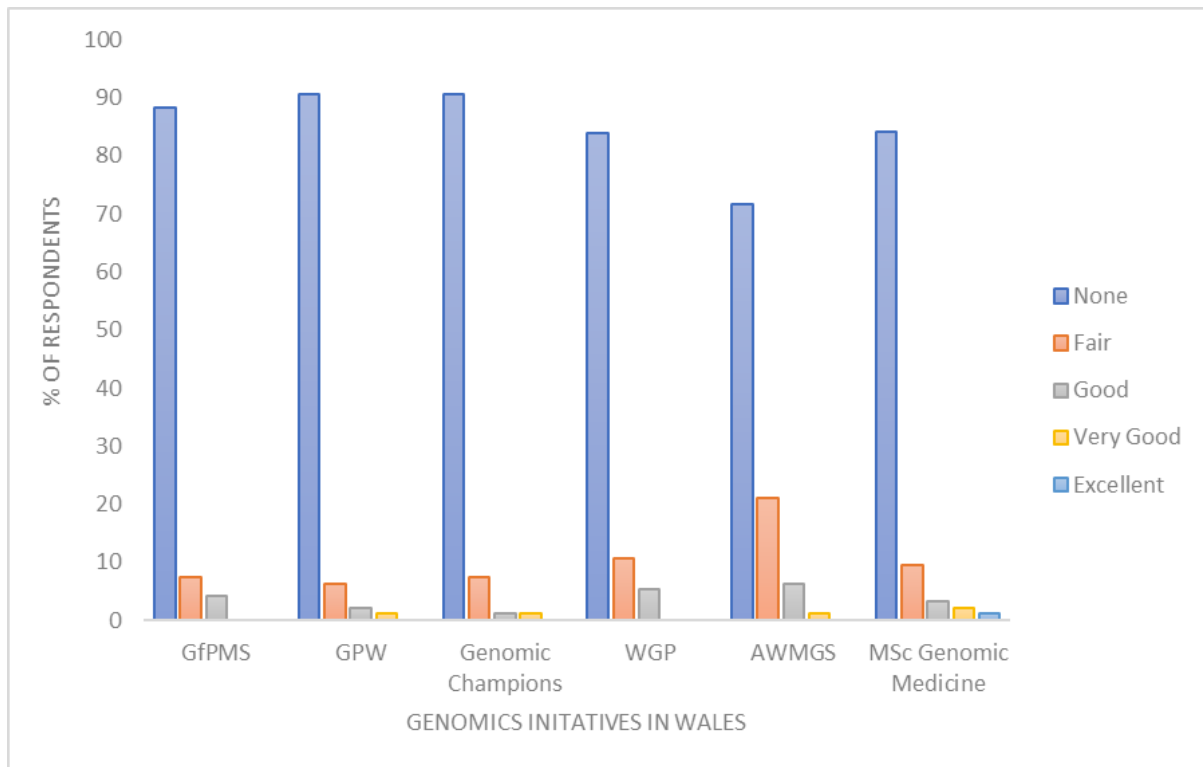
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Figures

Figure 1



Legends

Figure 1. Percentage of respondents reported levels of awareness relating to Genomics related initiatives in Wales such as Genomics for Precision Medicine (GfPS), Genomics Partnership Wales (GPW), Genomics Champions in Wales, Wales Gene Park (WGP), the All Wales Medical Genomics Service (AWMGS) and the Welsh Government funded Genomic Medicine MSc programme at Swansea University.

Tables

Table 1. Breakdown of respondents by geographical area and job role

Job Title	Locality of respondents									Total No.
	CV	AB	HD	BC	P TB*	CT	M	SB	VCC*	
	UHB*	UHB*	UHB*	UHB*		UHB*	UHB*			
Registered Pharmacist	28 (29.8%)	18 (19.1%)	0	1 (1.1%)	3 (3.2%)	1 (1.1%)		6 (6.4%)	7 (7.4%)	64
Pre-registered Pharmacist	0	0	0	0	1 (1.1%)	0	0	0	0	1
Pharmacy Technician	6 (6.4%)	5 (5.3%)	0	0	1 (1.1%)	1 (1.1%)		2 (2.1%)	7 (7.4%)	22
Other	5 (5.3%)	0	0	0	0	0	0	0	2 (2.1%)	7
Total	39	23	0	1	5	2		8	16	94