



What effect will pharmacogenomics have on mental health nursing?

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Practice points

- Pharmacogenomics poses many exciting possibilities, intricacies and debates that center not only on the individual patient but also the professionals and carers of the mentally ill.
- Genetic factors are the main determinant of the variation in drug effect, and are known to influence pharmacokinetics and pharmacodynamics of psychotropic medication.
- There is a strong argument to be made for nurses to have both knowledge and be active in pharmacogenomics as undoubtedly it will have many implications for the nursing profession.
- Many mental health nurses prescribe medication. Therefore, they will be required to understand and participate in pharmacogenomics practice to meet requirements of mental healthcare frameworks, and ethical and regulatory imperatives that advocate evidence-based treatments.
- There are several arguments that would seem to support pharmacogenomics in recovery-orientated mental health nursing to include evidence-based practices, effective psychopharmacological interventions, and sensitivity and respect for the diversity of the patient.
- As pharmacogenomics offers the promise of identifying genes that influence clinical response to drug treatment it can benefit the mentally ill, making mental health nursing a less conflicting profession.
- Patients want personalized medicine, and mental health nurses in partnership with other discipliners must seek ways of meeting these evolving needs. Pharmacogenomics has been met with optimism, hope and other positive expectations by the public.
- Pharmacogenomics is a promising and exciting development that provides much scope for improvements in mental health nursing and, ultimately, their patients. It has the potential to challenge the current 'trial and error' prescription practice and make for a much safer field of psychopharmacology.
- Pharmacogenomics is here and not just upon us. It is a real opportunity for mental health nurses who engage to reap its benefits.

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SUMMARY Pharmacogenomics offers much hope and optimism for those who are ill. As the largest workforce in mental health, mental health nurses are pivotal in continuously striving for quality improvements for the mentally ill. In this paper, we offer a speculative perspective on the impact that pharmacogenomics will have on mental health nursing. Despite the associations that may be construed between pharmacogenomics and the medical model of practice, we argue that the use of medication is central to many patients' wellbeing and, therefore, pharmacogenomics offers many benefits to both patients and mental health nurses. Benefits include a more robust and accurate practice of prescribing, an enhanced role for the nurse and greater professional autonomy. We conclude by encouraging mental health nurses to take a proactive role in future pharmacogenomic developments.

Genetics, genomics and biotechnology advances present many promising opportunities and contributions to improve the health and wellbeing of the population. Pharmacogenomics appears to offer personalized medicine, a greater understanding of ill health and targeted treatments. The terms pharmacogenomics and pharmacogenetics are often used interchangeably. As the term may suggest, pharmacogenomics is the study of how individuals' genes and pharmaceutical agents interact in the context of pharmacokinetics and pharmacodynamics. The aim of the science underpinning pharmacogenomics is to investigate how particular medications may impact on the individual's inherited genetic makeup (i.e., genome) and, therefore, determine efficacy and toxicity issues in the individual, with the aim of developing new therapeutic targets and interventions [1]. Pharmacogenetics refers to the inherited variation in metabolism and the response to medication in individual genes [2]. Although pharmacogenomics may be considered a relatively new field of study, in the disciplines of medicine and pharmacology there is an ever-increasing literature base that supports its relevance and importance in the pharmacological treatment of mental illness.

The world of pharmacogenomics poses many exciting possibilities, intricacies and debates that center not only on the individual patient but also the professionals and carers that are involved in caring for the mentally ill [1,2]. Other related areas that pharmacogenomics will impact upon are financial, ethical, moral and legislative frameworks. The evolving nature of pharmacogenomics will require operational changes in current healthcare systems, regulatory bodies and the professional educational programs that currently exist [101]. For example, within the UK's delivery of mental health nursing care services and educational programs, there is currently little exploration or discussion about its relevance to the philosophies, policies

and care frameworks that underpin nursing practice.

In this article, based on current ideologies and practice, we explore pharmacogenomics in the context of professional, philosophical, policy and patient issues pertaining to the role of the mental health nurse. Issues such as philosophies and ethical frameworks underpinning this specialist branch of nursing, along with health policies and care frameworks, will be analyzed. As there is paucity of both literature and research relating to pharmacogenomics and mental health nursing, we offer a perspective that, in part, is speculative, although is both reasoned and commensurate with current thinking and trends in mental health nursing. Mindful that many of the values that underpin the recovery framework (e.g., evidence-based practice and being responsive to diversity issues) are also reflected in the practice of pharmacogenomics, exploring the links between these two practices is an imperative for contemporary mental health nursing. The article aims to inform the reader of the juxtaposition of pharmacogenomics and the recovery framework that shapes and prevails in mental health nursing practice. We have the view that pharmacogenomics is an imperative practice that mental health nurses need to embrace, and argue that it reflects many of the salient issues that are pertinent to nursing the mentally ill.

Evidence supporting pharmacogenomics

Medication effectiveness and toxicity can vary across racial and ethnic groups. There are a number of factors that may influence variations in effect. These include the rate that the individual metabolizes the drug, smoking, alcohol consumption, age, gender and adherence patterns to medication [2,101]. However, genetic factors are the main determinant of the variation in drug effect [2,3] and are known to influence the pharmacokinetics and pharmacodynamics of psychotropic medication [4] in racial and ethnic

groups. While pharmacodynamics refers to the drug concentration and the resulting effect, pharmacokinetics refers to the time course of drug absorption, distribution, metabolism and excretion [5].

Asian individuals are likely to require a lower dose of antipsychotics, antidepressants and mood stabilizers than Caucasians [2,3]. A total of 33% of African-Americans and 37% of Asians metabolize antipsychotics and antidepressants slower than Caucasians [6]. Using comparable doses it has been found that Chinese individuals have a higher plasma concentration of haloperidol than Caucasians [7,8], and the CATIE study [9] demonstrated that variations in the gene *RGS4* of different ethnic groups determines the response to various typical and atypical antipsychotic medication. Based on the above, it can be assumed that one's genome and their rate or metabolizing status of medication will impact and determine drug response based on the pharmacodynamics and pharmacokinetics of the individual. Further evidence for variability in effect can be found in the response to treatment.

For a number of decades, pharmacogenetic studies have reported that genetically determined CYP phenotypes have interindividual variations, and strongly influence drug metabolism and biotransformation [10]. Response to psychotropic medication varies and is determined by the manner in which it is metabolized by the CYP450 enzyme. CYP is the major enzyme in drug metabolism and genetic mutation results in different versions of the CYP enzyme [2]. There are more than 63 *CYP450* genes that encode over 50 enzymes [5], and six of them metabolize 90% of drugs. The two most significant enzymes are CYP3A4 and CYP2D6. Drugs metabolized via CYP450 enzymes show genetic variability and influence a patient's response to medication [11]. In part, this offers an explanation as to why medication does not have homogeneous effects on the wider population, the variability in both effects and side effects of medication, and the similarities of treatment effect and treatment-induced side effects in familial studies [12].

The clinically significant or full response rate to psychotropic medication lies between 30 and 50% [12], and there is accumulating evidence that indicates that genetics significantly influence the response to symptom improvement [13]. Twin and family studies suggest that the response to psychotropics is a heritable trait [12].

Studies focusing on single pairs of monozygotic twins report that response to olanzapine [14] and clozapine [15] were similar in effect on symptom intensity and treatment-induced weight gain [12,13].

Most of the heritability data on psychotropic medication has been yielded from studies of antidepressant drug response and evidence gleaned from these studies would suggest that familial relatives are concordant for response [16]. For example, in a sample (45 pairs of relatives) of first-degree relatives with unipolar and bipolar depression, 30 (67%) responded to fluvoxamine [17]. In another earlier study, 12 correlations of effect were found between the proband and relative where each had received the same class of antidepressants, and ten correlations where the proband and first-degree relative received different antidepressant groups in which there was no similarity in response [18].

While a further review of medications used in mental illnesses is beyond the scope of this article, the literature purports that pharmacogenomics and the genetic metabolizer status of the individual is significant in other illnesses, such as Alzheimer's disease [19], anxiety and bipolar disorder [5]. However, while there has been an increase in studies pertaining to pharmacogenomics, environmental factors, such as diet and smoking, which may have an impact on treatment, have not been given consideration and, therefore, must bear greater relevance in future studies [12,17,20].

Considering the ever-increasing number of studies that include the pharmacogenomics of both physical and mental illness, there is a strong argument to be made for nurses to have knowledge and be active in pharmacogenomics research as part of their role. As identified above, knowing about the heritability of pharmacogenomics may be one area that can be included in patient assessments along with knowledge of ethnic variability in response to medication.

Pharmacogenomics & mental health nursing

The nursing regulatory body, Nursing and Midwifery Council (NMC) have yet to issue guidelines specifically relating to pharmacogenomics. In addition, few professional academic articles exist that discuss the relevance or implications that pharmacogenomics may have for those that are cared for by mental health nurses. When compared with other healthcare professional

journals, there is a lack of articles that address contextual pharmacogenomics issues in nursing journals, even though nurses may form the majority of the interdisciplinary team. While this may also be an indicator of the infancy in pharmacogenomics nursing research, it may also indicate that the relevance of pharmacogenomics is given less priority, as it may be considered the role of other professional groups (e.g., pharmacists and doctors) rather than nurses. Specifically for nurses who primarily care for the mentally ill, it may be a reflection of the historical tumultuous experience that they and their patients have had with the side effects of psychotropic medications, eugenic research in psychiatry and the perceived dominance of the medical model. Notwithstanding, the role of the nurse continues to expand, is ever evolving and, like other advances in medical and nursing science, pharmacogenomics will undoubtedly impact and have many implications for the nursing profession.

Similar to other clinical specialities, caring for the mentally ill is not a homogeneous profession and has a range of subspecialities, including children and adolescents, eating disorders, forensic and substance misuse services. Nurses have also extended their roles to management, research, academia and therapy. Despite these professional advancements in a range of practices, caring for the mentally ill is stigmatized by society and nurses in other clinical specialities, and is still valued less as a profession [21]. Nursing the mentally ill is seen as a caring profession that can be difficult to quantify. Many of its philosophies are opposed to the medicalization of mental illness, which is perhaps one of the major fundamental issues that we believe will shape the future of pharmacogenomics and mental health nursing.

Professional issues: psychiatric or mental health nursing?

Mental health nursing is a varied, complex and evolving profession that specializes in working with people with mental illnesses and mental health issues. It is both proactive and reactive, although the former lags somewhat behind when compared with other areas of physical health. While in the UK, the title 'mental health nurse' is used to denote the specialist branch of nursing that primarily seeks to care for those with a mental illness, in other parts of the world (e.g., Canada, Ireland and the USA), the term 'psychiatric nurse' is used. Although at first glance this may

appear to be a matter of semantics or influenced by the geographical location of the nurse, the literature argues that, as of yet, there are too many irreconcilable philosophical views, clinical practices and theoretical underpinnings that would enable the nurse to fulfill both roles [22]. Psychiatric and mental health nurses are considered to represent different ideologies that influence their practice. In view of this, it may be reasonable to assert that new practices, such as pharmacogenomics, will be embraced or rejected depending on the ideology and role identity of the practitioner.

It is difficult to articulate and quantify the role of the nurse who primarily cares for the mentally ill [23]. The praxis of nursing the mentally ill is a diverse occupation that spans from the perinatal period to old age and, commensurately, nurses' professional identities, ideologies and values may vary accordingly [24]. Issues known to impact on professional and role identity are relationships within organizational structures, organizational cultures, tasks assigned, expectations of employers and their ability to meet with these variables [25]. In part, it is these factors that contribute to the dichotomy between the psychiatric and mental health nurse. These may contribute to the tensions that lie between the nurse as a psychosocial therapeutic agent who advocates on behalf of the patient and the nurse as a deferential medical assistant who also has to fulfill the legislative demands that are imposed by the legal system [26]. It is postulated that psychiatric nurses have attached themselves to the biomedical model of distress in an attempt to closer align themselves with psychiatrists and, consequently, improve their professional status [22]. Interestingly, the same criticism has not been levied at mental health nurses who, it may be argued, are also aligning themselves with psychologists or social workers in an attempt to legitimize their professional status. However, it is unlikely that either of these stereotypes reflect modern nursing practice, regardless of the nomenclature used. Furthermore, such viewpoints detract significantly from those working in specialities such as neuropsychiatric nursing, which requires both an in-depth knowledge of biological causation, compassion and advanced holistic clinical skills that enable nurses to care for their patients.

Psychiatric nursing has been likened to the allopathic medicine practitioners who are reductionist and paternalistic in both approach and philosophy, whereas mental health nursing

centers more on humanizing, caring, seeking to understand and empowering the patients that they care for [22,23]. In view of this, it may suggest that nurses who identify with the concept of psychiatric nursing may be more likely to embrace pharmacogenomics owing to its closer link with the biological sciences rather than mental health nurses whose occupational frameworks may be more representative of psychosocial philosophies. Nonetheless, this simplistic viewpoint is as flawed as the notion that psychiatric nurses are less patient centered or caring than mental health nurses, or that mental health nurses are less biologically orientated than psychiatric nurses. Psychiatric and mental health nurses are independent thinkers and, like other professionals, they embrace a range of models of practice underpinned by biopsychosocial sciences. Support and contrasting evidence for this argument may be seen in current UK mental health nursing practices. For example, many mental health nurses now prescribe medication, a practice in itself that is more reflective of their medical colleagues. If they continue to fulfill the role of prescriber, this, in turn, will require them to actively engage with pharmacogenomics. Prescribing practices will require knowledge of the genetic profile, metabolic rates and medications that are specific to presenting conditions. Other support for the above assertion lies in the nurses' role to actively support and help their patients manage their medication. Since 2008, the NMC have made it mandatory that nurses are competent in medicines management. Specifically, Essential Skills Cluster 36 states that "People can trust the newly qualified registered graduate nurse to ensure safe and effective practice in medicines management through comprehensive knowledge of medicines their actions, risks and benefits" [2,27].

Pharmacogenomics promises to significantly reduce and possibly eradicate adverse side effects of medication. Until this happens, the role of the nurse, which includes monitoring for side effects, will continue. Nurses also administer medication and make decisions about the use of *pro re nata* medicines, therefore, they will be required to understand how their patient metabolizes the medication that they administer and observe for possible iatrogenic effects. It would seem that it is not a case of whether nurses have the option to engage or not engage with pharmacogenomics based on their own subjective role identity, but rather they are

duty bound to do so based on current mental healthcare frameworks, and ethical and regulatory imperatives, regardless of whether they see themselves as active participants in pharmacogenomics. As with other healthcare workers, nurses are required to keep abreast of current trends and deliver care accordingly. A more recent example of this is the introduction of the recovery framework [28].

Pharmacogenomics & the recovery framework

Recovery is a ubiquitous practice framework in the UK mental healthcare services. The ideas that underpin recovery emerged from the service user/survivor movement in the USA [29], although associated philosophies and practices soon followed in countries such as New Zealand and Australia [29,30]. Since then, various concepts of recovery have been offered. As with many theoretical foundations of mental health practice that take account of the unique experience of the individual, recovery is not an easy concept to define [29,28]. One of the earlier definitions in the literature has described recovery as a deeply personal experience unique to the individual rather than being imposed by others. Recovery involves developing hope and optimism, and a purposeful and meaningful life beyond the catastrophic effects of mental illness [31].

However, there are those who argue that in a system where the medical model dominates, hope and optimism can be difficult as it is based on a chronic disease model where the doctor leads the care of the individual and one in which the patient is a passive recipient [28,29,32,33]. Furthermore, they advocate a more collaborative partnership-based model of care that instills equality, encourages patients to be active participants in decisions about their treatment and reflects a more humanistic philosophy. Conversely, there are those who oppose the assertion that psychiatrists' practices are governed by disease, treatment and biological reductionism, in which psychiatric thought and role is entirely hostile to recovery philosophies, approaches, paradigms and movement [30]. In addition, they purport that current recovery practices are a rediscovery of critical psychiatry, questioned and initiated by the Tukes of York who founded practices based on kindness, compassion, respect and hope of recovery [30]. It would appear that symptoms, diagnosis and the use of medication has become synonymous with the medical model of practice, which also includes

seeking the pathology of an illness [29,33–37]. To some extent, for pharmacogenomics to succeed it will be necessary for such synonymous practices to continue. This may herald strong opposition from mental health nurses who may be reluctant or opposed to embracing biological psychiatry in their field of practice due to favoring psychosocial approaches to mental illness. Nonetheless, there are a few compelling arguments that would seem to support pharmacogenomics in mental health nursing. At the center of recovery is the patient, their uniqueness, wishes and vision for their future. Other facets include listening and acting in partnership with the patient, offering a choice of a range of interventions and seeking to improve their quality of life. It would, therefore, seem that the effect of pharmacogenomics will not be dependent on mental health nurses' views but rather by the patients that they work with. In their role of respecting and responding to patients' needs, nurses will need to be conversant with pharmacogenomics to enable them to participate in providing information and education about evidence-based pharmacology and the myriad of questions that arise from psychotropic medication.

Pharmacogenomics, practice dilemmas & moral distress

It is standard best practice before prescribing antibiotics to ask the patient whether they know if they are allergic to any particular antibiotic, such as penicillin. In doing so it prevents and reduces the distress and risk involved with allergic reactions for patients, prescribers and others involved in their care. However, such information may not yet be available for patients taking medications used in mental health practice and, as a consequence, this may contribute to both moral dilemmas and distress for the nurse. Moral distress is a major difficulty for all nurses and is prevalent in mental health nurses [38–41].

Moral dilemmas may be defined as a situation where there are two or more courses of action that may be taken but support inconsistent courses of action: if one is chosen, the other is precluded [38–41]. Moral distress is considered to be the emotion that one experiences when they are prevented from carrying out a morally appropriate action that they consider to be just and fair. Moral distress can be further divided into initial and reactive distress. The former arises when people feel negative emotions when faced with obstacles that prevent them from doing

what they consider to be morally correct, while the latter arises when they do not act upon their initial distress [42].

There are many dilemmas that are posed and arise in mental health nursing. These may include working with low levels of staff that are considered unsafe, giving priority to completing paperwork rather than spending the time with their patients, engaging in restrictive practices, such as locking doors, and following management directives or relatives' wishes over the needs and wishes of the patient [38,40]. In relation to medication prescribed and administered, there are a number of studies and literature that demonstrate some of the moral dilemmas and subsequent distress felt by nurses that conflict with their ethical frameworks for practice [41,43,44]. Accounts given by nurses indicate the moral distress encountered by the dilemma of administering medication that is not personalized on the 'trial and error' basis [45,46].

Particularly in inpatient settings, it is likely that nurses will have the greatest contact with patients than other professionals. Nurses are the professional group who will evaluate progress and inform the team about the effect that the medication is having on the patient. To a large extent, they are quite influential within the team about medication matters and will advise on the effectiveness of the treatment. However, this in itself may create dilemmas and distress brought about by unintentional betrayal of the patient, which can cause anguish and guilt, particularly if the changes made to medication causes harm and were influenced by them [47].

Another area of unintentional error involves community nurses who work with patients who are placed on a community treatment order. Medication adherence is one of the most common treatment conditions currently used [48] and patients may be recalled to hospital if they continue to not comply. This act of recall may be considered the most expedient; it also patronizes the mentally ill by denying them the opportunity to take responsibility for their actions [49]. Although nurses are not the individuals responsible for placing patients on these orders, they are expected to participate and share responsibility in the treatment and conditions of the order. Conversely, they are also expected to enable patients to make informed choices, which will entail offering information about possible adverse side effects and the impact that psychotropics may have on their physical wellbeing.

While these requirements may create a dilemma, it also requires the nurse to engage in behaviors that will resolve their dilemmas. The approach and avoidance motivation achievement theories [50,51] outline how humans are motivated to use different approaches and avoidance strategies with the expectancy of a positive result. As a result, the nurse who is faced with the dilemmas of being involved with medications that cause adverse effects may employ strategies such as avoiding giving information about a medication [52], or they may leave the profession owing to the emotional labor and demands of the role [39,53].

As may be seen from the above, some of the dilemmas, distress and emotional labor that mental health nurses face on a daily basis can be directly linked to medication, prescribing practices and iatrogenesis. As pharmacogenomics offers the promise of identifying genes that influence the clinical response to drug treatment [54] it can benefit the mentally ill, making mental health nursing a less conflicting profession. It has the potential to offer culturally sensitive medication that will challenge stereotypes of ethnic and cultural groups who may be prescribed larger doses than is necessary [2]. Furthermore, it may have profound positive effects on the physical health of patients that they care for.

Physical health & pharmacogenomics

The physical health of the mentally ill is of growing concern. Many mental health nurses are now actively involved in promoting the wellbeing and physical health of the mentally ill [55–58] through a range of interventions. These include physical health monitoring, psychoeducation and promotion of physical health programs. Patients with severe mental illness are likely to die up to 25 years younger than those without a severe mental illness [58], which has prompted some to call it ‘scandalous’ considering that patients come in to contact with health services so regularly [59]. Physical illnesses that are often diagnosed in patients with severe mental illnesses include obesity, diabetes, respiratory disease and metabolic syndrome [60]. There are many converging contributory factors to the patient’s poor physical health, including diet, sedentary lifestyle, smoking and psychotropic medication. Recently, the argument for psychotropic medication causing weight gain and diabetes has been refuted as one that is apocryphal or at least highly inaccurate [61].

Although it would seem that such assertions belie the evidence [62–64], the literature purports that many mental health nurses have a poor knowledge of physiology and pharmacology [2,56,65]. Therefore, while antipsychotics may contribute to poor physical health, healthcare practitioners also need to reflect on how they may have a more active role in physical wellbeing. In the case of mental health nurses, for pharmacogenomics to be meaningful for all, this will require a more in-depth knowledge base of the biological and pharmacological sciences, which can only improve current mental health nursing services. If mental health nurses are to continue to make a major professional contribution to caring for the mentally ill, and continue to be instrumental in leading and initiating innovative services, they will need to become much more conversant with pharmacogenomics. It is likely they will be one of the groups who will offer counseling, provide necessary explanations, and gain consent for taking samples and the processes involved while educating the patients and families about pharmacogenomics [66].

Psychotropics & pharmacogenomics

Medication is the most widely used form of treatment for mental illness in the UK [1,2,67,68] and Australia [102]. In the Healthcare Commission report, State of Healthcare 2007, it was found in a survey of community mental health services that 93% of patients reported taking medication and that 91% of hospital-based patients are prescribed two or more psychotropics [69]. The use of psychotropic medication is central to symptom control, used widely and considered important in the recovery process. It is considered a ‘safety net’ that maintains wellness and prevents hospital readmissions [2,70–72]. Although over the years a range of newer medications have been developed and seem to have greater therapeutic effects with less adverse effects, patients still experience adverse side effects [1,2,72] with some postulating that treatments are worse than the illness [70].

While patients consider medication as important, many struggle to continue with prescribed dosages and regimens [52,73]. Rates of non-concordance has been found to be as high as 74% in the CATIE trial [74], which is further supported in a number of both earlier and recent articles that report on concordance with medication [75–79]. There are numerous reasons that patients ‘give up’ on medications, which is

beyond the scope of this article. Reasons include the lack of information about the desired effects and aims of medication in their treatment, side effects and health beliefs, such as beliefs about the causation of their illness and beliefs about the need to take medication [77–79]. As a result patients relapse and millions of pounds are wasted on medications that are not effective owing to the prescribers often having to rely on symptom presentation. In part, this is due to not having the scientific information that would enable the prescriber to prescribe medicines on a personalized basis. Prescribing, it would seem, is more of an art than a science [72]. Currently, many patients are prescribed on a trial and error basis. They are prescribed medication, the effects are observed and then the drug is either titrated or discontinued so that the cycle can begin again. These prescribing practices can instill a sense of hopelessness in both the patient and nursing staff, which is diametrically in opposition with a profession that embraces and values instilling hope as a core feature of their role.

Pharmacogenetics and pharmacogenomics has demonstrated that drug responses depend on the genetics of the patient [2,80] rather than their weight, sex, age or symptoms. Therefore, they have the potential to address many of the matters raised above, that severely impact on the quality of life of patients and on mental health nursing practice. In the first instance, personalized medication will enable mental health nurse prescribers to be more confident when prescribing as they will have the scientific evidence that will contribute to evidence-based mental health nursing. In turn, this will enable the sustainability of a greater therapeutic relationship and engender trust that is a core condition for nursing practice.

Trust in the nurse and beliefs about medicines are positively related in medicine concordance [81–83]. Trust also has the potential to impact positively on patients' engagement with mental health services while also reducing violent attacks on staff. Patient violence exhibited towards staff has many underlying causes, one of which is where the patient is scared, frightened or feels threatened by staff. One instance where patients feel frightened is the consequences of refusing to take their medication and being forced to do so [84]. If they are formally detained and their section permits staff to forcibly treat, this may result in the patient being restrained [85,86]. Refusal to take the prescribed medication may be based on previous adverse effects [84] and, therefore,

personalized medication has the potential to reduce these incidences. It is known that frequent medication changes and a greater need for sedative medication is strongly associated with inpatient violence [87]. Staff who are fearful of their patients are known to disengage. Reduction of violent incidents will have many positive benefits, such as staff not feeling frightened of being assaulted and engaging more with patients [88]. Greater use of time will ensue between the patient and nurse. Overall, improved therapeutic relationships will emerge where nursing staff are not compromised in administering medication that they know may have adverse effects, which can be one of many dilemmas that they face.

Pharmacogenomics: the way forward?

It would seem that pharmacogenomics can offer many hopeful contributions to wellbeing for the mentally ill, and contribute greater knowledge and an evidence base to mental health nursing practice. In studies to date that seek to ascertain the public's view about pharmacogenomics practice [66,89], pharmacogenomics have been met with optimism, hope and other positive expectations. Patients want personalized medicine, and mental health nurses in partnership with other discipliners must seek ways of meeting these evolving needs. This will require taking a much more active role in research and development. While there will be financial implications for these two areas of proactive practice, cost should not be seen as a barrier to improving mental health nursing care and services. This will require reviewing current spending and seeking ways of implementing greater efficiency savings. One area that can be explored is in finding ways to reduce the large amounts of money wasted due to medications not being taken, side effects or therapeutic ineffectiveness. It will also require mental health nurses to work in partnership with colleagues in the medical profession so that a fairer and more representative amount of research funds than are currently allocated can be made available to mental health services. For example, while mental health services received 6.5% of total research funding, other services, such as cancer, received 25% and neurological diseases received 15% [90]. Pharmacogenomics is a development that can enhance mental health nurses research roles, specialist practice roles (e.g., mental health pharmacogenomics specialist) and a knowledge base for the profession. New roles will offer exciting opportunities and

will enhance recruitment and retention rates for both universities and healthcare organizations.

Research and development, and enhanced specialist roles will require a more knowledgeable and skilled mental health nursing workforce. Nurses will need to be able to interpret, appraise and critically review research findings based on their holistic understanding and knowledge of the patient. Nurse education programs, therefore, will have to address this issue in their curricula. While the profession has moved to an all graduate status, it is likely that the academic standards and knowledge will need to be further raised to a minimum of postgraduate level to keep pace with developments. Although currently there are many preregistration nursing programs that are being delivered at postgraduate level, it remains to be seen whether these programs provide the enhanced knowledge base that is required to understand pharmacogenomics. That is not to say that the currently postgraduate programs are not comparable with academic standards of other postgraduate programs. Rather it reflects the current postgraduate programs content being delivered. The subject areas are so wide ranging, incorporating biological, psychological, social and nursing sciences, that there is little scope for specialist depth in each area. Further clarity is gained when one considers that all nursing programs have equal weighting of practice and theory, and time for self-directed study is limited.

Mental health nursing academics will have to review current training to ensure that programs offer sufficient depth and duration that facilitates nursing students to gain vital knowledge to enable them to acquire the competencies for pharmacogenomics practice. It is likely, therefore, that mental health nursing programs will become 4-year MSc programs, and the curricula will have greater depth of the pharmacological and biological sciences. To make this a reality, academics and qualified nursing mentors will also have to further their own knowledge and practice competency. This will require developing educational modules that prepare the individuals for their prospective role.

There are financial implications and costs associated with enhancing nurses' roles and education. While some employers currently pay for postregistration training and education programs, this may not be available in the future. In view of this, mental health nurses will be required to fund their own professional development, which may require them to seek funding

through loans, scholarship or sponsorship from organizations. Pharmaceutical companies are likely to offer sponsorship to those who demonstrates the ability to enhance the science of pharmacogenomics. It is also likely that pharmaceutical companies will provide jobs for those they sponsored, which will create greater diversity in employment opportunities for mental health nurses. As mental health nurses will have a broader range of subject knowledge (based on their initial training program) than other specialist professionals may have, it is likely that mental health nurses will progress well within the pharmaceutical companies. Furthermore, with the leadership and management training that is inherent in mental health nursing, mental health nurses will have the added advantage of possessing these executive skills that are mandatory for the business and corporate worlds.

With a greater range of knowledge and skills, mental health nurses will be more in demand, and this will positively impact salaries and professional status. Larger salaries will herald an increase in those interested in the profession and the profession may witness a surge in applicants whose focus is on the salary and nonpatient contact roles. However, with the introduction of psychometric testing in student nursing recruitment [103,104], those who do not possess the caring characteristics, attributes and values will not gain entry onto a training program. As the training program changes from a direct entry BSc to a 4-year MSc, it is likely that potential nursing students will have to demonstrate evidence of caring experience and a degree in a nursing-related subject such as biology, psychology or sociology.

Conclusion & future perspective

Inherited differences in genes and drug metabolism determine the behavior and therapeutics of medication. For some time mental health nurses have identified this and have sought various methods to help patients cope with adverse side effects and other medication management issues. Pharmacogenomics is a promising and exciting development that provides much scope for improvements in mental health nursing and ultimately their patients. It has the potential to challenge the current trial and error prescription practice and make for a much safer field of psychopharmacology. In addition, personalized medication is a much more dignified approach to patient care and complements nursing values and ethics. Pharmacogenomics will equip nurses

with an enhanced understanding of the genetic disposition of their patients, which in itself may lead to further research into the field of genetics and mental illness. Although as stated above, historically psychiatry and genetics have been blighted by eugenics, there are now robust ethical committees in place that safeguard patients. Research can only impact positively on the well-being of the patient who is central to the mental health nurses role.

However, to make this a reality, mental health nurses need to become much more involved and proactive in pharmacogenomics to ensure that they are represented in the emerging field. This requires nurses to update their knowledge and become actively involved with any current projects that may be happening in their organization. Although historically pharmacology may not have been an area that mental health nurses were actively involved with and, as a consequence, may not have been invited or involved in developing new initiatives, this now needs to change. By virtue of the fact that nurses are the largest workforce in mental health service and are the profession who spend the most time with patients, they are much more likely to understand patient needs and desires. They can advocate for patients to ensure that disparities that have historically been seen with other health specialties do not occur in mental health. Mental health services must be treated equally, fairly and with the same urgency as other fields of nursing.

Nurses now need to consider involving pharmacogenomics information, research and development in the context of their local practice area. This may help ensure that national or international perspectives or policies do not become a 'postcode lottery' and disadvantage any patient on grounds of their geographical location, social circumstances or ethnic backgrounds. It would be wise also to mental health nurses involved with strategic business planning to commence exploring ways of how pharmacogenomics will be funded in their service. Although initial outlay may be costly, it is likely that the savings made in the long term will far outstrip and exceed expectations when set in context to current costs associated with nonconcordance of medication, readmission and all the other negative impacts that may be linked. Pharmacogenomics is here and not just upon us. It is a real opportunity for mental health nurses who now must engage to reap its benefits.

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