

# Pharmacogenetics and Pharmacy Education in the UK: Mind the Generation Gap

KIMBERLY JAMIE\*

*Department of Sociology, University of York, York, United Kingdom.*

## Abstract

**Background:** Pharmacogenetics is concerned with genetically-determined drug response variability and the need for pharmacists to be educated in pharmacogenetics is widely acknowledged.

**Aims:** To identify the opportunities and challenges presented by pharmacogenetics in pharmacy practice.

**Methods:** Thirty eight semi-structured interviews were undertaken with numerous pharmacogenetics and pharmacy stakeholders and practitioners in the United Kingdom (UK).

**Results:** A key theme emerging from the data was that a generational knowledge gap exists between young, newly trained pharmacists who were relatively genetically literate and more experienced pharmacists who have limited genetics training in professional development.

**Conclusion:** The knowledge gap identified could impact on the quality and consistency of patient advice and mean pharmacists are overlooked as central practitioners in delivering pharmacogenetic medicine in the future. The Royal Pharmaceutical Society and other professional bodies should engage with the debates and challenges presented by pharmacogenetics and seek to bridge this generational gap.

**Keywords:** *education, generation, pharmacogenetics*

## Introduction

Pharmacogenetics, often referred to as ‘personalised’ or ‘stratified’ medicine, is concerned with genetically-determined drug response variability. It is personalised in the sense that it represents a departure from traditional ‘one size fits all’ prescribing models by utilising patients’ genetic information to arrive at a more tailored treatment regime through the adjustment of drug choices and dosages accordingly. In doing so, pharmacogenetics is widely extolled as a way of reducing the burden that adverse drug reactions (ADRs) place on health care systems, namely the UK National Health Service (NHS), and improving the experience and management of ‘non-responder’ patients. In the UK, ADRs are estimated to cost the NHS around £2 billion annually (Compass, 2008) and have been identified as the fourth leading cause of death in the United States of America (USA) (Lazarou *et al.*, 1998). In addition, in the year 2003 the extent of patient non-responsiveness to medications was highlighted when Allen Roses (the then worldwide vice-president of genetics at GlaxoSmithKline) claimed that around 90% of drugs only work in 30-50% of patients (Connor, 2003). Hence, by introducing genetic factors into the drug production and prescribing processes, it has been argued that pharmacogenetics will make a ‘major impact in commercial labs and in the clinic’ (Webster *et al.*, 2004).

Pharmacogenetics has been posited as the ‘next great challenge’ for pharmacy practice (Clemerson *et al.*, 2006) as pharmacists will have an ‘essential role to play’ (Akhtar,

2002: 299) in delivering pharmacogenetic medicine in the hospital and community in the future. The exact nature of this role, particularly in community pharmacy, is, however, yet to be established as pharmacogenetics has made limited impact outside of tertiary or secondary care settings. Even so, roles around testing, results interpretation, counselling patients and offering advice to other healthcare practitioners have previously been suggested for pharmacists (Clemerson *et al.*, 2006). Within these discussions of potential future roles for pharmacists, a focus on genetic education has been foregrounded. This discursive focus on pharmacists’ genetic educational needs has also been centralised in health policy.

In 2003 the genetics advisory group to the UK government, the Human Genetics Commission, highlighted the need for a ‘genetically literate’ primary care workforce to manage patient access to appropriate genetic testing (Human Genetics Commission, 2003). In the same year, Burton and Shuttleworth (2003) noted that although British undergraduate pharmacists were in receipt of scientific training around genetics, their education in legal, ethical and social implications of genetic medicine was insufficient. Moreover, they argued that training in the principles of genetics was not a priority during preregistration or professional development. Following recommendations from the UK Department of Health’s White Paper *Our Inheritance, Our Future* (2003), the National Genetics Education and Development Centre (NGEDC) was established in 2004 with a specialist dedication to pharmacy education in British

\*Correspondence: Dr. Kimberly Jamie, *Research Fellow, Science and Technology Studies Unit, Department of Sociology, University of York, York, YO10 5DD. Tel: 01904 43 3055. Email: kimberly.jamie@york.ac.uk*

universities. In 2007 this centre, in collaboration with the Royal Pharmaceutical Society (previously the Royal Pharmaceutical Society of Great Britain until re-structuring in 2010) published a report which highlighted the need for increased pharmacogenetic education for undergraduate, preregistration and more experienced pharmacists (Newton *et al.*, 2007).

In the USA, the integration of pharmacogenetics into pharmacy curricula has also been identified as a priority. In their study of the nature of pharmacogenetic teaching in American colleges and schools of pharmacy, for example, Lafit and McKay (2005) found that 78% of the institutions surveyed provided some instruction on pharmacogenetics. More recently, Murphy *et al.* (2010) revisited Latif and McKay's work and found that the proportion of institutions teaching pharmacogenetics had increased to 92%. Despite this increase, Murphy *et al.* (2010) found that the 'depth' of pharmacogenetic teaching was still limited with only two of nine competencies in the ethical applications and economic implications of pharmacogenetics being taught in at least 50% of colleges.

Despite the potential for pharmacogenetics to make a significant impact on pharmacy practice and the recent policy focus on pharmacists' genetic education in the UK and elsewhere, relatively little research has been undertaken to assess British pharmacists' familiarity with genetics. Given this, this paper draws on empirical interview data to explore the educational challenges around implementing pharmacogenetics into pharmacy education.

## Methods

The author undertook qualitative research to elicit the perspectives of stakeholders and practitioners as to the potential futures of pharmacogenetics in hospital and community pharmacy. In total, thirty eight respondents were interviewed using semi-structured topic guides. Each of the interviews (of which three were group interviews) lasted between thirty and sixty minutes and were digitally recorded and later transcribed. Where necessary, telephone interviews were also offered and undertaken.

Respondents were drawn from a number of fields associated with pharmacogenetic technology and pharmacy practice in order to produce a detailed overview of the complexities of implementing pharmacogenetics into pharmacy. This sampling technique allowed the perspectives of those developing pharmacogenetic technologies, those currently engaging in pharmacogenetic practices and those who will potentially practise in this way in future to be encompassed.

Respondents were, then, drawn from five key (although not mutually exclusive and not reflective of respondents' wider skills or interests) fields. These practice fields were pharmacogenetic science, oncology, pharmacy policy and representation (what are being called here 'pharmacy stakeholders'), general medical practice and hospital and community pharmacy. Pharmacogenetic scientists, oncologists and pharmacy stakeholders were identified using internet searches of relevant bodies and practitioners. These potential respondents were then contacted by e-mail with a request to participate in an interview about pharmacogenetics and pharmacy practice. This method of recruitment proved

effective with 14 interviews being arranged following 14 initial e-mails. In a number of instances, the initial e-mail was forwarded to people or groups who were more appropriate given the topic of the research. Hence, these 14 interviews stemming from 14 recruitment e-mails does not represent a 100% response rate although it nonetheless demonstrates the effectiveness of this sampling strategy.

General practitioners and pharmacists were less easily accessible due to a comparatively limited online presence. In the case of general practitioners, a letter drop was sent to 21 GPs at four surgeries in one English city, which was selected for convenience purposes. From this, three respondents agreed to participate, although one of these later was unavailable. In the case of hospital pharmacists, chief pharmacists at three English hospitals were contacted using details that were available online. Two of these chief pharmacists were interviewed and then acted as gatekeepers to facilitate interviews with other hospital pharmacists in their institutions. Such informal gatekeeper techniques were also used in accessing community pharmacists as a city-wide community pharmacy letter drop to 15 pharmacies only elicited one respondent. Local Practice Forums and Pharmacy Superintendents were also approached as gatekeepers for community pharmacy but this contact elicited no responses. As such, and given time constraints, informal networks and gatekeepers were identified as the most effective recruitment technique for community pharmacists.

The project gained NHS ethics approval from South Yorkshire Research Ethics Committee and governance approvals from those NHS Trusts from which staff acted as respondents. In line with this, and the Helsinki Declaration (1975, revised 1983), written informed consent was obtained from respondents prior to the interview and all responses were anonymised prior to publication.

The transcribed interview data were analysed using the qualitative data analysis software Atlas Ti (version 6). This software allowed for a two-fold approach to data analysis through the creation of multiple hermeneutic units (projects). In one of these units, an inductive (*i.e.* bottom-up) approach was taken to analyse the overarching issues emerging from the data. A secondary analysis allowed these overarching issues to be sociologically deconstructed using, for example, Foucauldian and 'normalisation' (May & Finch, 2009) frameworks. This paper's focus on pharmacy education represents findings from an initial analysis of the data.

## Results

Through an initial inductive analysis of the interview data, a number of themes emerged which focused on the potential futures of pharmacogenetics in pharmacy and the challenges that it presents. One of these key themes which was discussed by 34 respondents across the sample was the issue of pharmacists' education (or lack thereof) in genetic principles, which was represented as a challenge to the successful integration of pharmacogenetics into pharmacy practice, particularly in the community setting. Within this, the notion of a generational knowledge gap was salient where an increased prominence of genetics in current pharmacy education was contrasted with more experienced pharmacists' lack of familiarity with genetic science.

This lack of familiarity in pharmacists who have been trained for some years was attributed to three main, and inter-related, elements. Firstly, in community pharmacy especially, heavy workloads mean that pharmacists felt they lacked the time needed to familiarise themselves with the latest scientific developments that do not directly affect their present practice. Secondly, increasing trained pharmacists' knowledge of genetics was thought to be a relatively low priority for pharmacy representative bodies. Thirdly, this lack of prioritisation of genetics by pharmacy bodies is thought to translate into a lack of professional development provision for pharmacists who have been qualified for a number of years.

## Discussion

Since the time of the 2003 UK Department of Health report, pharmacogenetics has become a more prominent feature of undergraduate pharmacy education in the UK with opportunities to introduce its principles through a number of areas within the General Pharmaceutical Council's indicative accreditation syllabus. Although the extent to which newly qualified pharmacists would feel comfortable using pharmacogenetics in their routine practice remains under-researched, the increased presence of pharmacogenetics in pharmacy curricula hints at the growth of a relatively 'genetically literate' generation of pharmacists as per the Human Genetic Commission's (2003) recommendations.

This increased genetic literacy is especially true for junior hospital pharmacists whose preregistration training might expose them to practices and practitioners where pre-prescription pharmacogenetic testing is routine given the high toxicity of many medications. In the community setting, given the comparatively low toxicity of medications and the limited financial problems associated with 'trial and error' prescribing, genetic literacy is more difficult to cultivate as pharmacogenetics has a limited presence. Hence, one community pharmacist commented "*I may be aware of friends who have mentioned that [pharmacogenetics] in hospital settings, particularly oncology departments and wards, etc., but not in the community setting*". This quote highlights that pharmacogenetic technologies and practices are, at present, more a part of everyday hospital, rather than community, pharmacy practice. Hence, the extent to which community pharmacists are able to become genetically literate is limited.

This difference between hospital and community pharmacists' genetic literacy is centred on their everyday work activities and the lack of genetics in that of the latter. This is despite the increased prominence of genetics in the common university curricula where the genetic principles of disease and treatment are spread across teaching within the degree. This is demonstrated by one junior hospital pharmacist who has been registered for around 12 months who commented "*it [pharmacogenetics] was involved in the modules and you were given reading to do around the subject area and then you had lectures on it*". This junior pharmacists' quote highlights the increased centrality of pharmacogenetics in pharmacy education as genetics increasingly underpins medical practice and therapy decisions. This increased prominence of genetics in current pharmacy education is in contrast to pharmacy education historically where genetics had a limited presence on university curricula as one community pharmacist commented: "*It's eight years ago... I don't remember having many lectures on pharmacogenomics, hardly any in fact*".

As pre-prescription genetic testing becomes cheaper, the importance of genetic information in medical treatment is likely to increase further as more medical knowledge and decisions become based around genetic information. Given this, the prominence of genetic education for all health care practitioners, including pharmacists, is likely to increase. Through this, the newly trained health care workforce will become increasingly genetically literate as per Human Genetics Commission (2003) report.

In contrast to this increased presence of pharmacogenetics in current university curricula, the prominence of pharmacogenetics in pharmacists' professional development has been limited. In their 2007 report for the NGEDC and the RPSGB, Newton *et al.* (2007) noted that pharmacogenetics would need to be 'demystified' and proven to be of clinical value in order to engage pharmacists who are already practising. The interviews undertaken by the current author with hospital and community pharmacists suggest that such demystification has not occurred as most generalist pharmacists who have been practising for more than five to ten years are relatively unaware of pharmacogenetic principles or developments, as a community pharmacist who has been registered for around 30 years highlighted; "*my generation of pharmacists are probably not very familiar at all [with pharmacogenetics]*". This notion of a generational knowledge gap vis-à-vis genetics is compounded by a pharmacogeneticist who qualified as a pharmacist around 50 years ago who commented "*there's a whole two generations of pharmacists who haven't had much exposure...it's an educational generational thing*".

This generational lack of knowledge about genetics was attributed to three elements - (i) heavy workloads and a lack of time to develop knowledge of new areas; (ii) genetics being a low priority for pharmacy representative bodies; and (iii) a lack of professional development provision in the area of genetics for pharmacists who have been qualified for some years. Pharmacy professional bodies' low prioritisation of genetics was thought to place an increased responsibility on pharmacists to undertake their own professional development in the area of pharmacogenetics. As one hospital pharmacist commented, "*there's a responsibility on the part of pharmacists to actively go out and learn about things*", which is challenging given the heavy workload which prevents pharmacists from engaging with developments that do not impact on their immediate practice.

The generational disparity in levels of knowledge about pharmacogenetic medicine outlined above presents two main challenges. Firstly, as genetic testing becomes cheaper and quicker and increasingly available in primary care settings, and as media discourse around 'personalised' medicine becomes more promissory, it is likely that patients will engage with and have questions about pharmacogenetic medicine. In a research report on patient and practitioners' perspectives of pharmacogenetics in the NHS, Fargher *et al.* (2007) note that health care professionals' lack of knowledge of pharmacogenetics could lead to a gap between 'patients' high expectations for information' and the information that health care practitioners can actually provide. If pharmacists, particularly in the community, are placed in a position to offer such pharmacogenetic information (see Clemerson *et al.*, 2006), there is a risk that patients may receive different advice depending on their particular pharmacist and the length of time that he/she has been practising.

Secondly, it has been highlighted elsewhere that pharmacists are in a pivotal position to secure a prominent role in delivering pharmacogenetic medicine, which could be beneficial for patients' experiences of genetic health care and increasing the professional profile of pharmacy (Clemerson *et al.*, 2006; Maitland-van der Zee *et al.*, 2004; Streetman, 2007). In order to legitimately stake claims for such involvement, the pharmacy profession will need to demonstrate that all of its members are suitably trained in this new paradigm of practice. If the generational knowledge gap persists whilst pharmacogenetic medicine is being implemented into routine clinical practice, there is a risk that pharmacists may be overlooked for central involvement in delivering pharmacogenetic medicine. It is, thus, imperative that the Royal Pharmaceutical Society and other representative bodies engage with the debates and challenges presented by pharmacogenetics in routine pharmacy practice and seek to bridge the generational gap through initiatives such as incorporating pharmacogenetic principles into clinical diploma curricula, running pharmacogenetics-focused workshops or implementing national training initiatives.

## References

- Akhtar, S. (2002) Pharmacogenomics: are pharmacists ready for genotyped prescribing? *The Pharmaceutical Journal*, **268**, 296-299.
- Burton, H. & Shuttleworth, A. (2003) Genetics education for pharmacists. *The Pharmaceutical Journal*, **270**, 84-85.
- Clemerson, J., Payne, K., Bissell, P. & Anderson, C. (2006) Pharmacogenetics, the next challenge for Pharmacy? *Pharmacy World and Science*, **28**, 126-130.
- Compass (2008) Adverse drug reactions wastes NHS £2BN (on-line). Available at: <http://www.compassonline.org.uk/news/item.asp?n=1551>. Accessed October, 2011.
- Connor, S. (2003) 'Glaxo chief: our drugs do not work on most patients'. *The Independent* (on-line). Available at: <http://www.independent.co.uk/news/science/glaxo-chief-our-drugs-do-not-work-on-most-patients-575942.html>. Accessed October, 2011.
- Department of Health (2003) Our inheritance, our future: realising the potential of genetics in the NHS. London: HMSO.
- Farger, E., Eddy, C., Newman, W., Qasim, F., Tricker, K., Elliot, R. & Payne, K. (2007) Patients' and healthcare professionals' views on pharmacogenetic testing and its future delivery in the NHS. *Future Medicine*, **8**, 1511-1519.
- Human Genetics Commission (2003) Genes direct: ensuring the effective oversight of genetic tests supplied directly to the public. London: HGC.
- Houstma, D., Guchelaar, H.J. & Gelderblom, H. (2010) Pharmacogenetics in oncology: a promising field. *Current Pharmaceutical Design*, **16**, 155-163.
- Lafit, D.A. & McKay, A.B. (2005) Pharmacogenetics and pharmacogenomics instruction in colleges and schools of pharmacy in the United States. *American Journal of Pharmaceutical Education*, **69**, 152-156.
- Lazarou, J., Pomeranz, B. & Corey, P. (1998) Incidence of adverse drug reactions in hospitalized patients: a meta-analysis of prospective studies. *Journal of the American Medical Association*, **279**, 1200.
- Maitland-van der Zee, A., Klungel, O. & de Boer, A. (2004) Pharmacogenetics in health-care practice. *Pharmacy World & Science*, **26**, 253-255.
- May, C. & Finch, T. (2009) Implementing, embedding and integrating practices: an outline of normalization process theory. *Sociology*, **43**, 535-554.
- Murphy, J.E., Green, J.S., Adams, L.A., Squire, R.B., Kuo, G.M. & McKay, A. (2010) Pharmacogenomics in the curricula of schools and college of pharmacy in the United States. *American Journal of Pharmaceutical Education*, **74**, 1-10.
- Newton, R., Lithgow, J., Li Wan Po, A., Bennett, C. & Farndon, P. (2007) How will pharmacogenetics impact on pharmacy practice? pharmacists' views and educational priorities. London: NHS, NGEDC and RPSGB.
- Streetman, D. (2007) Emergence and evolution of pharmacogenetics and pharmacogenomics in clinical pharmacy over the past 40 years. *Annals of Pharmacotherapy*, **41**, 2038-2041.
- Webster, A., Martin, P., Lewis, G. & Smart, A. (2004) Integrating pharmacogenetics into society: in Search of a Model. *Nature Reviews Genetics*, **5**, 663-669.