Defining Opportunities for Pharmacists in Global Public Health

in Resource Limited Countries

by

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ABSTRACT

With the profession of pharmacy globally shifting towards more patient-centered services than product-centered services, there still remains the question of what the role of the pharmacist can be as not only a patient care provider, but also a public health practitioner. As one of the most accessible healthcare providers, pharmacists worldwide are exploring how they can better protect and promote the health of their communities. While high-income countries have more established patient-centered services with public health implications, such as vaccinations, disease state management, and lifestyle counseling among others, poor countries lack recognition of these services, which can hinder their adoption and spread throughout this part of the world. Low to middle-income countries though often are in the greatest need of these services where they often face the double burden of both communicable and non-communicable diseases. Compounding this issue is that not only do poor nations have a higher disease burden, but also have a greater shortage of health care workers including pharmacists.

There are several areas of need and opportunity for pharmacists in resource-limited countries to engage in public health services. With the global health care worker shortage, pharmacists can help fulfill roles in primary care and extend their responsibilities to increase coverage in gaps of care. Supply chain management is another essential opportunity given the unique medication knowledge pharmacists have in combination with their familiarity with workflow and operations of a pharmacy. Additionally, medication safety and adherence continues to be a significant issue as low to middle-income countries address falsified and substandard medications. In order for pharmacists to be engaged in these and other services such as immunizations, government and association leaders should assess how pharmacists can
better be recognized and integrated within the public health infrastructure and systems within resource-limited areas.

INTRODUCTION

The role of the pharmacist in global public health continues to evolve. Pharmacists throughout the world have traditionally been involved in product-oriented services such as dispensing or compounding medications. However, there is a global shift that is occurring from product-centered to patient-centered and preventative services including disease state management, family planning, immunizations, lifestyle counseling, health screenings, and health education among others.¹ Many of the patient-centered services that pharmacists are involved with have public health implications. While these services are more established in high-income countries such as the United States, Canada, and the United Kingdom, low and middle income countries are beginning to explore and recognize the contributions of pharmacists to public health. From health screenings for diabetes and osteoporosis to immunizations and health education, pharmacists are positioned to have an impact on the health of both patients and communities. Beyond patient-centered services with public health implications, pharmacists in both rich and poor countries are also engaged in broader essential public health services such as community partnership mobilization and innovative research in order to discover and implement new practice models that advance the profession.²

In limited resource communities throughout the world there is a need and opportunity for pharmacists to be utilized across key global health areas over and above what is currently being done. From workforce development to supply chain management and medication safety,
pharmacists can apply their medication expertise to contribute to gaps in care that align with major global health efforts and programs. The role of pharmacists in these global health areas is yet to be defined and presents an opportunity to move the profession forward globally in establishing pharmacists as health care providers who also serve as public health practitioners.

**EVOLVING ROLE OF THE PHARMACIST IN PUBLIC HEALTH IN HIGH INCOME COUNTRIES**

Traditionally, the role of the pharmacist has focused around product-centered services such as compounding and dispensing medications. As technological advances in manufacturing occurred along with increased consumer demand for medication information, there was a need for pharmacists to focus more on patient-centered services as well. As the profession has shifted its attention over to patients, more attention has been given to what the role of the pharmacist could be within public health. Pharmacists can vaccinate in the United States, United Kingdom, and Canada highlighting their role in primary prevention. In Canada, nearly a third of patients surveyed stated that they would not have been vaccinated against influenza if it was not provided at their local community pharmacy.³ Tobacco cessation and lifestyle change recommendations are often services provided by pharmacists across the world. In a systematic review of public health pharmacy services, 83% of participants stated that pharmacists were appropriate providers of tobacco cessation services.⁴ It has been shown that community pharmacists had a higher success rate of tobacco cessation counseling compared to general practitioners (physicians) and that they were effective in medication adherence for key diseases states such as diabetes and cardiovascular disease.⁵ Additionally, pharmacists and student pharmacists frequently hold classes and provide presentations to the community on key
chronic disease states such as cardiovascular disease and diabetes as well as emerging health issues such as pain management and medication disposal.⁶

Many of the patient-centered services that pharmacists provide mentioned above are considered to be micro-level public health activities that are part of the responsibilities of a pharmacist. Currently, there is a lack of participation in macro level engagement such as the coordination and planning of a community health program and other high level activities within community organizations or government agencies.⁷ In 2008, the American Society of Health-System Pharmacists put out a position paper outlining the activities of health-system pharmacists that contribute towards public health. These include providing population-based care, developing disease prevention and control programs, developing health education policies and programs, collaborating with state and local authorities to address emergencies, engaging in population-based research, and disseminating new knowledge.⁸ As part of medication reconciliation efforts upon patient admission, pharmacists can design screening programs to detect gaps in immunizations as well as collaborate with social workers to detect barriers to care. Pharmacists in this setting can also contribute towards the detection and management of infectious diseases outbreaks. In addition to health system roles, pharmacists are also employed in government agencies. Careers for pharmacists with defined roles in public health in the United States are mostly within the U.S Public Health Service (USPHS). Within USPHS, the most pharmacists work within the Indian Health Service (47%), followed by the Food and Drug Administration (26%), Bureaus of Prisons (14%), and the National Institutes of Health (13%).⁹

Pharmacists are capable of being engaged at a higher level within the top ten essential public health services as outlined by the Centers for Disease Control and Prevention (CDC). This
is because pharmacists are one of the most accessible health care providers.\(^\text{10}\) A study by the Royal Pharmaceutical Society of Great Britain estimated that 94\% of the population visits a pharmacy at least once a year.\(^\text{11}\) Patients can walk into pharmacies often at any time of the day or night and receive professional advice without an appointment or paying a fee. With reduced barriers to care, vulnerable populations are able to find quality health services that they otherwise may not be able to have. There are often behavioral as well as financial barriers that prevent patients from picking up and adhering to their medications. The National Coalition for Prescription Information Education found that 50-60\% of medications to treat chronic conditions are not taken as prescribed.\(^\text{12}\) These issues are often not assessed at the point of physician diagnosis and can be addressed by community pharmacists who often refer patients to medication assistance programs or help patients adhere to their medications through techniques such as motivational interviewing.\(^\text{13}\)

In 2012, the CDC published a program guide on how health care professionals should collaborate with pharmacists for the control and prevention of chronic diseases.\(^\text{14}\) Just as pharmacists are part of team-based care plans, pharmacists should be part of program planning teams given the fact that nearly 45\% of Americans take at least one prescription medication and that people with chronic conditions account for 91\% of all prescriptions filled.\(^\text{15}\) To help facilitate these collaborative efforts, the CDC guide recommends using the Community Tool Box, a free online resource for community health development, as well as the CDC’s Framework for Program Evaluation.\(^\text{16}\) In a commissioned report by Public Health England, it too recommends that community organizations and other healthcare professionals partner with pharmacists for the effective planning of public health services.\(^\text{5}\)
ROLE OF THE PHARMACIST IN PUBLIC HEALTH – LOW INCOME COUNTRIES

The role of the pharmacist in public health activities is not limited to those in wealthier nations. The WHO currently recommends 1 pharmacist per 2000 population recognizing the contributions pharmacists can make to public health worldwide. Although the role of the pharmacist in global public health is not as established as it is for other health disciplines such as medicine and nursing, pharmacists are positioned to make a difference in global health. As in the United States, pharmacists in developing countries are often one of the most accessible health care professionals in communities and are positioned to advise on chronic disease state and lifestyle management. Low income countries are increasingly facing the double burden of both communicable and non-communicable diseases where over 75% of deaths due to non-communicable diseases are attributed to developing countries. Although non-communicable diseases are recognized by the WHO and others as a global health priority, less than 2% of global health funding currently goes towards NCDs. In 2013 the WHO developed the Global Action Plan for Noncommunicable Diseases with one of the goals having each country achieve at least 80% access to essential medications for NCDs. There has also been the development of the Non-Communicable Disease Alliance which pharmacists can be part of. Pharmacy services such as disease state management and patient wellness programs have been shown to be cost effective in several developed countries with the potential for this to be translated to limited resource environments.

The most evident forms of public health participation by pharmacists in LMICs are occurring in community pharmacy settings. Community pharmacists in Sudan are actively providing a variety of patient-centered services such as diet and lifestyle counseling, tobacco
cessation, contraception, and obesity and weight reduction. In Zimbabwe, supply chain management, health information provision, and chronic disease state management were cited as public health activities pharmacists are engaged in. Zimbabwe pharmacists also view the provision of medications to vulnerable populations as a public health activity associated with their ability to manage the supply change and procure the right medications for the right patients. Based on interviews of pharmacists in Zimbabwe though, there are concerns regarding the quality and consistency of these services. In Nigeria, 94% of surveyed pharmacists felt that it was acceptable to be engaged in public health activities. In Ethiopia, community pharmacists stated that the public health services they were involved with most were management and screening of infectious diseases, STD partner counseling, and antimicrobial stewardship. These increased efforts by pharmacists in developing countries to expand into public health is supported by the WHO concept of a 7 star pharmacist of which one of the stars is “being a lifelong learner reinforcing the complementary aspects between the fields of pharmacy and public health”.

In addition to these opportunities that are common to both high and low income countries, there are some areas unique to LMICs in which pharmacists can play an important role. Some of these are mentioned below.

**WORKFORCE DEVELOPMENT**

Workforce capacity has been identified as one of several factors that enable the implementation of pharmacy services in resource-limited settings. By 2035 it is projected that there will be a global health care workforce shortage of 12.9 million people, including
pharmacists. This translates into nearly 1 billion people not having access to a trained health worker. While much focus is put on physicians, nurses, and community health workers in filling the gap of the health workforce shortage, there is little effort to recognize pharmacists as a contributor towards the solution given their training and accessibility. Eighty five percent of WHO member states report having less than 1 pharmaceutical personnel per 1000 population. Developing countries are impacted the most by this shortage of qualified pharmaceutical personnel across both community and health system sectors. Countries such as Zambia, Uganda, and Ethiopia report having less than 3 pharmacists per 100,000 people compared to 88 pharmacists per 100,000 in the US. A study assessing the necessary human resources required for scaling up highly active antiretroviral therapy in Malawi identified pharmacists as the health profession cadre needed the most for the program to be effective. Another key issue in attaining an equitable and sustainable workforce is the appropriate distribution of health care workers in both urban and rural settings. A systematic review of the pharmacy workforce found that there is a lack of pharmacists in rural compared to urban settings. Retention strategies are needed to place pharmacists in rural areas so that patients have equitable access to care.

One of the focus areas within the Global Strategy on Human Resource for Health is the need for more and higher quality education. To help facilitate the discussion of advancing pharmacy education across sub-Saharan Africa, a UNESCO-Unitwin grant supported the development of the African Centre of Excellence in Pharmacy Education consisting of Ghana, Nigeria, Namibia, Uganda, and Zambia. In 2016 the pharmaceutical workforce development goals (PWDGs) were introduced by the International Pharmaceutical Federation (FIP) to help
address the critical shortage of pharmacists and expand their use across the health sector. The 13 different PWDGs focus on a locally-needs based, outcomes-focused approach that span across the areas of academia, professional development, and systems to fulfil the vision of advancing the pharmaceutical workforce globally. The PWDGs are intended to be utilized by each country independent of socioeconomic status.

The first of the 13 PWDGs focused on increasing the academic capacity of training institutions for both students and the existing workforce. To increase the quality of pharmacy education, governments can introduce higher education standards that are appropriately assessed through accreditation mechanisms. The Pharmacy Council of India created the National Taskforce for Quality Assurance in Pharmacy Education in order to address the increasing number of pharmacy institutions with a decreasing number of student applicants. There is also a need to ensure that the training of health workers not only meets higher quality standards, but is also relevant for the local needs of the population. If pharmacists are over-qualified for their responsibilities, this could lead to decreased job satisfaction and eventually attrition. With gaps in care that span beyond individual disciplines, pharmacists can be trained and utilized to help provide public health services in collaboration with other health care professionals to provide better care and coverage for patients.

| Case Study: UNC Project-Malawi |

Malawi currently has only one school of pharmacy in Blantyre that trains 40-50 students each year. This is not enough to meet the needs of the country. Since 2014, the UNC Eshelman School of Pharmacy has been sending students to Lilongwe, Malawi in affiliation with UNC.
Project-Malawi. UNC pharmacy students facilitate the outpatient operations and workflow of Kamuzu Central Hospital (KCH) and have the opportunity to help with diabetes and cardiovascular screenings in the outpatient clinic. Prior to increased UNC pharmacy involvement, KCH had employed only one pharmacist. As of 2017, KCH has now employed a total of four pharmacists working in both inpatient and outpatient settings. While most of the work focuses on dispensing supervision and supply chain management, there is interest in pharmacy expanding into more clinical patient-centered services that have public health implications after better understanding how pharmacists could be utilized in this capacity.

**MEDICATION SAFETY & ADHERENCE**

Improper medication use is a $500 billion problem worldwide with pharmacists positioned to be part of the solution given their medication expertise.\(^3^8\) Having an adequate pharmaceutical workforce helps ensure patient safety which is important in the discussion of quality being part of the larger global health agenda.\(^3^9\) Substandard and falsified medications pose a significant health risk worldwide with poor quality medications often having the wrong amount or lack of active ingredient leading to increased morbidity and mortality. Developing countries are impacted the most by falsified and substandard medications where life-saving treatments for communicable diseases such as malaria, tuberculosis, and HIV are often the targets. A 2012 Lancet study found that up to 35% of antimalarials tested in southeast Asia were falsified and that 35% of samples from sub-Saharan Africa failed chemical analysis.\(^4^0,4^1\) One study estimates that 122,350 under-five malaria deaths are actually due to the
consumption of poor quality antimalarials. Several factors known to contribute towards poor quality medications in which pharmacists can have an impact include self-prescribing behaviors, lack of pharmaceutical quality assurance, limited patient knowledge regarding medication authenticity, supply chain management, and a lack of regulations to ensure quality control. Pharmacists also have the opportunity to participate in the WHO Prequalification Team which helps government agencies ensure the procurement of quality essential medicines.

Not only are there individual patient issues such as treatment failure, but also public health issues including increased incidence and development of drug resistance. A recent WHO report indicated that there are too few drugs being developed to address to growing burden of multiple drug resistant tuberculosis. In addition, a recent meta-analysis of self-medication use in developing countries estimates that over 38% of patients self-diagnose and treat which can contribute to the growing global burden of antimicrobial resistance. Pharmacists are also essential to antibiotic stewardship programs which help ensure the rationale use of antibiotics.

In addition to falsified and substandard medications, medication errors is another global medication safety issue that costs $42 billion annually worldwide. While automation and sophisticated software systems have been in place for quite some time in developed countries to mitigate errors, developing countries lack the infrastructure and resources to implement such systems. Instead, more basic procedures and paper-based checklists and protocols are utilized. In 2007, the WHO launched the High 5’s Patient Safety Initiative aimed at implementing and evaluating standardized operating procedures for priority areas such as medication reconciliation which can reduce the number of medication errors for patients in hospital settings. To address the ongoing global health issue of patient safety, the WHO
launched the third patient safety challenge focusing on the topic of ‘medicines without harm’ with an ultimate goal of reducing medication-related harm by 50% over the course of five years. Pharmacists are again positioned to uniquely contribute to the global health effort of patient safety.

Even if medications are of high quality, they are of limited utility and benefit if patients are not adherent. A review of factors positively associated with antimalarial adherence in developing countries including individuals with higher household income, higher education, provision of information on how to take drugs, and knowledge about malaria and antimalarials. While pharmacists cannot influence the first two factors, they are critical in influencing the latter two. In Malawi and other parts of sub-Saharan Africa, some patients have made their own assumptions about the strength or weakness of antimalarial medications and adjust the dosage according to their beliefs. Educational implementation strategies have been integral in addressing antimicrobial resistance and pharmacists can play a larger role in helping shape health behavior.

Medication safety is also an influential factor in the recently launched Global Health Security Agenda which is a consortium of 31 countries seeking to combat infectious disease outbreaks and threats. In addition to combatting antimicrobial resistance and falsified drugs, the Global Health Security Agenda seeks to restrict the spread of zoonotic diseases through a One Health approach, which includes pharmacists. Pharmacists can also be part of biosafety and biosecurity efforts by ensuring the proper procurement and administration of medications in case of bioterrorism.
SUPPLY CHAIN MANAGEMENT

Supply chain management is an area that pharmacists in developing countries as well as those working in humanitarian efforts are engaged with in order to help improve access to essential medications for both communicable and non-communicable diseases. Each country is encouraged by the WHO to develop and use a National Medicines Policy (NMP) which should outline strategies and approaches for procuring and using certain medications drawn from the Essential Medicines List. Despite 71% of countries having a NMP, less than half of developing countries have revised their plan within the past 5 years. It is estimated that fewer than 30% of patients in the WHO Africa region have public access to essential medications. While technology and software solutions have helped develop robust supply chain systems in developed countries, pharmacists in developing countries such as Haiti are exploring how to utilize and implement web-based platforms to mitigate supply chain issues so that more time can be spent on patient interaction.

Several successful initiatives have been implemented to address shortages of essential medications. In 2003, Tanzania with the assistance of Management Sciences for Health (MSH) started the Accredited Drug Dispensing Outlet (ADDO) program with the goal of improving access to affordable, essential medications. The ADDO program had targeted interventions that improved the capabilities of pharmaceutical personnel that worked at the drug outlets and imposed new regulations designed to improve medication quality. Evaluation of the ADDO program has shown increased adoption of treatment guidelines, significantly higher availability of essential medications for children, and increased quality of dispensed medications. The
success of the ADDO program has been replicated in other sub-Saharan countries including Uganda and Liberia.

**Case Study: Zambia Health Shops Project**

Currently the Zambia Ministry of Health through the Zambia Medicines Regulatory Authority (ZAMRA) is looking to implement the Health Shops Project modeled after the ADDO program. While the urban population in Zambia (35%) has access to over 150 pharmacies, several rural areas where most of the population lives do not have any access to a pharmacy. This gap in care is filled by illegal drug outlets in which unregulated medications of unknown quality are sold and distributed on a transactional basis. The Health Shops Project seeks to enforce new regulations and pharmacy training requirements to provide access to key WHO essential medications. The program will be a key example of a public-private partnership in order to extend access to care for a larger population that couldn’t be done so by either entity. The Health Shops Project will address several of the objectives of the Zambia Health Sector Supply Chain Strategy and Implementation Plan (2015-2017) by helping ensure the procurement of quality medications as well as their rationale use.

Before rolling out country-wide efforts such as the Health Shops Project, it is imperative that one assess readiness before doing so. It is estimated that over half of large scale initiatives fail due to a lack of planning and readiness assessment. Current work is ongoing to help assess the readiness of ZAMRA as well as health shop owners to determine what gaps may exists that should be addressed as the Health Shops Project is piloted across several rural districts. Assessing organizational readiness can then lead to the creation of an implementation blueprint.
to facilitate the scale-up of health shops across districts and eventually the country. This case study is a collaboration between the UNC Eshelman School of Pharmacy, UNC Gillings School of Global Public Health, and the University of Zambia (UNZA).

**IMMUNIZATIONS**

The launch of the Global Alliance for Vaccine Initiative (GAVI) in 2000 promoted the adoption and utilization of vaccines in developing countries at scale. A recent study evaluating 10 vaccine preventable diseases across 73 low to middle income countries showed that vaccination for these diseases could prevent 20 million deaths and over 500 million cases of illness between 2001-2020.\(^5\)\(^7\) Despite vaccinations being shown to be one of the most cost-effective public health interventions, developing countries face numerous challenges in adopting and sustaining acceptable immunization rates. The WHO Initiative for Vaccine Research (IVR) seeks to increases the use of implementation research in order to increase adoption of vaccinations in the developing world. Complimenting this effort is the recent launch of the Ottawa statement which focuses on population health implementation research with a focus on primary prevention programs including immunizations.\(^5\)\(^8\)

According to a 2017 assessment report of the WHO Global Vaccine Action Plan, a key recommendation moving forward is to broaden the dialogue with other organizations and partners, and pharmacists are excellent candidates.\(^5\)\(^9\) Over the years policies and regulations in the US and other countries have helped pharmacists in other countries gain the necessary support to provide key immunizations to promote health and well-being. There is an opportunity for pharmacists to do the same in low to middle income countries. More research
is needed to understand how current immunization implementation plans in developed countries, such as the US Department of Health and Human Services National Adult Immunization Plan, might be translated to developing countries with the utilization of pharmacists. With continued progress towards the development of vaccines against malaria, Ebola, and Zika, pharmacists can be positioned to assist with new immunization efforts and programs.

The 2016-2020 GAVI five-year strategy includes four overarching goals including increasing the effectiveness and efficiency of immunization delivery. Pharmacists are positioned to actively contribute towards this effort given their accessibility, therapeutic knowledge, and operations management experience. The CDC’s Strategic Framework for Global Immunization describes the essential role of the health workforce in ensuring the delivery of vaccinations to those who need it. Based on the accessibility of pharmacies in developing countries where coverage rates for key immunizations are lower, pharmacists can be part of immunization screening programs when patients are there to seek medical advice or procure a medication.

**MOBILE HEALTH**

Pharmacists can play a significant role in the constantly evolving field of mobile health. Over 90% of the world has access to a mobile phone signal which is often much higher than access to other services such as sanitation, water, and electricity. Combining the accessibility of pharmacists with the wide-spectrum coverage of mobile phones presents an emerging opportunity.
The WHO has recognized the importance of determining ways to utilize mobile health for non-communicable diseases with the launch of the Be He@lthy, Be Mobile campaign in which each WHO Region started a pilot project around one of several disease state areas including cervical cancer, diabetes, and tobacco cessation. Pharmacists can be integrated within this initiative as they have been with other mHealth programs such as the SMS for Life program which has increased access to medications by improving inventory management systems. In this program pharmacists manage medication inventory by sending SMS text messages to district warehouses to indicate supply levels so as to ensure that these medications are available to the public. With increased training, pharmacists can extend their role in mHealth by using SMS text messages to participate in disease surveillance activities since pharmacists are often the first health care professional patients will see. Additionally, pharmacists can utilize mHealth to assist with medication safety and adherence issues by sending reminders and educational or motivational messages. Known implementation determinants of mHealth programs in sub-Saharan Africa include adequate incentives for participation, government support and engagement, and appropriate training for clinical staff. These determinants can help shape future studies as to what are the determinants of participation are of pharmacists in these initiatives to combat non-communicable diseases.

Due to the rapid growth of mHealth, there has been inconsistent terminology use, a multitude of new modes and frameworks, and a lack of understanding of what actually constitutes mHealth. These challenges make it difficult to compare and synthesize the findings of the limited studies being conducted in developing countries around non-communicable diseases. If there is standardization of certain design and planning elements of mHealth pilots...
and programs, there could be more effective monitoring and evaluation strategies for the scale up of mHealth programs in sub-Saharan African countries. Provided that most mHealth studies are looking at improving medication adherence, making lifestyle recommendations, or changing medication therapy regimens, pharmacists can play a significant role in advancing mHealth for non-communicable diseases.

**CHALLENGES FOR PARTICIPATION OF PHARMACISTS IN PUBLIC HEALTH**

Despite the enormous potential for pharmacists to contribute to public health in both high and low resource settings, there is still little formal recognition of the ability of pharmacists to serve as public health practitioners. In 2006, the American Public Health Association (APHA) created a policy statement formally recognizing the role of pharmacists within public health. One of the key insights within the statement was that although pharmacists are performing public health activities, their role in public health is not recognized unlike physicians and nurses. To strengthen the focus of pharmacists as public health practitioners, the Joint Commission of Pharmacy Practitioners, a group of CEOs from the leading US pharmacy associations, developed a 2015 vision statement that stated that pharmacists will be prepared for both patient-centered and population based care. This aligns with the increased training focus on public health within the pharmacy curricula. Even with formal recognition, there also appears to be a lack of confidence in how pharmacists view their services. In Scotland, only slightly more than half either agreed or strongly agreed that they considered themselves as public health practitioners despite offering services that would classify them as such.
Also, while organizations within and outside of pharmacy have declared the importance of pharmacists in public health, their still needs to be increased awareness and recognition by patients of this role. A 2016 report by the Royal Society of Public Health and Public Health England stated that a key challenge in establishing the role of the pharmacist in public health was that the public lacked awareness of the services pharmacists provide. Only half of the public in the United Kingdom knew that pharmacists provided immunizations, family planning, and general health checks.\textsuperscript{67} Although 80\% of pharmacy customers in Sweden expected to received drug related information from the pharmacist, less than a quarter expected to receive information on diet, smoking cessation, or disease management.\textsuperscript{4} In summary, while pharmacists are viewed upon favorably in other countries because of their accessibility and convenience, their role impacting public health is not as widely known or understood.\textsuperscript{68} In addition to patient stakeholders, health insurance companies and payers need to recognize pharmacists as well so that they can be compensated and incentivized to provide these services on a more consistent basis.

These barriers to recognition are also present in more acute forms in low resource settings. Factors known to hinder public health services offered by pharmacists in developing countries include a lack of knowledge and skills, lack of confidence, limited policies and regulations, poor recognition within the healthcare system, inadequate workforce capacity, and patient reluctance to use pharmacy services.\textsuperscript{26} In Ethiopia nearly 80\% and 90\% of pharmacy personnel were “not at all involved” or “a little involved” in tobacco cessation and diabetes management, respectively.\textsuperscript{26} Often in developing countries there are physical space restrictions within community pharmacies making it hard to provide public health services. In Malaysia,
30% of pharmacies lack a counseling area. Another barrier is perceived competency in assuming a more public health oriented role. Although aspects of public health are being incorporated into training curricula, graduating pharmacists and the existing workforce feel insufficiently prepared to delivery such services. Additional barriers to advancing the role of pharmacist in global public health is a lack of distinct separation from medication prescribing and dispensing as well as a critical shortage of pharmacists. Even when services are provided, there is a high degree of variation concerning the type and the quality of the service.

RECOMMENDATIONS

In summary, while several areas across LMICs progressive growth of pharmacy-based public health services, this is not universal. Overall, pharmacists are underutilized within public health worldwide and can make an even larger impact on the health of the communities if appropriately positioned and recognized. The following policy recommendations are to be considered by governments in developing countries in order to enhance the impact that existing and future pharmacists can have on global public health.

1) Recognize pharmacists as part of the public health workforce

As done in developed countries, formal recognition of pharmacists by associations and the governments as part of the public health workforce can provide the confidence needed for pharmacists to act as public health practitioners. Further, enhanced recognition at district and national levels can increase the visibility of the profession and attract future applicants and leaders to enter into pharmacy.
2) Establish pharmacists’ roles in immunization and medication safety programs that promote well-being

Immunizations are one of the most cost effective interventions, but remain underutilized. Pharmacists have been shown to provide safe and effective delivery of immunizations and positively influence the behavior of patients receiving them. Governments can push for pharmacists to be trained as immunizers so as to reduce the already high workload of physicians and nurses. A review of training outcomes for healthcare professionals in low to middle income countries revealed a number of effective short-term training strategies including using train-the-trainer programs in order to upskill the existing workforce.

3) Integrate mHealth interventions in community pharmacies

The accessibility of pharmacists complement the vast accessibility of phones within limited resource settings. With the right training, pharmacists can be utilized in mHealth interventions that address both communicable and non-communicable diseases. It has already been shown how pharmacists can help with supply chain management as in the SMS for Life program and this technology can be extended to engage pharmacists in disease surveillance activities as well as medication safety and adherence programs. According to the Global Strategy on Human Resources for Health, mHealth tools should be utilized to enhance global public activities such as supply chain management and patient safety. Government leaders should invest in the infrastructure necessary to support the implementation and scale-up of mHealth services which can help mitigate the unequal distribute of health workers in rural areas by leveraging technology use.
4) **Utilize implementation science methods in pharmacy across limited resource settings**

Many of the above mentioned global health areas have success stories and evidence based practices that have been utilized in high income countries. However, it is unknown how evidence based practices from the global north translate to the global south. Implementation science is the field of understanding how to translate evidence into everyday practice and can be utilized across public health issues from medication safety to mobile health. While implementation science is stimulating research opportunities in the community and primary care settings for pharmacy in the United States, there is a lack of research regarding the effective implementation and evaluation of pharmacy services within developing countries. There is a need for the appropriate monitoring and evaluation of pharmacy provided public health services so that these can be adopted and scaled up accordingly. Implementation research for pharmacy in low to middle income countries can help provide the data needed for government leaders to support the integration of pharmacists into public health services. As pharmacists develop their niche within global public health, there will be the need to understand how and why pharmacy services can improve the health and well-being of communities throughout the world in resource-limited settings.

5) **Incorporate public health principles in pharmacy education**

There is growing demand by students and pharmacists in developing countries to have further instruction and engagement with public health activities so that they can more effectively contribute towards the broader health of the community. In order to implement public health services, students must be appropriately trained in basic public health
competencies to be able to understand how patients fit into populations and how to manage the health of these populations. Beyond key principles of pharmacoepidemiology and health policy management, pharmacy students in developing countries should take a primer on implementation science that introduces them to the basics of program planning, quality improvement, and monitoring and evaluation. This skill set will equip graduates with the capability to putting research into practice. Additionally, continuing professional development should be offered for those in the workforce to elevate the training of the whole profession.

This is a need that is also important in high income countries. More schools and colleges of pharmacy are developing PharmD/MPH dual degree programs to help prepare individuals with the skill sets necessary to be effective in public health programs. The most recent accreditation standards for schools and colleges of pharmacy included public health as one of the key competencies required for students upon graduation so they can effectively utilize population health management strategies and implement public health activities and programs. Others have called for increased competence across the broader core competencies in public health in order for pharmacists to make a larger difference on population health.

CONCLUSIONS

Despite the challenges pharmacists face in limited resource settings, the role of the pharmacists in global public health in low to middle-income countries will continue to evolve as pharmacists become better recognized and engaged in the above mentioned areas. The shift pharmacists have made in high-income nations from product-centered to patient-centered
services with public health implications took decades to achieve. The shift for pharmacists in low to middle-income countries will also take time. More studies are required to further demonstrate the impact pharmacists can have in resource-limited areas within certain areas of global public health. The accumulation of more evidence and data can help drive the development of new policies and advocacy efforts to recognize pharmacists not only as patient care providers, but also as public health practitioners.
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