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Research Article

THE TRANSFORMATIVE ROLE OF PHARMACISTS IN PERSONALIZED MEDICINE

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ABSTRACT

Emphasis has been placed on "external" factors that affect practice adoption in research about pharmacists' incorporating pharmacogenomics (PGx) testing into their basic care procedures, especially local pharmacies. Other "internal" elements that affect chemists' capacity to do PGx testing, including their opportunities, motives, and capabilities, were examined in this study. The study, titled Pharmacists as Personalized Medicine Experts (PRIME), evaluated semi-structured interview data to investigate the obstacles and enablers of pharmacists integrating PGx testing into primary care practices. The authors determined which TDF domains were most pertinent by means of theme analysis, using the TDF domains as deductive codes. They then used BCW, or the behavioural change wheelto produce sorts of interventionsthat would help with the execution of PGx testing. pharmacists gave a description what influences on their capacity to offer PGx-testing services were their identities and practices as professionalssettings, assurance and attitudes about the advantages of pharmacogenomics. Pharmacists could be trained to handle a higher patient load, assisted in navigating the program andtechnological requirements of the pharmacogenomics service, and had their workflows and documentation requirements streamlined as possible interventions to enhance the Pharmacogenomics service's implementation. In order to fully address the "internal" issues influencing pharmacists' capacity to incorporate testing into their practices, further approaches are required as interest in the widespread adoption of pharmacogenomics testing through neighbourhood pharmaciesincreases.

Keywords: Chemists, Pharmacogenomics, Pharmacy, Service delivery, Theoretical domains framework.

INTRODUCTION

Pharmacogenomics based prescribing recommendations, pharmacogenetic test implementation, and patient and healthcare professional education regarding pharmacogenetic test result interpretation are all effectively carried out by chemists (Padgett L *et al*., 2011). Even so, there are still Pharmacogenomics usage in primary care is hindered by the service'sexpense, a shortage of time, chemists' knowledge gaps, and patients' lack of desire (Alexander K.M *et al*., 2014, de Denus S *et al*., 2013, Benzeroual K.E *et al*., 2012). By giving participating pharmacists access to a Pharmacogenomics training programme and supporting them as they started providing Pharmacogenomics services in their current practices, To address several of these shortcomings, the Pharmacists as Personalised Medicine Experts project was launched. (Crown N *et al*., 2020). In order to provide PGx services, chemists must take on new responsibilities within the intricate frameworks of their current practice environments. Research on implementation can be utilized to comprehend how these new tasks interact with one another, as well as the behaviors and variables that affect chemists' willingness to participate in them. Implementation research's unified framework and the theoretical domains frameworkis two prominent conceptual frameworks that are employed in implementation research (Cane J *et al*., 2012, Damschroder L.J *et al*., 2009). Though most of its 14 domains are associated with behaviour-governing variables. that are typically thought to occur at an individual level the TDF can aid in directing the identification of the factors that

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influence service implementation across various levels. (Birken S. A 2017). The capacity to supplement the Ability, chance, drive, and model of behaviour for comprehending conduct is one of the TDF's special features. According to the COM-B model, a person's ability to perform a behavior is a function of their physical and psychological makeup, their beliefs and emotions that drive them to do sothe environmental and social conditions that foster the opportunity to perform the behavior, and their motivation. The COM-B model's components, which each indicatecauses of behaviour and, as a result, may be the focus of treatments meant to encourage behaviour modificationare mapped onto the TDF domains. Integrated with the behaviour change wheel (BCW), the COM-B model offers a theory-based instrument for identifying successful methods for modifying a certain behavior, including policies and intervention techniques (Michie S *et al*., 2014).

Population

If a chemist took part in PRIME, they were qualified to participate in interviews. The qualifying requirements Additionally, chemists who applied for the PRIME study had to practice within primary care environments, such as community pharmacies and inter professional primary care clinics, for at least 50% of their monthly work hours and be With the Ontario College of Pharmacists, registered under Part A. If a pharmacist worked exclusively in hospital pharmacy or had completed another pharmacogenomics training programme, they were not eligible to participate. Because the interviewer spoke English, participants had to be able to communicate in that language as well. (Damschroder L *et al*., 2009)

Recruitment Strategy

Email invitations and study information letters were sent to All of the students are chemists.who had finished PRIME training programme, inviting them to take partin interviews conducted over the phone. Following their expression of interest, prospective participants were called to respond to enquiries concerning the research information letter and toget their oral agreement prior to the interview started.

Data Collection

A semi-organizedphone Conversations wereplace in February and April. Of 2017.Information was gathered up until everything is PRIME chemists who expressed interest were spoken with. The goal of the interview guide was to get a detailed account of the chemists' opinions and experiences on Pharmacogenomics testing in their practice, with an emphasis the facilitators and obstacles in particular. As the interviews went on, the interview questions were improved iteratively. An independent transcriptionist verbatim transcribed the audio recordings of the interviews. After that, the interviewer confirmed and de-identified the transcriptions.

Analysis

The de-identified interview data were coded, interpreted, and analyzed using the reflexive thematic analysis method developed by Braun and Clark (Braun V *et al*., 2006). In order to characterizethe 14 domains of the theoretical domains framework (TDF) were used as deductive codes to code the interview data based on the participants' subjective reports of their experiences with PGx testing in practice.M.L. created an initial coding manual outlining the TDF's application to the information from the interview andensuring reliability in ourresearch. L.M. independently verified the handbook to make sure it was relevant to the research and that it was consistent with the TDF. query. Subsequently, M.L. and H.L. worked separately on the first three transcripts, applying the coding manual. Following each transcript, they met to talk and adjust the manual as needed. M.L. and H.L. coded the final seven transcripts without additional debate. (Atkins L *et al*., 2017)

ROLE OF PHARMACIST IN PERSONALIZED MEDICINE

Health-System Pharmacists' American Society, the American Pharmacists Associationand the Paediatric Pharmacy Advocacy Organisationare just a few of the professional pharmacy organizations that have issued comments supporting pharmacist involvement in pharmacogenetics and describing potential roles and responsibilities for pharmacists in this area. (Am J Health Stys Pharm. 2015). Most of the proposed tasks focus on thepractical using pharmacogenetics andinvolve tasks like formulating drug and dosage regimens specifically for each patient, evaluating test findings, and proposing pharmacogenetic testing. Not with standing their level of education and pharmacogenetics experience, they are advised to be the fundamental duties of all chemists. (Reiss SM 2011). Additionally, suggestions are made regarding the possible roles that chemists with pharmacogenetics-related specialization, training, and/or experience may play. In order to provide safe, efficient, and reasonably priced pharmaceutical practices, chemists are also urged to take the lead in developing the clinical application of pharmacogenetics. (Kennedy MJ *et al*., 2011). Pharmacists have numerous other possible roles in personalized Pharmacogenetics and medicinethat go beyond standard patient care activities, even though the direct patient care applications are the most natural for them. SinceIn community pharmacies, DTC genetic testing kits are commonly accessible, pharmacists are the most approachable health care practitioners in the neighborhood. This creates a fantastic opportunity for patient counselling and education. Since that consumers typically see many doctors while visiting a single drugstore, the community pharmacy is frequently the point of contact for prescriptions from various prescribers and medical professionals. For storing genetic data, the neighborhood pharmacy might consequently act as a central “hub”. The development of databases, pharmaceutical usage guidelines, clinical decision support technologies, and procedures, genetic testing logistics, research, and clinical

guideline development are just a few of the areas in which pharmacy expertise is vital for the successful implementation of clinical pharmacogenomics. Pharmacogenetics and personalized medicine present a wide range of prospects for chemists. Pharmacists face a particular difficulty in a field undergoing transformation, despite the tremendous potential that come with personalized treatment. There seems to be a general consensus among chemists regarding their professional involvement in pharmacogenetics and personalized medicine (Owusu-Obeng A *et al*., 2014). One of the reasons why present and future chemists are unable to prepare is the absence of clearly defined roles and responsibilities. biggest obstacles to the advancement of pharmacogenetics within the profession.

STRENGHTS, WEAKNESSES, OPPORTUNITIESANDTHREATS

Advantages, disadvantages, opportunities, and dangers Analysis offers a special framework that makes it possible to carefully examine whether or not chemists are prepared for the problem of personalized medicine. Pharmacist involvement in clinical pharmacogenetics is supported and facilitated by a variety of circumstances, and its benefits are abundant. Clinical recommendations based on evidence have been established for actionable gene-drug combinations pharmacogenetic testing is getting more and more cost-effective and clinically beneficial; and genetic testing is becoming more widely available and less expensive. (Phillips KA *et al*., 2014). Pharmacists feel that pharmacogenetics is applicable to their work, and personalized medicine is a topic that they are all passionate about and engaged in (Ramsey T *et al*., 2016, Sansgiry SS *et al*., 2003) Professional pharmacy organizations aggressively encourage pharmacist involvement in personalized care, a role that doctors and other prescribersbroadly accept and support. (Mccullough KB *et al*., 2011, Hartley LJ 2015). Furthermore, Pharmacogenetic services in clinical settings have beeneffectively introduced in both community pharmacy and inpatient settings, and chemists have spearheaded many of the significant projects pertaining to the clinical advancement of pharmacogenetics. The existing lack of agreement and clarity regarding the precise roles and responsibilities of the pharmacist in this new practice area is the biggest issue affecting pharmacists' readiness for the challenge of personalized medicine. (Williams MS, 2014). How will the industry guarantee that present and upcoming graduates fulfil this as-yet-undefined criterion, and what does it really mean to be practice ready. The answers to these basic but crucial issues are necessary for the continued growth of clinical pharmacogenetics within the pharmacy profession. Addressing the current infrastructure barriers—such as those related to information technology, reimbursement, and the formation of multidisciplinary teams will also be crucial (Pharm GKB Dosing, 2018). Fortunately, chemists have a lot of opportunities in personalized medicine, and many of the practice advancement-limiting limitations that exist now actually present special chances for true practice innovation. (Weitzel KW *et al*., 2016) Personalized medicine offers a great opportunity for the establishment of novel practice models in community and inpatient contexts, not with standing its challenges. Personalized medicine offers chemists significant opportunities, including developing the infrastructure needed to properly deploy and execute Pharmacogenetics in clinical settingservices and applying breakthrough genetic testing techniques. The short time frame that chemists have to complete clinical pharmacogenetics and the paucity of funding for testing for genesand pharmacist interpretation of results put these prospects in jeopardy, necessitating innovative solutions. (Weitzel KW *et al*., 2014).

PERSONALILZED MEDICINE: IT TAKES MORE THAN GENOMICS

The possibility of resequencing entire genomes at the population level for a little charge, together with other remarkable discoveries in genomics, have fueled the global interest with personalized medicine. (Crews KR *et al*., 2011) The proteins involved in the drug's absorption, distribution, metabolism, and excretion through the pharmacogenomics pathway or a genetic mutation of a constitutive protein in the target cell are the two ways that genomics can have an effect.(Phillips K *et al*., 2006) Tyrosine phosphatase inhibitors, which are used to treat chronic myelogenous leukemia, and One monoclonal antibody called trastuzumab targetsHER-2, the human The overexpressed epidermal growth factor receptor insome breast cancer cells, are two scenarios of the former approach. (Lammers L *et al*., 2010). Genetic variations in the drug-metabolizing cytochrome C enzymes CYP2D6, CYP2C19, and CYP3A4, as well as the drug efflux transporters multidrug resistance protein and P-glycoprotein, are instances of the latter route. Research on pharmacogenomics is ongoing. The Pharmacogenomic Knowledge Base, which was established in 2000 to compile information on the connections between human genetic variation and drug response, is a crucial resource in this field. (Kramer J *et al*., 2007). Researchers can interact and exchange ideas by using this potent resource, which also offers high-quality information. To push the pace of putting genetic knowledge into reality even faster, the National Institutes of Health has approved seven network resources and 14 more scientific projects. The development of personalized medicine is influenced by variables other than genetics, as seen in Figure 1. Therefore, the chromosomal differences in target receptor proteins, or proteins related to drug pharmacokinetics, can be used to stratify patients. This requires significant adjustments to the way clinical trials are designed and how financial models are chosen to oversee drug development. Though there are a number of alternatives that have been put out to expedite the process and account for difficult at-risk populations, the randomized controlled clinical trial will continue to be the gold standard in drug development for the foreseeable future. There will undoubtedly be creative changes in the way medications are developed and regulated as the intended patient group gets smaller. A new culture brought

about by the quest of personalized medicine may prove too much for the commercial infrastructure that has upheld the blockbuster model of drug development. (Zolk O, 2009). Thus, a new business aimed at converting evidence-based personalized medicine into better human medicines is gaining traction, thirty years after the biopharmaceutical industry was founded. It is up to the creativity and dedication of the forerunners in personalized medicine to determine whether this new pharmaceutical industry can emulate the telecom sector's amazing transition from landline to wireless technology. Drug development will inevitably become more interdisciplinary and better coordinated due to necessity. It will make considerable use of both public and internal knowledge bases. It is anticipated that the medication will be available on the market in 3-5 years.

PERSONLAIZED MEDICINE AND DRUG SAFETY

A result of personalized medicine is increased drug safety by matching the right medication to the right patient. The civil aviation system serves as a metaphor for addressing this difficulty. Achieving near-perfect safety is the top priority for everyone involved in the system, from those designing aeroplanes to those running it, all while keeping costs down and overall operating costs and dependability high. Similar to how engineers utilize mathematical models to design and construct aeroplanes, Pharmacoeconomics can be used to balance competing elements in medication creation, testing, and prescribing. In order to guard against unplanned malfunctions, aircraft are designed with backup systems and alert systems, and pilots are extensively taught to recognize and react to any potential alarm by following established procedures. Likewise, it would be easy to create several redundant warning systems to identify any anticipated negative medication responses, and doctors and chemists could receive training on how to methodically look for and address any warning indication. (Wilson C *et al*., 2007). The professional dedication of air traffic controllers, supported by radar and other technologies, is crucial in minimizing "adverse aircraft interactions" and almost completely eliminates the possibility of collision. But more individuals die from harmful drug interactions than from airline crashes. To reduce this risk, pharmacies should be given top priority as drug traffickers, and clear guidelines should be developed, similar to those utilized for Pilots and meteorologists automatically transmit hazards to the system and other pilots in the weatherthe vicinity. These pilots promptly Ask Air Traffic Control for authorisation. To modify their flight schedules. In order to avoid any negative consequences. Compare this to the possibility of reporting, analyzing, and using adverse event data throughout drug development, testing, and routine use to modify practices in real time and reduce risks, maximize benefits, and save costs. Nevertheless, pharmacokinetic and physicochemical factors alone can only go so far in designing a molecule for therapeutic safety. It follows that further actions are necessary. In order to fit the pharmacokinetic features of the drug behavior changes of the patient, they involve genetic profiling of patients to match the targeted drug delivery systems and instruction provided by chemists on the appropriate use, safety measures, and potential negative consequences. The monitoring of therapeutic progress and prompt administration of corrective remedies would be made easier with a smooth communication network between the patient, chemist, and physician. (Schilsky RL, 2010). The clinical effectiveness and tolerability of a medical product in a diverse population can be better understood through global replication. Along with the design and testing of new drug products, this knowledge would be helpful for managing the inventory of currently available drug items.

Participants

PRIME training program was conducted for 21 pharmacists and 10 of them accepted the invitation via email and took part in the interviews. Five instances of them participated. Four people in a community pharmacy practiced in interprofessional primary care clinics and one practiced in both of these. The site is located in Canada in both rural and urban environments.

CONCLUSION

During the interview PRIME chemists talked aboutabout the ideas that apply to every TDF domain. The primary domains that were determined by content andpattern were a) Beliefs about Consequences, b) Perceptions of Capabilities, c) Social/Professional Role and Identity, d) Resources and Ambient, e) Social Influences, f) Behavioral Regulation, g) Memory, Attention, and Decision Processes.In the sections that follow, themes relating to the COM-B model were found within various domains and presented. This study identified internal enablers and obstacles to PGx testing integration inPharmacypractisewhich involved the application of TDF frame work, secondary examination of pharmacy interviews(Retain MJ, 2007, Barnbrook L.A *et al*., 2019) (32,33).Implementing successfully depends on the professional identity, practice environmentself-assurance and the advantagesobtained on adding PGx testing to their practice (Crews K.R *et al*., 2012, Madian A.G *et al*., 2012) (34,35). The PRIME training program provided the participants with knowledge of both theory and practice forpracticing PGx, like drug-enzyme pairings and how to communicate with patients effectively about PGx. But however there are administrative gaps in the capabilities to deliver PGx services because PRIME was able to specifically say how participants would integrate the study procedures into existing practice setting and work flow(Ventola C.L, 2013, Yau A *et al*., 2015) (36,37)In order to prepare druggists for handling a larger caseload, navigating any software and technological issues related to the PGx service, and optimizing workflows and attestation conditions (e.g., transferring cases filling out symptom questionnaires beforehand or following up over the phone instead of in person),unborn interventions may be more effective.

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CONFLICT OF INTERESTS

The authors declare no conflict of interest

ETHICS APPROVAL

Not applicable

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AI TOOL DECLARATION

The authors declares that no AI and related tools are used to write the scientific content of this manuscript.

DATA AVAILABILITY

Data will be available on request\

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