

Describing Pharmacists' Core Public Health Competencies During Post-Graduate Early  
Career Readiness: A Case Study in Ghana

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Akua Asantewaa Appiah-Num Safo

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Advisor: Dr. Kristin Kari Janke

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# Dedication

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# Abstract

## Background

Due to emerging complex disease states, and patients' demands for high levels of care, it is imperative that health professionals, including pharmacists, are equipped with adequate educational and training competencies to meet those needs. To assist in formative evaluation and quality improvement, more information is needed on the competencies being promoted and developed in doctor of pharmacy (PharmD) programs, including *how* the program works and *why*? Training may be structured differently among institutions, even though the ultimate goal, to graduate professionals for the field, might be the same. Many western countries have had decades of experience in pharmacy education and yet, continue to refine and revisit educational content and training strategies. But many Low-to-Middle Income Countries (LMICs) are relative novices to the professional doctorate degree program. Hence the need to investigate and identify gaps for improvement. To further understand one of the four main domains of the GbCF, the study focused on Pharmaceutical Public Health.

## Aims

Aim 1: To describe the educational processes and outcomes that contribute to readiness of pharmacists to take on public health roles in LMICs using evaluation science approaches in a university Doctor of Pharmacy Program in Ghana as a case study.

Aim 2: To assess new practitioners' perceptions of readiness for the various Pharmaceutical Public Health competencies set forth in the Global Competency Framework (GbCF).

## Method

This case study involved a formative, evaluative approach to uncover new understanding of public health in the doctor of pharmacy (PharmD) degree program. This method was conducted to explicate current processes for education in public health and expected outcomes. Document reviews and interviews with program directors were conducted to begin understanding "how and why" the PharmD program was working. The exercise was needed to gather contextual information. Then, stakeholders were purposefully sampled and engaged in interviews or focus groups, including early career practitioners, faculty members and administrators from KNUST, seasoned pharmacists, leaders of the Pharmacy Council, Ghana and FIP members/officers in FIP's academic section with public health interest. Thirty-three individuals participated in the study.

## Results

Findings indicating that the KNUST PharmD program intentionally created specific public health experiences/activities for students to get hands-on training. Participants reported that the theoretical aspects are efficient, but the practical opportunities are limited. Participants reported responding positively to experiential training, but they want more opportunities to discuss public

health areas of practice where they can apply the competencies. In fact, some FIP members/officers with public health interest view engagement with local and national level health ministries and government as an advantage in assisting with training opportunities in areas like immunizations. Education outcomes evident in the study were: cognition, behavior, attitude, economic, affect, relationship, environment and status. The results were also evident that the program works by providing tools and sharing knowledge, testing students on specific public health competencies, and requiring relevant Continuing Professional Development (CPD) courses.

## Conclusion

The study demonstrates that just knowing the competencies alone is not adequate, practical training in addition to theoretical knowledge is essential for public health roles. Pharmacists' readiness for public health roles is evident in their cognition, behavior, and attitude among other education outcomes. The recommendation is for KNUST educators to explore the addition of simulation-based learning in their pharmacy curriculum, for early career practitioners and seasoned pharmacists to mentor, advocate and become role models for students, for FIP members in the academic section to regularly direct focus on need for public health competencies in PharmD programs and for researchers to seek perspectives of current students and seek more evidence to add and teach specific content areas like counterfeit drugs, procurement and supply chain management.

Evidence was provided that supports adequate theoretical knowledge, impact of program directors years of experience in developing competency-based curriculum and evidence in teaching and overall support for learners.

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# Chapter 1: Introduction

There are ongoing conversations among health professional educators, including educators in pharmacy, about the importance of competencies in health professional education. Some experts have voiced their opinions on why certain core competencies should be expected of graduate pharmacists.<sup>2,3</sup> According to these experts, particular skills, knowledge, abilities, and/or aptitudes vary in the way they may be assessed or measured among health professional institutions and training sites.

Some discussions have centered on the distinction between competency approaches and Competency-Based Education (CBE).<sup>4,5</sup> Additional discussions have been on definitions and the need to address some of the challenges in offering CBE. Pharmacy programs continue to engage on topics about competencies, competency-based education and competency frameworks even with decades of knowledge and experience in training pharmacists in doctor of pharmacy (PharmD) degree programs. In high income countries, programs work to determine outcomes of education using the evaluation sciences to analyze their efficacy by determining “*how*” and “*why*” programs work or do not work. New PharmD programs are being started in various countries globally, especially in Low-Middle Income Countries (LMICs), and their curriculum has been adopted from existing programs with minor adjustments. Little exploration of outcomes or processes have been initiated in LMICs, where new programs face additional challenges in ensuring students attain competencies, including defining expectations of faculty and students, engaging in supportive pedagogies, and instituting informative student assessment. However, courses in public health have not been a part of the traditional pharmacy educational curriculum.

Public health education is the key focus of this inquiry because the challenges in sustaining resources affecting low-income countries dealing with public health issues are substantial. The status of pharmacy practice related to its role in public health, the clinical responsibilities of pharmacists, and pharmacists' preparedness to engage with other health professionals in public health emergency situations in Ghana, are areas of inquiry that are necessary for advancing pharmacy education and practice. The need for pharmacy programs to include public health in their curricula and train pharmacists to contribute to public health roles<sup>6</sup> has increasingly gained importance within the American Association of Colleges of Pharmacy (AACCP), which has voiced its support for population based care in its Center for the Advancement of Pharmacy Education (CAPE) Educational Outcomes.<sup>7</sup> Recommendations for PharmD programs in high income countries to incorporate elements of public health in their curriculum are growing,<sup>6</sup> and it behooves us to investigate how new PharmD programs in LMICs are responding to this public health need.

With the aim of understanding outcomes of educational programs and the processes that lead to competency attainment, it is important to describe and understand the various parts of the Global Competency Framework (GbCF).<sup>8,9</sup> The GbCF was created by the pharmacy education taskforce within the International Pharmaceutical Federation (FIP) in 2012 and contains a core set of behavioral competencies (Fig 1). The GbCF consists of four domains i.e., 1.) Population Focus (Pharmaceutical Public Health), 2.) Patient Focus (Pharmaceutical Care), 3.) System Focus (Organization and Management) and 4.) Practice Focus (Professional/Personal).<sup>8</sup>

According to the FIP, the GbCF is expected to provide some guidance for entry and advanced level practice. Further, FIP suggests the use of the GbCF as a tool for country-specific curricular design, based on specific needs for practice and professional advancement.<sup>8,9</sup> For instance, FIP encourages countries to focus on needs-based education to develop and advocate for local transformation. While pharmacy professional programs may be using competency approaches within their curricula, little is known about their structure and function, awareness of stakeholders, or *how* and *why* their programs are working or not working in terms of students achieving those competencies.

Therefore, research and publication about competency development is necessary, as well as further investigation into the processes for developing competencies in pharmacy education, especially in LMICs. Providing information about country specific development of core competencies will be a step forward in training pharmacists to provide culturally adaptive and context-specific services more effectively for patients within their communities, which can lead to best outcomes.

The purpose of this study is to understand stakeholder (i.e., new practitioners, faculty, administrator) perspectives about pharmacists' readiness to take a role in and contribute to public health, through a case study of the doctor of pharmacy degree program at Kwame Nkrumah University of Science and Technology in Ghana.

## Aims

Aim 1: To describe the educational processes and outcomes that contribute to readiness of pharmacists to take on public health roles in Low-to-Middle Income Countries (LMICs) using evaluation science approaches in a university Doctor of Pharmacy Program in Ghana as a case study.

Aim 2: To assess new practitioners' perceptions of readiness for the various Pharmaceutical Public Health competencies set forth in the Global Competency Framework (GbCF).

## Significance

As the leader in pharmacy education globally, the International Pharmaceutical Federation (FIP) advocates for “high-quality education and training to provide the foundation for workforce development, in addition to professional and scientific advancement.”<sup>8,9</sup> To achieve this, specific competencies contributing to the development of a competent pharmacist must be identified and monitored,<sup>10</sup> especially during the required internship year.

Pharmacy education is tasked with ensuring graduates can execute their professional role competently.<sup>11</sup> The challenge for most pharmacy programs is integrating the general and professional abilities required for pharmacists to take responsibility for drug therapy outcomes and patients’ wellbeing.<sup>12</sup> Studies on pharmacists’ competencies, especially in developed countries, have gained momentum. Further, experienced programs are now defining core competencies, having recognized the value in ensuring that pharmacists develop their skills and knowledge in particularly vital areas of patient care.

The Global Competency Framework (GbCF)<sup>8</sup> describes four major areas of competency development: pharmaceutical public health, professional/personal, pharmaceutical care, and organization and management. Pharmaceutical public health covers behavioral competencies in emergency response, health promotion, and medicine information and advice. Related to public health issues, like the recent COVID pandemic, measures for emergency response are of great interest. Multidisciplinary work, examination of the impact of culture/societal setting on population health, and innovation in health promotion (e.g., vaccination) require continuous monitoring. These competencies are important in Ghana because knowledge of them contributes towards supporting foundation level practitioner development<sup>8,9</sup> of professional doctor of

pharmacy degree programs. It can also inform policy and accreditation decisions in Ghana about pharmacy education now and for the future.

**Figure 1.** GbCF Version 2 Competencies - Domains and Illustrative Competencies from the GbCF V2 for Pharmaceutical Services



Reprinted from Global Competency Framework (GbCF V2) 2020 Image. International Pharmaceutical Federation (FIP).<sup>8</sup>

# Chapter 2: Review of the Literature

## Competency Approaches in Pharmacy Education

Pharmacy education is continually advancing as one of the key healthcare professional programs in the care of patients. Pharmacy education has the educational design and capacity to develop the workforce for a diversity of settings (e.g., community, hospital, research and development, academia) across varying levels of service provision and competence (e.g., technical support staff, pharmacists, and pharmaceutical scientists) and scope of education (e.g., undergraduate, postgraduate, lifelong learning).<sup>13</sup>

In pharmacy, scholars debate the expected competencies a pharmacist must have as they progress through their educational training. Given the emphasis on pharmaceutical care as a competency and part of pharmacy students' readiness for patient-centered care, pharmacy education is tasked with ensuring graduates can handle this professional role competently.<sup>11</sup> For most pharmacy programs, pharmaceutical care is integrated into the general and professional abilities required by graduated pharmacists to take charge of drug therapy outcomes and patients' wellbeing<sup>12</sup> and it is integral to the philosophy of practice.<sup>14-16</sup> While the clinical and non-clinical performance as part of pharmacy education can vary, there are expectations of early graduate pharmacists' competence, defined as a "set of knowledge, skills, capabilities, judgment, attitudes, and values" that they are to integrate and demonstrate in their roles.<sup>11</sup> Such competency expectations can be beneficial to the students' education and also for patient care.

The benefits of quality education involving certain competencies for PharmD students is clearly illustrated in the students' ability to take up new and expanded patient-centered roles and

responsibilities, maintain practice autonomy, function as healthcare team members, participate in community service, and mentor other pharmacists.<sup>17</sup> These abilities require competence in the general functions of pharmacists as designed by various pharmacy programs to attain a certain level of excellence.

Regardless of the setting, competent pharmacists can provide a high level of patient care.<sup>11</sup> Competent pharmacists also have the potential to improve therapeutic outcomes and patients' quality of life.<sup>10</sup> Specific competencies that contribute to developing a competent pharmacist should be investigated, especially in new practitioners who have gone through rigorous education. Per the Center for the Advancement of Pharmacy Education (CAPE), "expansion of pharmacists' professional roles has led to the need for curricular reform across all aspects of the educational training process."<sup>18</sup>

Health professional programs continue to integrate Competency-Based Education (CBE) within the curricula through the implementation of robust CBE models<sup>19</sup> which define the competencies and the outcomes. For instance, in a competency model where the foundation of that competency is the health care needs of the community, it is those health care needs that define the competencies and the outcomes.<sup>20</sup> In a narrative review by Katoue MG, Schwinghammer TL,<sup>21</sup> the growing interest in CBE can be seen in its implementation in health professional schools, including pharmacy education programs. CBE is intended for healthcare providers to develop clinical competencies that meet the healthcare needs of the society through effective services<sup>21</sup> without a set semester time frame<sup>4</sup> for completion. Compared to competency approaches currently used in health profession education, CBE provides flexible completion timelines for individual students to work at their own pace.<sup>4,21,22</sup> With CBE, the need to assess and evaluate graduate professionals' competencies is key. In addition to making sure that graduate students meet a

“standard minimum acceptable level of outcomes,” units of Entrustable Professional Activities (EPAs) are used to demonstrate competencies.<sup>21</sup>

Some educators suggest implementation of CBE as a model for pharmacy education, while others have pointed out the complex nature and challenges of using such models.<sup>22</sup> For example, in regard to CBE in pharmacy education, Medina<sup>4</sup> discusses the challenges in adopting the CBE model, such as difficulties in using time-based curricula, complications with assigned faculty time, and more focus on skill versus knowledge. Additionally, the flexibility in learning timeframes and progression at an individual’s own rate raises complex logistical problems and issues with faculty time in handling time-consuming assessments.<sup>3,4</sup> Further challenges identified include managing students’ performance and progression without the efficiency of a cohort. These discussions counter certain benefits to programs in medicine assumed to be generalizable to pharmacy education.

Medina M. mentions the growing interest in integrating the use of CBE in medical education and healthcare professionals’ education.<sup>3</sup> CBE is an instructional model that is gaining some footing, although its future is unclear in pharmacy education. However, the attention on CBE highlights a distinction between a competency-based approach (i.e., using competencies in pharmacy education) and formal CBE. Medina shows the benefit in confirming students acquire specific competencies at different levels, but also acknowledges the challenges in implementing CBE with limited resources.<sup>4</sup>

## Pharmacy Education in Ghana

Pharmacists' education and training in Ghana started in the 1800s when pharmacists underwent supervised, hands-on experiential dispensing of medications in government hospitals.<sup>23</sup> Over time, the profession has evolved, transitioning through various phases. From 1961 to 2017<sup>23</sup>, the only bachelor of pharmacy degree, offered at Kwame Nkrumah University of Science and Technology (KNUST), mainly focused on strengthening basic science and training in all aspects of medicine production, distribution and use.<sup>23</sup> The shift in Ghana to a six-year PharmD program happened later than in some western countries, only being implemented in 2012 at KNUST with the first cohort of students graduating in 2018.

Currently, the Pharmacy Council, Ghana has accredited seven pharmacy schools including Kwame Nkrumah University of Science and Technology (KNUST), University of Development Studies, University of Ghana-Legon, University of Health and Allied Sciences, Central University, Entrance University College of Health (EUCH) and University of Cape Coast.<sup>24</sup> The first three are public universities and the remaining are private institutions.

Kwame Nkrumah University of Science and Technology is the only tertiary institution that has graduated six cohorts of PharmD professionals in Ghana with the seventh anticipating graduation in 2024. Being the first pharmacy school established in Ghana, its pharmacy program has had more experience in pharmacy education and training than any other accredited institution in Ghana. Therefore, it will be advantageous to assess the preparation of KNUST's graduates in their competencies and to investigate "how" and "why" the program is working. With KNUST's position as an advanced institution in pharmacy education, findings from this study could prepare

them for reaccreditation, as well as inform other pharmacy programs within Ghana and other international programs.

In Ghana, educational programs including pharmacy, were initially accredited by the National Accreditation Board (NAB) and then approved by the Pharmacy Council, Ghana. But under the new Educational Regulatory Bodies Act, 2020 (ACT 1023) the NAB has become part of the Ghana Tertiary Education Commission which will now grant the initial acceptance of programs.<sup>25</sup> The Pharmacy Council, Ghana also oversees registration, renewal of licenses, etc. just like boards of pharmacy in the United States. However, the Pharmacy Council, Ghana does not provide competency expectations in terms of public health to the schools. Generally, pharmacists are not typically trained and educated with easily identifiable and explicitly named public health competencies. However, such competencies are sometimes embedded within the curricula or incorporated within training guides to prepare pharmacists for professional practice, but this should be done more formally.

The parliament of the Republic of Ghana passed the Public Health Act of 2012<sup>26</sup>, showing the Republic's emphasis on public health. The Public Health Act is in nine parts: 1) – communicable diseases, 2) – vaccination, 3) – quarantine, 4) – vector control, 5) – environmental sanitation, 6) – tobacco control measures, 7) – food and drugs, 8) – clinical trials and 9) – miscellaneous provisions. Health professionals (pharmacists) are not explicitly named as an asset in public health activities and functions. Even though they are obviously involved in public health activities, we do not know much about the “how” of their involvement. Therefore, learning more about pharmacists expected roles in public health is important because they are not explained either by the Pharmacy Council, Ghana, which only states that public health is part of a pharmacist's responsibility, or the Public Health ACT, 2012<sup>26</sup>, which does not indicate that public health

practice is in any way part of a pharmacist's responsibilities. Expectations for pharmacists' role in public health are not well captured in writing and therefore require exploration and affirmation.

For many years, pharmacists in Ghana have been primary care givers for many sick people in the communities they serve. This is partly due to the limited access to healthcare and necessary medications in disadvantaged areas. Pharmacists assume many healthcare professional roles by taking care of less complex disease states and providing initial care for complex medical cases before referral. As pharmacists, it is expected that they are ready to provide many aspects of care as needed by the sick in the communities where they work. This could strengthened the pharmacist-patient relationship within communities, leading to the public developing more trust in pharmacists' care during public health outbreaks compared to seeking care at distant health facilities or getting care from a traditional herbalist.

In the past, there was separation of the traditional herbalist and western trained drug experts. But now, there is a merging of colonial influence and current cultural practices. Most of the colonial practices in pharmacy evolved to pharmacognosy (herbal medicine) and that has progressed steadily.

Depending on the public health needs of the community, the societal approach has been welcoming of certain activities relating to communicable and non-communicable diseases, such as quarantine, vector control, environmental sanitation, food, and drugs use.<sup>26</sup> However, there has been leeringness towards some vaccines and clinical trials. Perhaps, pharmacists could be a bridge between cultural expectations and global approaches that are meant to be supportive of the communities.

## Pharmacy and Public Health

The health of a population is important, and medications contribute to the overall outcomes of a community's health. Pharmacists' role within communities can have a strong influence through interventions like immunizations, chronic disease management and infectious diseases control<sup>27</sup> that promote healthy living in many diverse groups of people. Organizations like the American Public Health Association (APHA) continue to highlight the expanding roles of pharmacists in administrative positions, disease prevention, patient education, and health promotion and advocacy, as well as other public health functions in leadership and policy settings to improve health outcomes<sup>28,29</sup>

These expanding roles call for certain expertise not just in pharmacy, but also the acquisition of knowledge in public health competencies through educational curricula and training targeting core clinical skills for population health.<sup>27,30</sup> Pharmacists with educational background and training in public health are well positioned to train other healthcare professionals about medication-related topics. Such pharmacists are identified by doctors, nurses, and other allied healthcare providers as a resource for drug information, prescribing and medication use guidance.<sup>28</sup> The common question is, "What will happen if new practitioners are not prepared for public and global health challenges?" Educators are therefore entreated to continuously adjust curricula to include clinical prevention and population health competency frameworks<sup>27</sup> to prepare graduate pharmacists to assist with public and global health problems/challenges.

Efforts made towards global health issues have included discussion of the need for a broadly trained and diverse health workforce to be more accessible.<sup>31</sup> Hence, current milestones in healthcare involves diverse partnerships in interventions improving population health and

intended to “promote and protect the publics’ health”.<sup>29-31</sup> Further, partnerships can result in lowering health care costs - especially in underserved areas, limiting fragmented care, increasing awareness of global health issues and promoting local and international research collaborations to strengthen evidence on better outcomes.<sup>31,32</sup> The pharmacist’s role in care teams and their additional training in public health are important to healthcare delivery, policy and research, which has led to more pharmacists pursuing and earning public health degrees.<sup>31</sup>

Research has shown that most health professional students (pharmacy and medicine), support the need for public health content in the curricula and recognize the key role health workers play in public health interventions, but they also agree that knowledge and skill competencies are limited.<sup>32,33</sup> Researchers are encouraged to investigate and publish more on the interface between public health and pharmacy to reinforce existing evidence and recognition of pharmacists’ role in population health.<sup>29</sup>

In the American Council for Pharmacy Education (ACPE) Accreditation Standards for the Professional Program in Pharmacy Leading to the Doctor of Pharmacy Degree, there are recommendations for schools and colleges to assess and evaluate students learning and curriculum effectiveness<sup>34</sup> in public health related areas.<sup>34</sup> Likewise, the 2013 Center for Advancement of Pharmacy Education (CAPE) Report’s section on educational outcomes argued that there is need for further guidance on weaving public health content with curricula and co-curricular activities and evaluating interprofessional education and co-curricular training.<sup>7,29</sup>

ACPE also encourages pharmacy schools and colleges to consider students’ perspectives and representation in assessments and evaluations and recommends competency evaluation for students to achieve educational outcomes, as well as evaluating stakeholders, such as graduates and faculty.<sup>34,35</sup>

## Program Evaluation

The influence of evaluation on improving programs, public services, and policies is well documented.<sup>35</sup> Evaluation of processes and outcomes could create differences in how people think about program design, logic, implementation and outcomes, leading to a change in action to build a solid knowledge base.<sup>36-39</sup> Also, there is growing interest in using evaluation as a decision-making tool in the design, implementation and improvement of programs at various levels – local, national and international.<sup>40</sup> The importance of evaluation in decision-making is illustrated when:

*“Evaluation serves to identify strengths and weaknesses, highlight the good, and expose the faulty, but it cannot single handedly correct problems, for that is the role of management and other stakeholders, using evaluation findings as one tool that will help them in that process.” (p. 27)<sup>40</sup>*

Preskill<sup>38</sup> points to the use of evaluation as a learning function for continuous improvement where evaluative thinking and evaluative evidence become part of the decision-making for organizational practices. This is because,

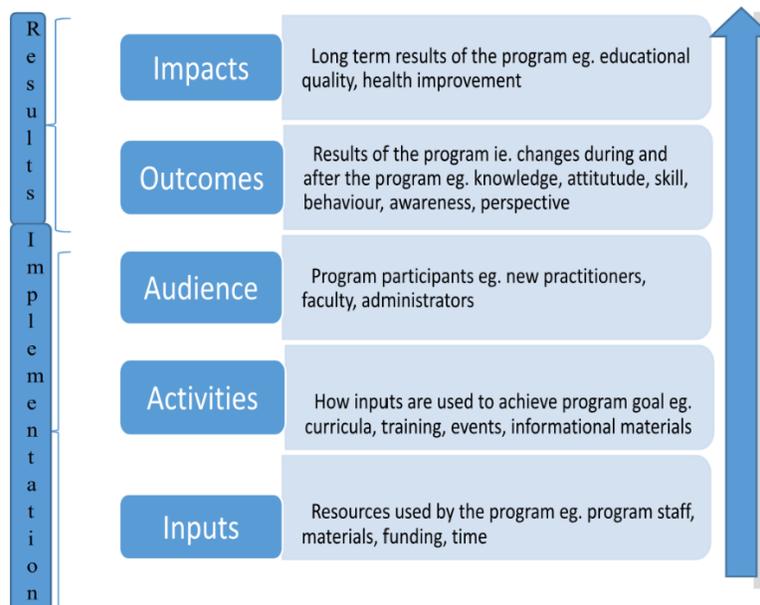
*“the processes and findings of evaluations may result in thinking about a program’s logic or theory of change; changes in a program’s design and implementation; changes in program policy; changes in perception about the merit, worth, or significance of a program; or changes in attitudes concerning evaluation’s potential value.” (p. 129)<sup>38</sup>*

Theory-based evaluation is “a mode of evaluation that brings to the surface the underlying assumptions about why a program will work and then tracks those assumptions through data collection and analysis at different stages to the final outcome”.<sup>41</sup> Theory-based evaluation

illustrates years of consensus on the value of the approach,<sup>42-44</sup> which is seen as supporting both the structure and analysis in evaluation.<sup>45</sup> Theory-Based evaluation explores how and why programs succeed or fail by providing information not necessarily available in traditional processes and outcomes research.<sup>46</sup> In view of this, theory-based approaches in practice target how interventions such as projects, programs, initiatives or policies, are designed, described, measured and evaluated.<sup>45</sup> For example, an attempt must be made in situations where the program/intervention was unsuccessful to address questions like: What is it about the intervention or context that caused the results? What about the program/intervention, did not work? Was the correct theory used? Was the implementation not properly planned? On the other hand, successful program/intervention questions should also be tackled, such as: What worked well to achieve the desired results? How well were the theories aligned with the interventions? Findings from these questions are to help describe details of the public health business.

A Theory of Change (ToC), visualized in the form of a logic model, can be used to further describe, and explain links between the various levels of outcomes and outputs. ToC is “project-specific and related to evaluation, making the underlying rationale of a project explicit to support planning, implementation and assessment of the project.”<sup>47</sup> Using a logic model (Fig 2) allows us to trace the program from inputs to outcomes.<sup>48</sup>

**Figure 2.** Logic Model Framework



Modified from: Logic models: A tool for designing and monitoring program<sup>49</sup>

## Evaluation and Research

The current study is positioned to help answer questions relating to both program evaluation and research.

The importance of competence and competencies creates a pressure for accountability for program outcomes that are often addressed through program evaluation. In view of the fact that programs can be complex, sometimes it is challenging to understand how and why they work.<sup>50</sup> Hence, evaluators may use different visual and written tools to “frame, clarify, contextualize, explain, and build consensus on what the program is and the impact it’s supposed to have on participants.<sup>58</sup> An example of this would be using evaluation to describe the *theory* of a program with a logic model. But first, evaluation itself has to be understood as a tool.

There have been multiple definitions for evaluation, and the struggle to identify just one definition has led to the ongoing difficulty in promoting the field. Gullickson<sup>51</sup> and others have made a case for a definition, pointing to the fact that a definition may provide boundaries leading to determination of practitioner expertise and description of quality performance.<sup>51</sup> Gullickson<sup>51</sup> suggests that without a definition or multiple definitions for evaluation, there is no clarity.

Thinking about the value in defining evaluation, Scriven's description below resonates within its context. With primary expertise in values and valuation, Scriven<sup>35</sup> states that:

*“Evaluation is the process of determining the merit, worth, and value of things,” and evaluations are the products of that process.*<sup>35</sup>

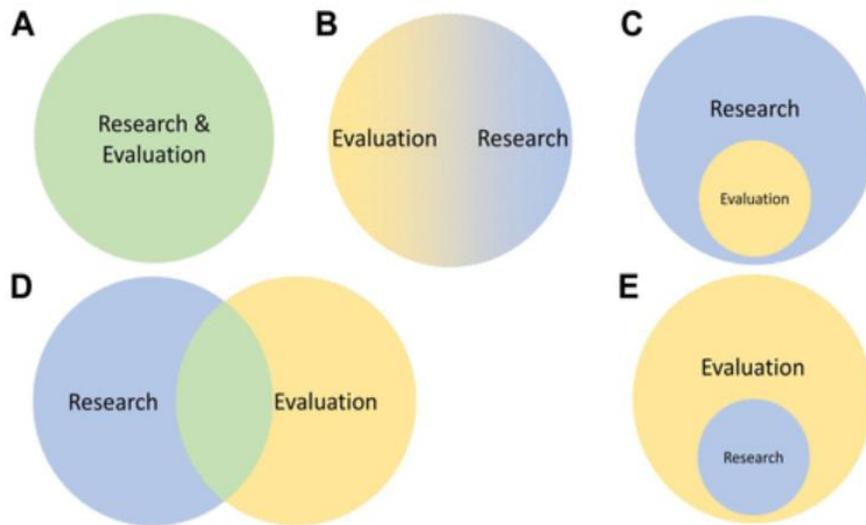
Further, other researchers have pointed out how the lack of agreement on what evaluation is within its own field makes it difficult to explain to “non-evaluators” what evaluation is and how it differs from research.<sup>52</sup> Some evaluators accept “evaluation as applied research”<sup>53,54</sup> without noting any difference between applied social science research and program evaluation. Others recognize and agree to the difference between social science research methodology and evaluation.<sup>55</sup> There is benefit of research on evaluation in the advancement of knowledge and skill, and that cannot be ignored. Carol Weiss<sup>56</sup> argued that “it is time to spend more time doing evaluation, teaching people how to do evaluation, advising on evaluation, reviewing and critiquing evaluations, meta-analyzing evaluations, and in general, advancing the practice of evaluation”.<sup>56</sup> However, the inability to reach a consensus about one standard definition makes it difficult to communicate.<sup>57</sup>

There is an unconscious bias about the essence of evaluation making it challenging to differentiate between evaluation and research, which is usually at the expense of evaluation.<sup>58</sup> From some experts' arguments, evaluation is research,<sup>52</sup> while others view evaluation as applied research.<sup>53</sup> Wanzer<sup>52</sup> presents five potential relationships between evaluation and research (Figure

3): (A) evaluation is research with no or few differences, (B) evaluation and research as end points on a continuum, (C) evaluation as a subset of research, (D) evaluation and research overlapping like a Venn diagram and (E) research as a subset of evaluation.

To quote Michael Quinn Patton at an EVALTALK discussion in 1998, “The idea that research and evaluation are on a continuum or on different continua.... The purpose of making such distinctions, then, must guide the distinctions made.” Patton<sup>59</sup> mentioned that in his practice, most clients prefer and value the distinction because they want to be sure they are involved in evaluation, not research. The distinction is meaningful and helpful to them, and making the distinction helps engender a commitment from them to be actively involved, and it also deepens the expectation for use.<sup>60</sup> Even though this may resonate with researchers who have an interest in evaluation, there may be less agreement among researchers who do not want to work within the evaluation sciences.

**Figure 3.** Five Potential Relationships Between Evaluation and Research



Reprinted with permission from the author. What is evaluation?: Perspectives of how evaluation differs (or not) from research.<sup>52</sup>

In the field of education, Arnott A. and Guenther J.<sup>61</sup> state, “the tacit distinction between research and evaluation has been such that the latter is subsumed by the former”, meaning research involves evaluation, but most evaluators predominantly favor the Venn diagram representation (Fig 3, D) where there are some similarities in the use of designs and methods from the social sciences.<sup>52</sup> There are also noticeable differences where evaluators ask and answer evaluative questions about quality, value and importance.<sup>62</sup> However, there are distinct ways evaluation and research can be compared in terms of their purposes and outcomes.<sup>52</sup> The diagram (Fig. 3, D) shows an overlap between evaluation and research, noting their similarities and also their comparable development.<sup>52</sup>

Although the distinction between evaluation and research has been briefly discussed above, Table 1 presents a visual that allows us to view the areas of difference in another way.

**Table 1.** Areas of Difference Between Evaluation and Research<sup>a</sup>

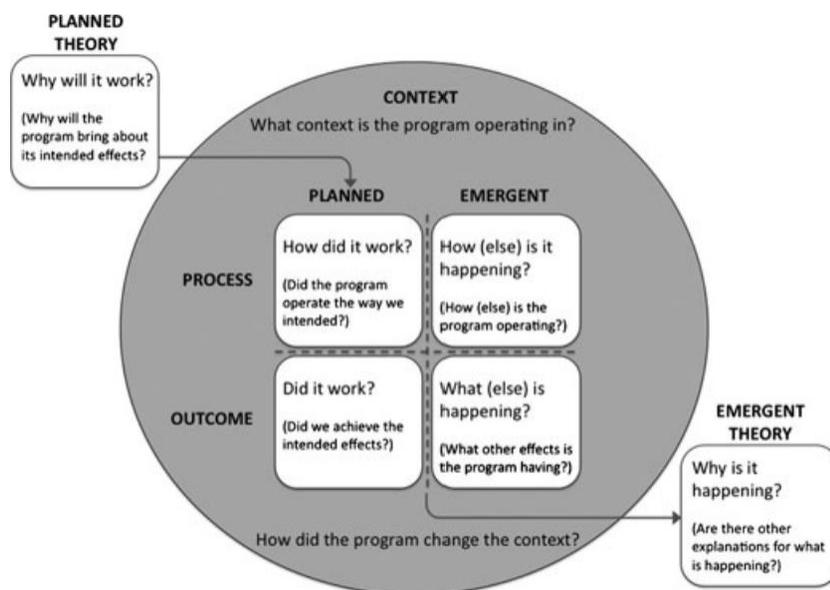
<b>Area of Difference</b>	<b>Research</b>	<b>Evaluation</b>
Competencies	Social science research design, methods, and theory	Same as researchers, but also interpersonal effectiveness, planning /management, political maneuvering
Purpose	Generate knowledge to inform the research base	Generate knowledge for a particular program/client and provide information for decision making/learning
Primary audience	Other researchers	Clients (internal and external)
Primary decision	Researchers decide the topic, method, and design	Clients and founders often have a large role in determining what is studied
Timeline	Determined by researcher	Bounded by the organizations or funder’s time frame requirements
Funding	Research grants or university funding	Clients’ organization or funder, foundations
Questions asked	Researchers formulate their own hypothesis; research questions	Answers questions that primary stakeholders are concerned with; evaluative questions

Role of theory	Social science theory is embedded	Uses social science theory, program theory evaluation theory to inform the evaluation
Value judgements	Value neutral	Provides a value judgement and often provides recommendations
Action setting	Basic research takes place in controlled environment	Takes place in an action setting where few things can be controlled, and things are often political
Utility	Often doesn't think critically about use	Often concerned with use from the beginning
Publication	Published in journals	Rarely published and typically only clients view the reports

<sup>a</sup>Data adapted and modified from American Journal of Evaluation<sup>52</sup>

Figure 4 provides a view of seven elements with associated evaluation questions from the Haji et al.<sup>1</sup> paper “Rethinking program evaluation in health professions education: beyond ‘did it work?’” This conceptual model can be helpful when considering evaluations for education programs. It helps to balance the educator’s natural inclination to outcomes with other important educational variables.

**Figure 4.** The Seven Essential Elements of Program Evaluation Process



Reprinted with permission from author. Rethinking programme evaluation in health professions education: beyond ‘did it work?’<sup>1</sup>

## Chapter 3: Methodology

This chapter describes the use of evaluation as a tool to uncover and answer the research questions relating to public health competencies within the PharmD program at Kwame Nkrumah University of Science & Technology (KNUST) in Ghana.

In this study, the researcher used qualitative methodology to understand how and why events occur and how individuals make meaning of them<sup>1</sup> from a constructivism perspective with an interpretivist epistemology.<sup>63</sup> In this worldview, there are multiple realities, and based on people's past experiences and knowledge, they construct different understandings. The researcher and the researched are attached where the researcher's beliefs and experiences influence the questions asked and how the findings are understood.

The qualitative methodology used is for inquiring about the perspectives of key stakeholders – early career practitioners, faculty members, administrators at KNUST, seasoned pharmacists, pharmacy council leaders, and FIP members/officers with public health interest – to gain understanding of the education and training of PharmD students for public health roles. These insights are intended to highlight areas in the PharmD program that are working and gaps that require improvement.

**Table 2.** Summary of Methods Used in the Study

<b>Study methods</b>
<b>Evaluation approach</b> Document review Interviews
<b>Initial logic model</b>
<b>Qualitative methodology</b> Interviews Focus group discussions
<b>Enhanced logic model</b>

## Evaluation Approach

Perspectives gained from the study contribute to pharmacy education's understanding of public health education, as well as the role of evaluation in competency assessment. The findings of the study also add insights to evaluative literature by highlighting the role of evaluation in the curriculum within institutions in underserved areas, as well as a resource for informing other international PharmD programs. The design of this study gives voice to the participant's own experiences, opinions, and views. Further, it sheds light on the compliance perspective (competencies pharmacists need) and the learning perspective (knowledge obtained and how it relates to pharmacy practice).

The following questions guided the evaluation:

1. How were the competencies developed for the PharmD program?
2. What is the context for the PharmD program's work in public health? How has the PharmD program been influenced by this context and vice versa?
3. How were the PharmD program's public health-related components intended to work?
4. Were the outcomes met? How were they met?

The approach was derived from Haji's et al.<sup>1</sup>, which highlight elements not only about judging merit or worth, but also about generating reliable, valid, and useful information for educators looking to adopt PharmD programs. This model draws attention to moving beyond 'imperative of proof'<sup>64</sup> and focusing on 'clarification studies'<sup>65</sup> that additionally ask "how and why" interventions do (or do not) work and seek to show what else happens when programs are implemented.<sup>1</sup>

In this chapter, the methodological approach is further developed by describing the background of the study with elaboration on the research design, methods, data collection and

analysis. IRB approval of the study was obtained from the University of Minnesota College of Pharmacy, Minneapolis and Kwame Nkrumah University of Science and Technology, Kumasi. Both approvals were determined exempt at both universities.

## KNUST Program Description

The didactic aspect of the PharmD program occurs in classrooms at Kwame Nkrumah University of Science and Technology (KNUST) campus located in Kumasi, one of the biggest metropolitan areas in Ghana. The curriculum is sectioned according to the goals/objectives and outcomes of each year from the first to sixth year of the PharmD degree. Each year covers two (2) semesters of course work labeled as 1<sup>st</sup> semester modules and 2<sup>nd</sup> semester modules, respectively. The doctor of pharmacy is a six (6) year degree (12 semesters) and starts with four (4) years of rigorous academic work (preclinical) with emphasis on the basic, biomedical, and pharmaceutical sciences and two (2) years in a clinical phase (KNUST - Doctor of Pharmacy (PharmD) syllabus, revised: Aug 2021) with emphasis on patient care and professional training. During the clinical phase, students engage in patient care activities with more time devoted to hands-on experiential training where they also build their professional skills at various training sites.<sup>66</sup> Part of the 5<sup>th</sup> year and the entire final year (6<sup>th</sup> year) of the PharmD program are spent off campus at rotational teaching sites.<sup>67</sup>

There are five (5) academic departments contributing to the overall PharmD degree program. The departments namely pharmacy practice, pharmaceutical chemistry, pharmaceuticals, pharmacology, and pharmacognosy. The PharmD program is a qualification required as part of the process of becoming a registered pharmacist in Ghana.

## Public Health within the Pharm.D. Degree

A mandatory public health course (i.e., a sequence of teaching) is provided in the KNUST PharmD curriculum. Its presence in the PharmD program reflects a comprehensive approach to pharmaceutical education, acknowledging the integral role pharmacists play in disease prevention and health promotion. The rationale behind incorporating public health into the curriculum is to equip future pharmacists with the knowledge and skills needed to address population health issues, prevent diseases, and contribute to the overall well-being of communities. The philosophy underlying the inclusion of this course emphasizes the pharmacist's role as a healthcare professional committed to public service, health promotion, and disease prevention (M. Opare-Addo, December 11, 2023).

The goals of the public health course are: 1) to integrate fundamental public health concepts and principles into the PharmD curriculum, to give students an understanding of the social determinants of health, epidemiology, the healthcare system and health disparities; 2) to cultivate a sense of social responsibility among pharmacy students by promoting community engagement and emphasizing the pharmacist's role in public health initiatives; 3) to encourage collaboration between pharmacy students and professionals from other healthcare disciplines to address complex public health challenges collaboratively and 4) to equip students with the skills to provide effective health education and promotion initiatives, empowering them to be advocates for preventive care in the community (M. Opare-Addo, December 11, 2023).

The public health sequence is taught in the fifth year (first and second semesters) of the PharmD program with two credits assigned to each of the semesters. This year the program is mainly intended to focus on certain aspects of supply chain management. Although there is limited

experiential training within the public health courses, students participate in classroom activities and then are assessed by instructors/lecturers on the course goals/objectives.

**Table 3.** Goals/Objectives of the Public Health Modules in the PharmD Curriculum<sup>a</sup>

<b>Public Health I</b>	
Modules	Topics
a) concepts of public health and health systems	definition of public health and areas of application, how humans have responded to health problems, model of a natural health system, analysis of the National Health System, statements on the development of health systems
b) health and illness, understanding the public perspective	illness as a public health concept, the experience of chronic illness, lay knowledge and beliefs about illness and health
c) measuring health and disease	sources of health data, public health measures, measure of disease frequency and association
d) control of communicable/non-communicable diseases	control principles and strategy, control methods, control organization, control of selected diseases – malaria, guinea worm, STDs/HIV-AIDS, onchocerciasis, tuberculosis, rabies and anthrax
e) gender and health	gender norms and values, gender inequalities and inequities in health, social interactions and behavior in health
f) public engagement in disease prevention strategy	
<b>Public Health II</b>	
Modules	Topics
a) health issues of vulnerable groups	children and women, child health, mortality, and morbidity, child survival <sup>b</sup> programs/eradication and elimination of specific childhood diseases, disabilities in children, maternal health and mortality, adolescent health, family planning <sup>b</sup> programs
b) first aid in simple ailments	introduction: The purpose of the education of first aid, initial assessment and management, open and closed mechanical injuries, hemorrhage, control of hemorrhage, thoracic and abdominal traumas, unconscious patient, endocrine emergencies, resuscitation theory and practice - thermal and chemical injuries and transport of injured patients
c) health education and promotion	definition, focus and basic concepts and principles of health education/promotion; understanding human behavior, behavioral change theories and strategies
d) man-environmental interaction process and its public health importance	no specific public health topics were listed under this model.

e) demography	scope and objective of demography, population census, demographic sample surveys, errors in demographic data. age and sex composition, population policies and <sup>b</sup> programs in Ghana, migration and population distribution, introduction to the general principles of population estimates and projections
f) nutrition in public health	macro and micronutrients requirements of the human body
g) public health in Pharmacy Practice	

<sup>a</sup>KNUST Doctor of Pharmacy (PharmD) syllabus; Faculty of Pharmacy and Pharmaceutical Sciences<sup>66</sup>

<sup>b</sup>Program = intervention

The experiential training is designed to help students make a successful transition from classroom teaching to a practical environment. The integration of classroom knowledge and field experience is to “instill professionalism and the requisite competencies for the provision of pharmaceutical care.” (Doctor of Pharmacy – Experiential Training Manual for Students, Revised 2021) The skills to be enhanced are focused on professionalism, knowledge, communication, and patient care. The training is in two parts: 1) Introductory Pharmacy Practice Experience (IPPE) – 1<sup>st</sup> to 4<sup>th</sup> year (vacation period: August – December) and then 2) Advanced Pharmacy Practice Experience (APPE) – starts during 5<sup>th</sup> year vacation to the last month of the 6<sup>th</sup> year academic year. Each training is six (6) weeks practice experience. The IPPE’s are completed on four levels as shown in Table 4.

**Table 4.** The Four (4) Levels of Introductory Pharmacy Practice Experience (IPPE)<sup>a</sup>

<b>Experience Type</b>	<b>Objectives</b>
Level 1: Introductory Community Pharmacy Practice Experience (ICPPE)	a. Participate in daily activities of serving patients in a community pharmacy setting b. Know the categories and types of medicines available in the facility c. Know and appreciate appropriate stock management practices (procurement, inventory control, record keeping, medicines arrangement on shelves etc.)

	d. Learn the concept of professionalism in pharmacy practice (ie, dressing appropriately, neatness, interacting well with staff and clients for efficient service delivery)
Level 2: Introductory Hospital Pharmacy Practice Experience (IHPPE I)	<ul style="list-style-type: none"> <li>a. Demonstrate understanding and appreciation of the organizational structure and scope of services delivered in the hospital</li> <li>b. Strengthen students' knowledge and skill in prescription reading and medicines dispensing</li> <li>c. Improve students' skill in communicating with patients, nurses, clinician and other service providers</li> <li>d. Strengthen the skill of compounding extemporaneous and other pharmaceutical preparations in hospitals</li> <li>e. Expose students to patient folders</li> </ul>
Level 3: Introductory Hospital Pharmacy Practice Experience (IHPPE II)	<ul style="list-style-type: none"> <li>a. Prescription audit</li> <li>b. Patient case profiling</li> <li>c. Patient medication profiling</li> <li>d. Develop pharmaceutical care plans using the "SOAP" approach (ie, subjective, objective assessment of patient)</li> </ul> <p>Students are also expected to learn and put into practice skills developed for patient counseling</p>
Level 4: Introductory Community Pharmacy/Industrial Practice Experience (ICPPE II/IIPPE I)	<p>Objectives: ICPPE II</p> <ul style="list-style-type: none"> <li>a. Prescription audit</li> <li>b. Packaging, labeling and dispensing of medicines</li> <li>c. Patient counseling &amp; delivering relevant drug information services to facilitate the rational use of medicines by clients</li> <li>d. Demonstrate appreciation and understanding of the practice of pharmacy in the community setting to improve patient care</li> <li>e. Skills to be enhanced are professionalism, knowledge, communication and patient care fostered by mentorship and hands-on experiences with real patients in the pharmacy</li> </ul> <p>IIPPE I</p> <p>Students should understand:</p> <ul style="list-style-type: none"> <li>a. The significance of Good Manufacturing Practice</li> <li>b. The reasons and mechanisms for raw material testing, storage and release procedures</li> <li>c. The basic principles underlying the design of sterile and non-sterile manufacturing units</li> <li>d. The basic principles underlying the maintenance of premises, environment and equipment in which manufacturing occurs</li> <li>e. The training requirement of staff working in these environments</li> <li>f. Equipment use – design and maintenance considerations and scaling up problems for sterile and non-sterile manufacturing</li> </ul>

- 
- g. The process of batch control through manufacture, sampling and testing
  - h. Packaging and label control records
  - i. The in-process controls required for the production of sterile pharmaceuticals
  - j. The basic principles involved in sterilizing pharmaceuticals in an autoclave
- Safe working procedures in a manufacturing environment
- 

<sup>a</sup>KNUST Doctor of Pharmacy (PharmD) Training Manual; Faculty of Pharmacy and Pharmaceutical Sciences

There are also four (4) levels in Advanced Pharmacy Practice Experience (APPE). Namely 1) Advanced Community Pharmacy (ACP), 2) Advanced Hospital Pharmacy (AHP I), 3) Advanced Hospital Pharmacy (AHP II), and 4) Clinical Areas/Topics. The main objective is to provide an opportunity for students to build upon knowledge acquired in their didactic and early experiential education and apply the knowledge and skills in direct patient care settings.

In addition to the students' external experiential training at various teaching hospitals, there are other patient health issues and population health issues of discussion embedded in the curriculum. In the first year, students take a required course, Information Technology for Pharmacy, with a module on Public Health Information Systems as part of patient education and continuity of pharmacy care. In the third year, PharmD students take a required course, Pharmacy Jurisprudence and Ethics, which gives them a general overview of public health practice as described in the Ghana Public Health Act ,2012<sup>26</sup> (Act 851), emphasizing parts of the public health content related to the Food and Drugs Authority (FDA) in Ghana.

To cover content that is relevant for preparing graduates to be ready for any public health call for assistance, the Faculty of Pharmacy and Pharmaceutical Sciences at KNUST introduces students to other topics, such as pharmacists specializing/practicing in public health areas, the global call for training essential workers in various public health disciplines, and the need to find

qualified health professionals with public health expertise or training to teach and mentor students. These are presented in the form of seminars for the students in the various year groups and students' assessments are completed via term papers, class presentations or multiple-choice questions. In addition, outcomes listed for Public Health I and II (in no particular order) in the KNUST current curriculum included the following:

**Table 5.** Listed Outcomes for Public Health I and II<sup>a</sup>

<b>Public Health I</b>	<b>Public Health II</b>
Shows understanding of the concept of public health and health systems	demonstrate knowledge in health issues relating to vulnerable groups and make intervention
Illustrates appreciation for the role of community collaborations in promoting population health	demonstrate knowledge and skills in first aid procedures
Describe effective environmental health interventions	describe effective environmental health interventions
Outline basic analysis, planning, and management methods in health care	outline basic analysis, planning, and management methods in health care
Uses epidemiology to interpret and use data reported in routine statistics, research and research summaries	use epidemiology to interpret and use data reported in routine statistics, research and research summaries
Shows understanding of the relationship between gender and health	
Communicates health information to a wide range of audiences using all types of media	

<sup>a</sup>KNUST Doctor of Pharmacy (PharmD) syllabus; Faculty of Pharmacy and Pharmaceutical Sciences<sup>66</sup>

## **Program Staff**

Specific to the delivery of the public health content within the curriculum, the director and co-director from the Department of Pharmacy Practice teach along with faculty and visiting faculty from the School of Public Health, Department of Pharmacy Practice at KNUST and other

international academic institutions in the United Kingdom and the United States. According to the director, there are three categories of stakeholders who contribute to the delivery of the public health competencies within the curriculum. These are:

1. **Program Coordinators/Lecturers:** Qualified and experienced faculty with expertise in both pharmacy and public health disciplines.
2. **Public Health Professionals:** Professionals from public health organizations, local health departments, and community health agencies, providing real-world perspectives and expertise through collaborative involvement.
3. **Pharmacy Practitioners:** Practicing pharmacists who can share practical insights and experiences related to the integration of public health in their daily practice through their active participation. (M. Opare-Addo, personal communication, December 11, 2023)

The directors and co-directors oversee the organization of the public health content in the curriculum and the delivery of the lectures. They appoint faculty to teach various topics as approved by the curriculum council at the faculty level and they supervise the experiential training for the students. Faculty members assess the students' public health competencies through classroom assignments and experiential activities.

Overall, there is only one faculty member in the Department of Pharmacy Practice who has a masters degree in public health. To assist in covering some of the content areas within the curriculum, the other faculty members have identified competencies in public health, which are their professional areas of strength and expertise. These faculty members have experience in content and practice areas, such as child and maternal health, surgery, HIV care, oncology care, and Pharmacoeconomics. Some of the faculty members have also completed specialty training at the Ghana College of Pharmacists (GCPHARM), a college set up by the Ministry of Health -

Ghana, to provide opportunities within the country for specialty training in academic and practical fields of pharmacy. Programs offered at the college are for health professionals seeking specialist training.<sup>68</sup> Minimum admission requirements include: 1) The candidate should have basic pharmacy qualification from a recognized institution, 2) The candidate should have undertaken pharmacy internship training and successfully passed the Ghana Pharmacy Professional Qualifying Examination (GPPQE), 3) The candidate must be a Registered Pharmacist who has practiced for a minimum of 3 years post-registration, and 4) For PharmD candidates a minimum of 2 years post registration is required.<sup>68</sup> GCPHARM has three (3) divisions (Pharmaceutical Care, Social and Public Health and Pharmaceutical Production and Quality Assurance) and six (6) faculties (Public Health Pharmacy Practice, Social and Administrative Pharmacy Practice; Drug and Herbal Medicine Discovery, Development and Production; Quality Assurance Pharmacy; Clinical Pharmacy Practice; Community and Family Health Pharmacy Practice; and providing specialist training for practitioners. Upon successful completion of a specialty area, candidates become Specialists and a Fellow of the Ghana College of Pharmacists.

### Degree Program Participants

Since the beginning of the PharmD program in 2012/13, the number of admitted students ranges from 140 – 400. In July 2018, the PharmD program had its first graduates. There were 142 students. Each year, pharmacy schools are given a maximum number of students to admit, and this mandate comes from the Pharmacy Council, Ghana. Students enrolled in the PharmD program usually have a science background from Senior Secondary School (SSS) or senior high school (SHS) as a stepping stone to learning more advanced level sciences required in the Doctor of Pharmacy program.

The PharmD program is a professional degree program and not considered a postgraduate degree. All students enrolled are to take Public Health I (offered in fifth year first semester) and Public Health II (offered in fifth year second semester) as part of their course completion and graduation requirements. Currently, there are no elective courses in Public Health offered to students in the PharmD program.

### Program Evaluation Stakeholders

Evaluation often distinguishes between different groups of stakeholders, for instance, there are those who are directly involved in the program (i.e., the group that conceptualizes, conducts, or implements the program) and on the other hand, the group that may be affected by the program (i.e., those using or participating in the program). In this research the primary stakeholders include the public health program directors and faculty and program directors at the Department of Pharmacy Practice. Although current students are major secondary stakeholders, this study did not seek their perspectives because the FIP GbCF was intended for early career practitioners and this study focused on those with experiences after graduation. Other secondary stakeholders are practitioners (early career graduates and seasoned pharmacists), and the Faculty of Pharmacy and Pharmaceutical Sciences.

The primary stakeholders will learn from the evaluative report to understand whether the program is achieving the set goals. Findings from the study could support accreditation requirements for program renewal. However, the concern is, would students be able to apply the theoretical knowledge in practice and also identify opportunities within their communities after completing the program?

Current students, as part of the secondary stakeholders, would be concerned about acquiring the necessary knowledge and skill to be ready or prepared to accept roles in practice after graduation. However, early career practitioners and seasoned pharmacists would be concerned about knowledge, skill, and experience to assist in local, global health threats or any other national emergency call for healthcare practitioners.

Although there are other stakeholder groups, e.g., tertiary stakeholders, like preceptors, the focus here would be the primary and the secondary groups, since they are close to the program, have work experience and can report on their personal experiences with the program. The tertiary stakeholders could provide honest feedback in support of recommended changes from the evaluation.

The primary intended users of this evaluation are the program directors, and Faculty at the Department of Pharmacy Practice, the Faculty of Pharmacy and Pharmaceutical Sciences at KNUST, pharmacy programs in Sub-Saharan Africa and FIP. These participants are specific faculty members in-charge of content areas with public health competencies. Results from this research will provide information to learn and fully understand whether the program is achieving its set goals. The perspectives of participants may be used for continuous improvements as more information is gathered about the content, activities, materials, and delivery of the program.

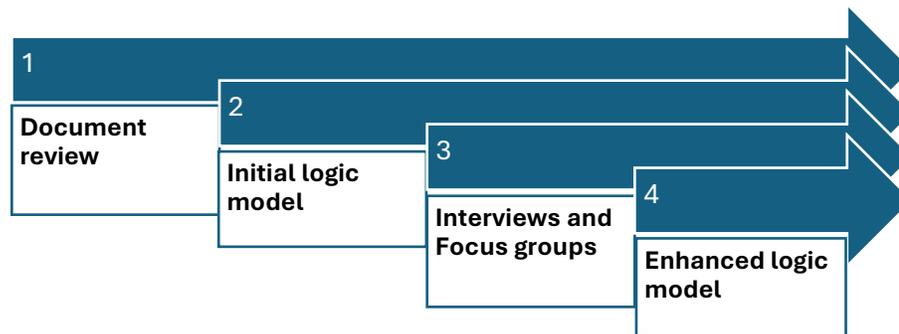
## Study Design

This study involves an intrinsic case study research design. It incorporates program evaluation that is formative and process-oriented. Case study was used for this research because it is useful for the study of a phenomenon in its natural context.<sup>69,70,71</sup> According to Stake,<sup>71</sup> the

term intrinsic suggests that researchers have a genuine interest in the case when the intent is to better understand the case<sup>71</sup> not primarily because the case represents other cases or it's illustrative of a particular trait or problem, but because the case is of interest<sup>69-71</sup> According to Yin,<sup>72</sup> case studies may be used in evaluation research to explain, describe, illustrate, explore, or as a meta-evaluation.<sup>72</sup> According to Creswell, case study research explores a real-life, contemporary, bounded system (a case) or multiple bounded systems (cases) over time, through detailed, in-depth data collection involving multiple sources of information (i.e., interviews, documents, etc.).<sup>73</sup> In an intrinsic case study the focus is on the case itself (e.g., evaluating a program). This research looked at a single PharmD program (i.e., a single case study) using multiple sources for example interviews (i.e., dyadic interviews and focus group discussions with early career practitioners, faculty members, seasoned pharmacists, and dyadic interviews and one-on-one interviews with FIP members/officers with public health interest, administrators), and documentation (e.g., Experiential training manuals for students and syllabus from directors/lecturers). A case study was used for this research because it is useful for the study of a phenomenon in its natural context.<sup>69-71</sup>

In a case study, researchers are not limited to any one type of data or evidence, and using different data sources and techniques (focus groups, participant observation, interviews, etc.) can result in rich data.<sup>69</sup> In this study, different types of evidence were used to triangulate or converge on the same research questions.<sup>69</sup> Yin<sup>69</sup> suggests “defining a logic model prior to data collection and then testing the model by seeing how well the data supports it”.<sup>69</sup>

**Figure 5.** Steps in the Research Process



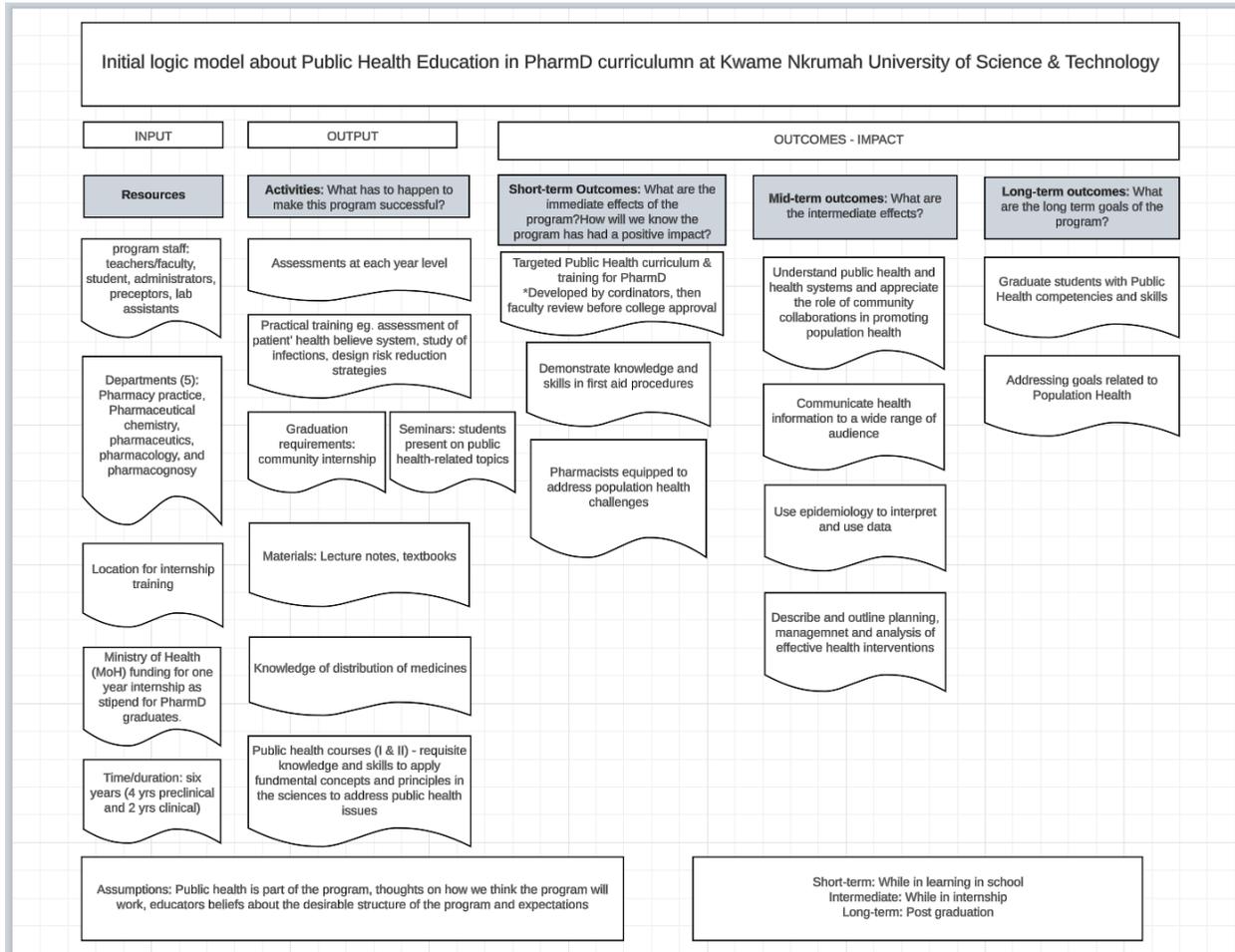
Memoing was used throughout this inquiry to document insights, ideas, and observations. Birks et al.,<sup>74</sup> mentions the flexibility in memoing for both novices and experienced researchers, adding that it strengthens data exploration and communication.<sup>74</sup> Subjectivity was capitalized on as an integral part of the data<sup>74</sup> and continue used of memos and reflexive techniques was used to ensure capturing as much as possible during the interpretive and analytical processes.

### Initial Logic Model

The initial logic model was created to explain how the program is planned to work. The preliminary interviews with program directors and document review informed the initial logic model. Following data collection, an updated logic model was created (Figure 6).

Based on the document review, the goal of the program with respect to public health competency was described. Short, intermediate, and long-term outcomes are defined. The outcomes are the measurable changes that are expected if the program goals are met.

**Figure 6.** Initial Logic Model about Public Health Education in PharmD Curriculum at KNUST



## Study Aims

**Aim 1:** To describe the educational processes and outcomes that contribute to readiness for public health roles for pharmacists, evaluation approaches were used to explain “how and why” the program works.

**Aim 2:** To assess new practitioner perceptions of readiness for the various competencies in the Global Competency Framework (GbCF).

## Participants

The study aims were addressed through inquiry with multiple audiences. Each audience was aligned with a data collection method (Table 6).

**Table 6.** Program Participants, their Role, Data Collection Method and Selection Technique

<b>Participants</b>	<b>Reason for Selection</b>	<b>Data Collection Method</b>	<b>Method of Identifying and Selecting<sup>75</sup></b>
Early career practitioners (5 years post-graduation)	Selected for their recent experiences with competencies in their education and training	Focus group	Type: Purposive – choice of participants based upon the researcher’s judgement  Sampling technique: homogenous  Nature of participants chosen: similar characteristics, limited variation  Potential relevance to research question: participants reveal or illuminate depth, minor differences apparent in key themes
Faculty members (Department of Pharmacy Practice)	Selected for their knowledge of competencies in the curriculum and for creating syllabi	Interviews Dyadic Focus group	Type: Purposive – choice of participants based upon the researcher’s judgement  Sampling technique: Critical case  Nature of participants chosen: crucial to what is being researched  Potential relevance to research question: participant (s) important or can make a point dramatically
Administrators	Selected for their role in providing resources, assessing the students and/or evaluating the program	Focus group	Type: Volunteer – choice of participants based on those who offer to take part  Sampling technique: Self-selection  Nature of participants chosen: identified by existing participants strong feelings about research questions

			Potential relevance to research question: participants willing to devote time
Seasoned pharmacists (at least 6 years post-graduation)	Selected for their years of experience in practice	Interview Dyadic	Type: Haphazard- choice based on convenience of access.  Sampling technique: Convenience  Nature of participants chosen: willingness to participate  Potential relevance to research question: participant(s) readily available, easy to access, save resources
Leaders of Pharmacy Council, Ghana	Selected for their input in current practice expectations, path forward and an understanding of what is being tried at the system and policy level	Written	Type: Volunteer – choice of participants based on those who offer to take part  Sampling technique: Self-selection  Nature of participants chosen: self-identify to take part  Potential relevance to research question: participants willing to devote time
FIP members/officers (with public health interest)	Selected for their global perspective and involvement in pharmacy education worldwide.	Interviews Dyadic	Type: Purposive – choice of participants based upon the researcher’s judgement  Sampling technique: Opportunistic  Nature of participants chosen: as revealed potential relevance to research question, participant(s) allow new leads to be followed

## Data Collection Methods

Data collection methods involved documents review, interviews and focus groups discussions described below.

### Document Review

This study began with review of documents. The intent of the document review was to begin understanding “*how and why*” the PharmD program was working. This exercise was needed to gather contextual information to add to inform the questions for participants. Documents requested from the Faculty of Pharmacy and Pharmaceutical Science at KNUST for the review were syllabi, guidelines for students’ internship training, overview of courses/classes and documents on description of preceptor expectation. This process involved reading (examining the document in detail) and interpretation. The study continued with interviews with the program directors, who were identified from a list at the Department of Pharmacy Practice at KNUST. Due to their small number, all of the selected members were contacted to participate in the initial evaluation interviews.

Qualitative inquiry engages various interviewing techniques which allows individual interviews (one-on-one), dyadic interviews (two participants) and focus groups (three or more participants) to be used in this study.<sup>76</sup> All three are interactive forms of interviewing and respond to open-ended research questions.<sup>76</sup> Individual interviews and focus groups are common in qualitative work, but some researchers conduct dyadic interviews among specialized groups where interviews are solely relationship-based.<sup>76-78</sup>

Comparing individual, dyadic interviews and focus groups, participants bring out responses from each other in dyadic and focus groups.<sup>76</sup> Also, dyadic interviews and focus groups stimulates ideas between participants whilst in individual interviews, the interviewer controls the session.<sup>79</sup> An important point is the ability to gather more detailed and in-depth information from each participant in individual and dyadic interviews.<sup>76</sup> Participants are also able to create a personal narrative in regard to the research area.<sup>76</sup> Researchers have argued that a key advantage with focus groups interaction is the opportunity of sharing and comparing similarities and differences among participants.<sup>76,79</sup> Then again, recruiting large numbers of people for focus group can be challenging but with dyadic and individual interviewing, seem simplified and highly desirable. All three qualitative interviewing techniques add to the benefit of gathering data with multiple methods.

## Interviews

In this study, interviews were used for some of the participants in FIP academic section-FIP members/officers with public health interest, seasoned pharmacists and faculty groups because of scheduling conflicts and dyadic interviews were used for others in the seasoned pharmacists and faculty groups because of availability to participate. Questions for the interviews were created to align with each group's level of expertise as found in (Appendix I). The questions were drafted by the principal investigator and shared with other researchers to ensure they were accurate and understandable. The PI conducted the interviews, and each took about an hour in-person and via Zoom (Zoom Video Communications, Inc., San Jose, CA). All the interviews were audio recorded via Zoom and conducted over 3 months from October 2023 to January 2024 as part of the preparation to determine the full evaluation plan for the research. Program directors were invited

in-person, by email (Appendix B) and follow-up phone calls and gave consent. The same approach was used to enroll other participants. A consent form link was attached to the email invitation to complete the form electronically via a Google form (Google LLC, Menlo Park, CA). Verbal consent prior to the interview was taken as an alternative for participants who did not complete the online consent form and documented. Once participation was confirmed, researchers corresponded with participants individually via email and phone calls to schedule the time and date for the initial interview. Dates/times had to be adjusted several times due to industrial strikes, power outages and sometimes unstable internet. Confirmed meetings were scheduled and Zoom links were shared with participants.

### Focus Group Discussions

Focus group discussion was used for administrators, early career practitioners and some of the faculty members because of work schedule, availability to connect via Zoom at the set schedule and preference for a particular time of day, respectively. Purposeful sampling was used to select the focus groups. This included identifying and selecting individuals or groups of individuals with specific experience or knowledge<sup>79</sup> about public health competencies for pharmacists. Patton draws us to the notion that “the logic and power of purposeful sampling lies in selecting information-rich cases for studying in-depth.<sup>59</sup> The term purposeful sampling means gathering information rich cases about central issues of importance for the purpose of the inquiry and in which one can learn a great deal of knowledge.<sup>89</sup> The selections of participants was based on the following criteria: a) the degree of willingness and openness to engage as determined by a researcher who has been building a relationship with the KNUST Department of Pharmacy Practice for decades, b) the

degree of influence as a stakeholder the potential participant has on pharmacy education and the PharmD program, and c) availability and willingness to communicate their experiences and perspectives in an articulate, expressive and reflective manner.<sup>80</sup>

Participants were contacted via email and telephone. The directors in-charge of the public health sections of the curriculum requested face-to-face recruitment. The goal was to recruit at least 5 participants in each of the six (6) groups; early career practitioners (selected due to their recent experiences with competencies in their education and training) who had completed their PharmD at KNUST within the last 5 years, faculty members (for their knowledge of the competencies in the curriculum and their teaching experience), administrators at KNUST (for their roles in providing resources, assessing the students and/or evaluating the program), seasoned pharmacists (for their years of experience in practice i.e., at least 6 years, within the communities and healthcare systems), leaders of the Pharmacy Council, Ghana (for their input on current practice expectations the path forward, and to understand initiatives at the system and policy level), and those in FIP academic section – FIP members/officers with public health interest (for a global perspective from international leaders who make recommendations for pharmacy education worldwide).

Participants were recruited in cycles to ensure the attempt to meet target number of five in each group. Upon correspondence via email or via phone, the consent forms were electronically signed, or verbal consent was given. No incentives were provided for participation. This was acceptable because participants were interested in the study and wanted to help as a service to the profession, out of care for the structure and improvement of the PharmD program and because they wanted to be heard.

## Data Collection

For the interviews and focus group discussions, participants were guided in a semi-structured discussion with a set of open-ended questions.<sup>80</sup> This began with broad questions about public health competencies and then narrowed into focal points of interest, including the specific behaviors related to those competencies.<sup>81</sup>

Documents relating to curriculum and practice requirements for the PharmD program were obtained from the Department of Pharmacy Practice at the Faculty of Pharmacy and Pharmaceutical Sciences at KNUST, as well as elements from the Haji et. al.<sup>1</sup> model (Figure 4) guided question development. This model includes: context (What context is the program operating in? How did the program change the context?), planned theory (Why will it work? Why will the program bring about its intended effects?), planned outcome (Did it work? How did it work?), (Did the program operate the way we intended? Planned process (How (else) is the program operating?), emergent process (How (else) is it happening? What else is happening?), emergent outcome (Did we achieve the intended effects? What other effects is the program having?) emergent theory (Why is it happening? Are there other explanations for what is happening?). The discussion questions were designed to stimulate thought and provide more information about understanding competencies in the curriculum.

In an interactive discussion, participants can freely talk to other participants<sup>81,83</sup> and engage with each other. Discussions were conducted in English among all focus groups and for all interviews and recorded via Zoom audio (Zoom Video Communications, Inc., San Jose, CA) and transcribed using otter.ai (otter.ai software company, Los Altos, CA). Transcripts were reviewed for accuracy and de-identified to meet ethical standards.

In line with the targeted nature of the questions, five (5) participants per group was anticipated to be sufficient to provide fair information, with redundancy and saturation to be used as a criterion to determine the sample size. Saturation is seen as a maker of qualitative rigor and quality.<sup>84</sup> Different groups of stakeholders are predicted to have varying experiences due to their position or involvement with the program and its activities. Thirty to sixty minutes were used for each session. Recruitment was stopped when additional focus groups and interviews started generating no new information. At this point, it was assumed information collected had been maximized. The intended participation numbers were estimated prior to any data collection. During the process of inquiry saturation was achieved. This involved sixteen (16) sessions of data collection and thirty-three (33) individuals with those sections having shared questions. The groups were chosen for the reasons shown in Table 5. These interviews and focus group discussions were conducted from December 2023 to March 2024.

Memos were subsequently documented for each interview and focus group to capture the researcher's observations and reflection.

Following transcription of the interviews/focus groups, the transcripts were read multiple times to get familiar with the content, an analysis process described as “immersing one's self in the data.”<sup>82</sup> The quality of the data was assessed to check whether the responses received answered the research questions and were not ambiguous. Bias and consistency were checked by examining the questions and responses used for the focus groups and the interviews, including how questions were asked, and verifying if unexpected findings emerged. The process of frequently checking the quality of the data, getting familiar with the content of the data, and examining the FGD and interview techniques helped to refine and revise the process as the interviews/focus groups progressed and reach saturation.

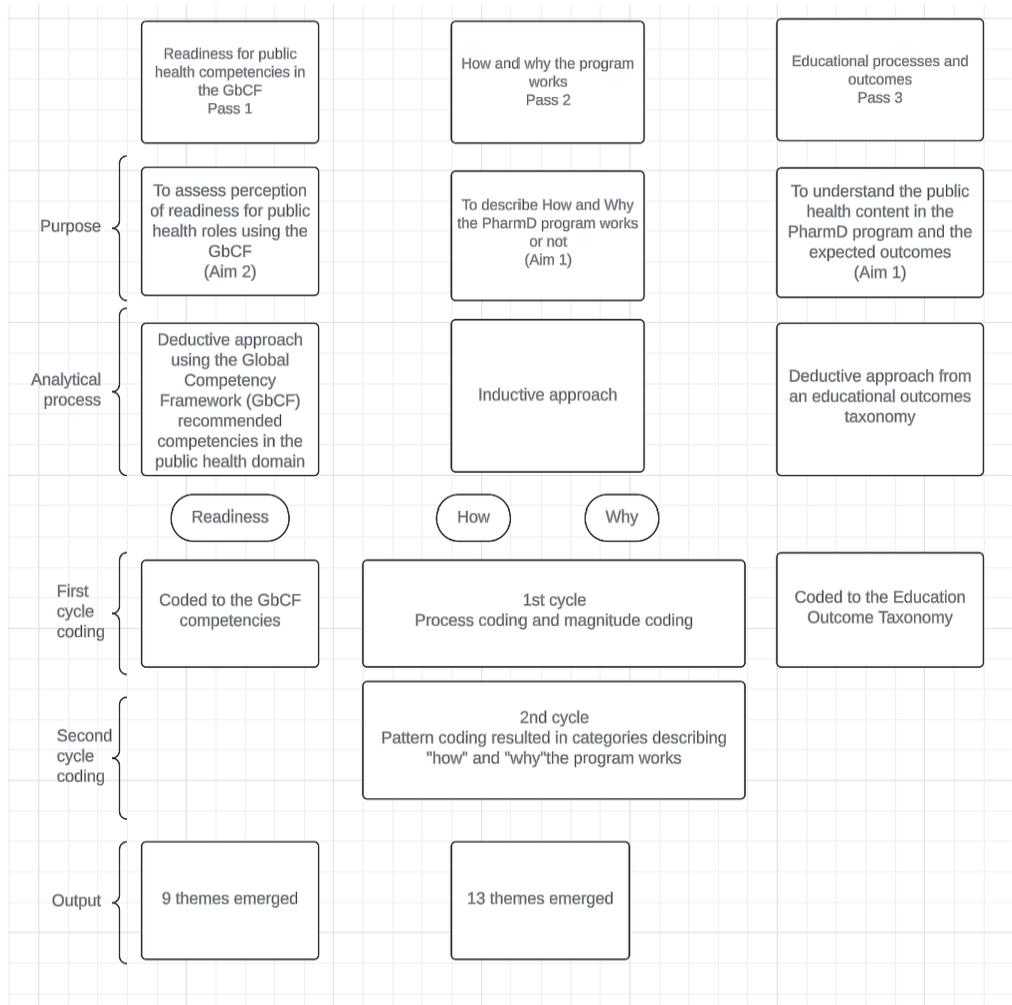
## Data Analysis

All data, i.e., de-identified transcripts and documents, were initially analyzed by the principal researcher/evaluator. After transcription in otter.ai (otter.ai software company Inc., Mountain view, CA), the transcribed data was moved to a Word document and was reviewed to resolve discrepancies in wording and interpretation of participants' responses. The data were unitized in Excel (Microsoft IT corporation, Redmond, Washington, United States) by highlighting sections to isolate sentences and paragraphs from the transcript and to ensure focus for coding.<sup>83,84</sup> Following the principles of authenticity, some of the quotes from the transcripts were trimmed to be “illustrative” and “representative” of participants original responses.<sup>85</sup> A codebook was created for each pass through the data. Data were coded using Microsoft Excel (Microsoft IT corporation, Redmond, Washington, United States). The raw data went through two cycles of coding and analytical memoing.

Using guidance from Saldana J, there were three passes through the data (Figure 7). Inductive and deductive approaches were used in the coding cycles to obtain essential information from the documents and the transcripts. In pass 1 (first pass), a deductive approach was used to assess readiness of public health roles using the public health competencies in the GbCF. The competencies in the GbCF were used as the basic standard to explore the PharmD program outcomes and gaps for improvement. For pass 2 (second pass), an inductive approach was used to identify variables that describe the “how” and “why” the public health competencies in the PharmD program works. An inductive approach was used for this assessment because very little is known about the distinctive activities in the PharmD program and their effects on outcomes. Using an inductive approach allowed further exploration into it. For pass 3 (third pass), a deductive approach was used to code a taxonomy of program evaluation education outcomes (Table 8). There are nine

(9) categories of the Education Outcomes Taxonomy but eight (8) were coded: attitude, affect, behavior, cognition, status, relationship, environment and economic. Biological outcomes were not identified in the data. A codebook with descriptions of the Education Outcomes Taxonomy was created (Table 8). Notes and analytical memoing were also used by researcher in the coding cycles.

**Figure 7.** Summary of the analytical process



**Table 7.** Codebook for Public Health Competencies in the GbCF (Pass 1) (Deductive Approach)<sup>a</sup>

<b>Key term</b>	<b>Definition</b>
Emergency response	Participate in the response to public health emergencies Assist the multidisciplinary healthcare teams in emergency situations
Health promotion	Identify and support national and local health priorities and initiatives
Medicine information and advice	Support the patient’s use of health information technologies and digital communication (including IT driven health solutions)

<sup>a</sup>International Pharmaceutical Federation (FIP). FIP Global Competency Framework: Supporting early career training strategy. Version 2. The Hague: International Pharmaceutical Federation; 2021<sup>8</sup>

**Table 8.** Codebook for Process Coding on How and Why the Program Works (Pass 2) (Inductive Approach)

<b>Keyword selection</b>	<b>Definition</b>
Enriching	Adding value, depth or quality to one’s understanding or experiences
Transforming	Bringing about significant change or improvement
Engaging	Holding attention and interest effectively
Stimulating	Provoking interest, excitement, or curiosity
Demonstrating	Give practical exhibition and explanation of skill Clearly showing the existence or truth of (something) by giving proof or evidence
Communicating	Share (pass on) or exchange information among others
Interdisciplinary	Involving multiple academic disciplines or fields of study
Empowering	Providing the tools, knowledge, or confidence for self-improvement or success Providing individuals with the means to take control of their lives and decisions

**Table 9.** Codebook of Education Outcome Categories (Pass 3) (Deductive Approach)

<b>Education Outcome Categories</b>	<b>Description(s)</b>
Attitude	Likes or dislikes that influence behavior towards a person or a thing. A summative product of different processes, including emotions, thoughts, and behaviors. <sup>86</sup>
Affect	An interplay of physiology, actions/behavior, cognition, and feelings. <sup>86</sup> Examples: joy, sadness, fear, anger, stress <sup>86</sup>
Behavior	An overt, observable act. Conduct towards self or toward another, in response to internal or external stimuli.
Cognition	The processes of thinking, gaining knowledge, and dealing with knowledge.
Status	The perceived quality of someone or something in relation to others. The relative social, professional, or other standing of someone or something. <sup>86</sup>
Relationship	The way in which two or more concepts, objects, or people are connected, or the state of being connected. <sup>86</sup>
Environment	The physical and psychological surroundings or conditions in which a person operates. Also includes the social environment, which is the physical surroundings, social relationships, and cultural milieu within which groups of people function and interact. <sup>86</sup>
Economic	Described as the generation of wealth, understanding scarcity and the decisions that drive behaviors. In program terms, economics is contextualized as resources generated as a result of the program activities including time, money, and other resource-specific outcomes. <sup>86</sup>

Modified from: LaVelle J, Dighe S. A transdisciplinary model of program outcomes for enhanced evaluation practice. *Can J Progr Eval.* 2020;35(1). doi:10.3138/CJPE.61660

The principal investigator performed first-cycle (i.e., process and magnitude) coding in Excel (Microsoft IT corporation, Redmond, Washington, United States). Process coding is also referred to as “action coding.”<sup>83</sup> For example, words like “collaborating, empowering, enriching”

are representative of process coding. The second cycle (i.e., pattern coding) was completed by the principal investigator to identify similarly coded data.<sup>83</sup> Pattern codes are explanatory or inferential codes that identify an emergent theme, configuration, or explanation. Pattern Coding is a way of grouping summaries into a smaller number of themes.<sup>83</sup>

After assessing the meaning of the unitized portions and how they were linked, themes were developed. The themes were developed with *conscious* reasoning and attention to planned and emergent (unplanned) processes and outcomes.<sup>66</sup> Using *The Coding Manual for Qualitative Researchers* book by Saldana and the article *Demonstrating Rigor Using Thematic Analysis: A Hybrid Approach of Inductive and Deductive Coding and Theme Development* by Fereday J, Muir-Cochrane E., themes were generated into sentences or phrases to identify what a unit of data is or represents.<sup>83,87</sup> Theming the data, acknowledges that extended passages of code in the form of sentences can capture the essence and essentials of participant meanings.<sup>83</sup>

First, the researcher became familiar with the data, in alignment with the six steps of thematic analysis approach.<sup>88</sup> Transcripts were unitized by selecting main responses and separating it from responses that did not relate to the questions asked to make the transcripts more concise and easy to analyze.<sup>89,90</sup> The researcher immersed herself in the data by documenting and identifying important information that is relevant to the research aims.<sup>91</sup>

The researcher selected relevant quotations and reread the transcripts to enhance identification of important quotes. Quotations enhance readers' connectedness with the text and emphasize unique areas of the data.<sup>91,83,84</sup> To analyze the interviews and focus group data, the researcher selected quotations from the data and grouped them together under a code.<sup>83</sup> Keywords were selected from the chosen quotations for code development and interpretation.

Selected quotations had patterns in the data with a diverse range of participant responses. The aim for the thematic analysis is to identify and report the most repeated patterns as well as non-frequent but important responses in the data.<sup>83,88</sup> Coding is done to identify elements of the data that are important to the research question, then used to develop a more comprehensive understanding of the underlying concepts and idea.<sup>87</sup> Keywords in coding are essential terms or phrases from the data that are important to understanding the themes or patterns within it.<sup>91</sup> These are words used to categorize the data.<sup>91</sup> The pattern identification is indicative of an inductive data analysis whereas using a pre-existing framework for coding and theme development is a deductive approach.<sup>88</sup> The codes were generated from the data itself to get the patterns and themes to emerge from the data.<sup>87,91</sup> Themes represents a pattern meaning within the data.<sup>88</sup>

Themes were aligned with the two (2) aims of the study using an analytical and interpretive process.

Given the intricate nature of the program, transcripts from the focus group discussions, interviews, codebooks, and the theme development were reviewed by an auditor. This step was taken to assist with clarity and interpretation of participants' comments by providing context on participants input to affirm the analytical work and increase dependability. (See Audit Trial and Methodology).

## Enhanced Logic Model

Following focus group discussions, the original logic model was enhanced by the PI and checked by an auditor.<sup>92,93</sup> An enhanced logic model was created to show the relationship between the resources, activities, and outcomes of the program, to the major education outcomes categories.

The enhanced logic model aligned the evidence with the desired outcomes and an adult learning theory overlay on the logic model,<sup>94</sup> highlighting areas for growth.

## Audit Trail Procedure

In reference to choosing an auditor, the recommendation is to find an expert in their search field in question, who is able to assess the study from a methodological viewpoint and have an independent opinion about the study.<sup>93</sup> Choosing the appropriate auditor is vital for supporting the quality of the research<sup>92,93</sup> Therefore it is understandable the auditor should be independent and have knowledge of the field. Then again, the challenge is how “independent” the auditor can be. Akkerman et. al.<sup>93</sup> suggest that in situations where the criteria of being an expert in the field of study can be fulfilled by the understanding of the methodological perspective and an independent opinion of the research, a supervisor can be considered to act as the auditor, if they are willing to assess the quality of the work.<sup>93</sup> But Kleijn and Leeuwen.<sup>92</sup> argue that a supervisor will not have an independent opinion, since they may have been involved in the decisions concerning data collection and data analysis and also have interest in successful completion as a potential coauthor.

Choosing an appropriate auditor was based on two principles; that the auditor is someone who has expertise in the research area and that the auditor has an independent opinion and is not part of the research team.<sup>92,93</sup>

Dr. Bernard Appiah, an assistant professor at Syracuse University, Falk College, Department of Public Health, agreed to be the auditor of this study. Coincidentally, Dr. Appiah’s last name bares part of the researcher’s last name, but they are not related. Prior to joining Syracuse University, Dr. Appiah was Assistant Professor at Texas A&M University’s School of Public Health in the Departments of Environmental and Occupational Health and Public Health Studies.

He was the Founding Director of the Research Program on Public and International Engagement for Health. Previously, Dr. Appiah served as a Drug Information Pharmacist/Publications Manager at the National Drug Information Resource Centre (NDIRC) for the Ministry of Health in Ghana.

The auditor who audited this study is an independent researcher<sup>95</sup> and also an external to the research project.<sup>96-98</sup> In addition, some authors have argued that the description of the analysis phases in the dissertation constitutes an audit trail, and its quality can be evaluated by the reader.<sup>92,99</sup> From this standpoint, readers get to combine their own audit with that of the auditor for an overall view on the study.<sup>93,94</sup>

The auditing process involving the auditor and the auditee gives the auditee an important quality improvement experience. The auditor reviewed the study, reflected critically on data collection and analysis, and gave recommendations for improvement which the auditee adhered to. Discrepancies were resolved through conversations with the auditor at scheduled meetings. The auditors' objective contributions and successful completion of the audit is gratefully appreciated but no agreements were made concerning co-authorship to avoid reader's concerns about that influencing the auditor's judgment.<sup>92</sup>

The auditor assessed the quality of the research and presented the findings to the auditee (researcher) to find the way forward. The intent of this stage is to establish the visibility, comprehensibility and acceptability of the research as seen by the auditor.<sup>92,93</sup> The purpose of this stage is to support "establishing and increasing quality."<sup>93</sup> The auditor starts with the final research documents and evaluates if the findings and conclusions align with the data collection and analysis according to "general standards".<sup>93</sup>

The audit trail procedure followed the stages proposed by Akkerman et. al., and Kleijn and Leeuwen (Table 9). In the seven (7) stages of the audit procedure,<sup>93</sup> the auditor and auditee negotiated about goals, roles, and rules of auditing. While the auditor might have been engaged right after data collection for an opportunity to establish and increase validity by using the auditor's feedback in the remaining stages of analysis,<sup>92</sup> the auditor began their work when analysis was complete. Comments from the auditor were critically appraised by the auditee. The auditor's report suggested points that enhanced the analysis of the data and increased transparency of the final writeup. At the final stage, the dissertation writeup was deemed satisfactory in its visibility, comprehensibility, and acceptability. The final audit trail report is available to readers upon request.

**Table 10.** Stages of the Audit Procedure<sup>a</sup>

<b>Stage</b>	<b>Description</b>
Orientation to the audit procedure	The auditee and auditor negotiate and agree upon goals, roles, and rules of the audit.
Orientation to the study	Auditee arranges the logistics for the auditor, explains the audit trail, and auditor becomes familiar with the study.
Auditability of the study	Auditor determines the completeness, comprehensibility, and utility of the audit trail. Auditee and auditor discuss the auditability.
Negotiating the contract	Auditee and auditor establish timeline, determine goals, specify roles, arrange logistics, determine outcomes and format and identify renegotiation criteria.
Actual assessment	Based on the audit trail auditor assesses the research process in terms of the specific quality criteria
Regeneration	Auditor presents findings and discusses discrepancies; Auditee assesses the accuracy of the auditor claims and adherence to the agreement. This conversation might result in redesigning the research process (leading to

another audit), adjustment of the auditor report, or a modification of the agreement.

Final audit report

Auditor writes a confirmed assessment on the trustworthiness of the study

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<sup>a</sup>Modified from *Auditing Quality of Research in Social Sciences*<sup>100</sup>

## Methodological Quality and Rigor

Trustworthiness of the findings can be assessed by considering credibility, transferability, dependability, and confirmability.<sup>101</sup>

### Credibility

Credibility refers to the extent to which the research findings are considered accurate and believable.<sup>102,103</sup> The creditability of qualitative data can be ascertained through the use of multiple viewpoints during the data collection.<sup>104</sup>

Member checking is a technique commonly used to share research information with participants to confirm the accurate representation of their views in the data.<sup>105</sup> Member checking is generally used to check credibility, by asking members to review the data collected. For this research, member checking was not used due to concerns reported in the literature, such as participants having access to only their perspectives while investigators have access to a collective dataset for interpretation and challenges in resolving discrepancies between participants and investigators interpretations of results.<sup>106</sup> In using multiple methodology for data collection among six (6) different groups, the researcher anticipated that effective member checking would require significant time to orient members to the broader scope of the work and obtain their feedback, but

availability of participants was a challenge. As an alternative, an audit trail process was used to support credibility.

Triangulation is a method of using several data sources to understand a phenomenon.<sup>107</sup> Thurmond describes triangulation as “the combination of at least two or more theoretical perspectives, methodological approaches, data sources, investigators, or data analysis methods with an intent to decrease, negate, or counterbalance the deficiency of a single strategy, thereby increasing the ability to interpret the findings”.<sup>108</sup> To increase credibility in this study, several methods (i.e., preliminary interviews, focus groups and document review) were used to gather stakeholder’s perspectives and these perspectives were triangulated during the analytical process.

## **Transferability**

Transferability requires adequate description of the original framework of the study to inform adjudication,<sup>93</sup> e.g., the extent to which the research findings are applicable to similar persons or settings. This was demonstrated by clearly stating assumptions and contextual inferences of research participants and setting.<sup>104</sup> The importance of reader interpretation is vital and therefore a detailed description of the research methods and samples of the raw data,<sup>93</sup> including direct quotes, logic models and themes, were used in the write-up to give clarification to readers' own understanding.

## **Dependability**

Dependability is expected to show an in-depth description of the methodology and design to allow the study to be repeated.<sup>104</sup> For the analysis of the study data, there was a coding process where the principal investigator coded sections of the data and after about two weeks recoded the same data. Results from both coding were compared. In addition, an external researcher functioned as an auditor and assessed data collection and analysis process and through conversations and feedback gave additional perspective, as a way to increase dependability.<sup>92,93</sup>

## **Confirmability**

Confirmability involves ensuring the data and results are not due to the participants and/or the researcher's bias.<sup>104</sup> Researchers exposure to situations or environment can influence their position or frame of reference overtime.<sup>94</sup> Hence, the researcher used memos and field notes to keep an audit trail (i.e., auditability) of data sources, interpretations, coding and amalgamation<sup>90,95</sup> to support critical analysis and reflection. Memoing and critical analysis were crucial to the researcher's perspectives throughout the study.

## Reflexivity Statement

This statement is reported using Olmos-Vega's guidance.<sup>109</sup>

### **Personal Reflexivity**

My interest in pharmacy education, public health and evaluation has developed over time. Having gone through a rigorous doctor of pharmacy program at the University of Minnesota College of Pharmacy, I am familiar with PharmD education and pharmacy practice. I have had diverse pharmacy practice experiences working in tele-pharmacy, inpatient and outpatient pharmacies, long term care pharmacy and community/retail pharmacies in the United States. Moreover, I have had fair amount of experience in Ghana as a pharmacist. My interest in public health has grown from participating in various public health initiatives, supporting global public health programs within communities and in education, and through taking classes to gain more information and skills in public health work. Moreover, being a member of FIP gives me a platform to share research projects internationally through poster presentations, as well as networking and learning from renown pharmacy leaders who are passionate about pharmacy education and pharmacists' roles in public health.

For the past fifteen years, I have engaged with the KNUST School of Pharmacy and other pharmacy institutions within Ghana to gain insights and familiarity with the roll out of the new PharmD program there and to build relationships. I have volunteered and assisted in various projects and presentations, including providing seminars covering a wide range of topics like changing trends in pharmacy, pharmaceutical care practice, interpretation of pharmacoepidemiologic studies and pharmaceutical care for patients with chronic diseases.

Further, some faculty members have extended invitations for assistance with training students on rotations. In these roles, I participated in training students on patient assessment, cases, and articles discussions for different year groups. These experiences contributed immensely to my professional growth and made it fairly manageable to coordinate different aspects of my research at the Faculty of Pharmacy and Pharmaceutical Sciences, KNUST.

As a female researcher and a practicing pharmacist, I recognized the importance of addressing biases throughout the inquiry and paid particular attention to it. Passionate about quality education and equal learning opportunities, I identify as an advocate for less privileged students. Likewise, I am empathetic towards students who struggle due to barriers in their education or unequal resource allocation. I care about the impact of students' education and their training in relation to patients' experiences and outcomes.

It is important to note that my entire pharmacy education, training, and practice has been in the United States. Even though in the past I have frequently visited Ghana and volunteered in diverse ways in providing healthcare, the influence of my foreign experiences in pharmacy are foundational. As a trained US pharmacist, perhaps I have imposed certain values, ethics and personal principles that may be different than participants. This could have further influenced the questions asked, the methods used, and honestly, the entire inquiry. With purposeful memoing, I continuously interrogated my unique perspective on this research work, and I was aware of my perspective as an asset and how that influenced the study through data collection, data analysis, or data presentation.

Personally, I prefer to “try it out myself first” in order to learn through the process in any endeavor. I feel inept when things are handed to me without due process especially in education, learning and in practice. But I also acknowledge that there are areas where I needed help, and it

was acceptable for me when that area was my weakness and complemented by another person's strength. Perceiving how Ghanaian culture functions on "who you know" (i.e., getting things done based on your connections or the people you know) I had to critically assess benefit over risk of getting assistance without compromising my values.

Overall, being the principal investigator (PI) and a PhD candidate, I have had growing experience in qualitative research, strong interest and minors in education and program evaluation. I have also had years of global health and global engagement experiences in several countries including several years of building relationships with KNUST Faculty of Pharmacy and Pharmaceutical Sciences.

## **Methodologic Reflexivity**

Methodologic reflexivity is to "address the nuances of decisions throughout the research process."<sup>109</sup> Several major decisions required this form of reflexivity.

Member checking is considered an important methodological process for establishing credibility by some qualitative researchers. However, member checking was not feasible given the complexity of the work. To ensure scholarly methodological processes were followed as expected in qualitative inquiry, an alternative process (audit trail) was used to enhance credibility.

As a reflexive researcher constantly making decisions and reacting to data,<sup>110</sup> another methodological decision made was on data collection method. In the original research proposal, focus group discussion was intended for collecting data from all participants. However, as the research evolved, it became necessary for interviews to be used in addition to FGDs to proceed.

## Chapter 4: Results

In this results section, Table 11 shows the details of the various participant groups and the mode of participation. In two of the groups – seasoned pharmacists and Pharmacy Council, Ghana - participation rates were lower. Scheduling conflicts, different regulatory requirements for seasoned pharmacists’ presence at the community pharmacies, and lack of experience in research participation were a few reasons noted for non-participation.

**Table 11.** Interviews and Focus Groups and Mode of Participation in the Evaluation

<b>Date of interview/ Focus Group</b>	<b>In-person/ zoom</b>	<b>Participants</b>	<b>Number Invited</b>	<b>Number Participated</b>	<b>Total Length</b>
November 21, 2023	In-person Interview	Directors (prior to FGD)	5	1	2:05:00
November 22, 2023	In-Person Interview	Directors (prior to FGD)	5	1	2:15:00
November 30, 2023	In-person Interview	Directors (prior to FGD)	5	2	2:07:00
December 8, 2023	Zoom FGD	Early career practitioners	7	5	1:25:47
December 14, 2023	In-Person Interview	Faculty members Session i	6	1	59:56
December 20, 2023	Zoom FGD	Faculty members Session ii	7	4	33:14

January 25, 2024	Zoom Dyadic interview	FIP members/officers i	7	2	32:39
March 27, 2024	Zoom Interview	FIP members/officers ii	10	1	45:06
April 2, 2024	Zoom Interview	FIP members/officers iii	10	1	27:48
April 4, 2024	Zoom Interview	FIP members/officers iv	10	1	36:31
April 12, 2024	Zoom Interview	FIP members/officers v	10	1	14:38
February 6, 2024	In-Person Interview zoom	Seasoned Pharmacist i	6	1	38:75
April 7, 2024	Zoom Interview	Seasoned Pharmacist ii	5	1	18:11
May 13, 2024	Zoom Interview	Seasoned Pharmacist iii	5	2	56:20
February 16, 2024	In-person FGD	KNUST Administrators	6	5	17:32
February 21, 2024	Written	Leader of Pharmacy Council, Ghana	5	4	Not applicable
<b>16 sessions of data collection</b>			<b>109</b>	<b>33</b>	<b>14:11:57</b>

FGD=Focus Group Discussion

About 259 pages of documents were reviewed (Table 12), coded and analyzed. In addition, 11 hours 23 minutes 25 seconds of one-on-one and dyadic interviews and 2 hours 48 minutes 32 seconds of focus group discussion meetings were conducted, resulting in 111 pages of transcripts.

**Table 12.** List of Documents Reviewed, Information Retrieved, and Use of Information

<b>Documents Reviewed</b>	<b>Information Retrieved</b>	<b>Use of Information</b>
KNUST PharmD Syllabus	Competencies in curriculum	Helped with the construction of the initial and advanced logic model
Experiential training manual	Public health competencies during experiential training	Informed initial logic model
Semester timetables	Confirmation of taught competencies	Informed initial logic model
Documents with overview of courses/classes	Reviewed for clarity of curriculum content in the syllabus	Informed parts of the FGD questions
Pharmacy Act	Rules and regulations of practice	Understanding practice expectations
Preceptor manual	Not applicable	Not applicable

### Aim 1

**To describe the educational processes and outcomes that contribute to readiness of pharmacists to take on public health roles in LMICs using evaluation science approaches in a university doctor of pharmacy program in Ghana as a case study.**

The educational processes and outcomes contributing to readiness of pharmacists for public health roles were determined through evaluations of the outcomes and alignment with the program's intended outcomes. There are nine (9) categories of the Education Outcomes Taxonomy, but eight (8) were coded which included: attitude, affect, behavior, cognition, status, relationship, environment and economic. Biological outcomes were not identified in the data. In Table 13, eight (8) themes are shown, which describe a breakdown of each of the Education Outcomes and how they relate to seventeen (17) supporting themes. This is also reflected in the advanced logic model shown in Figure 8 below with letter representation of the Education Outcomes.

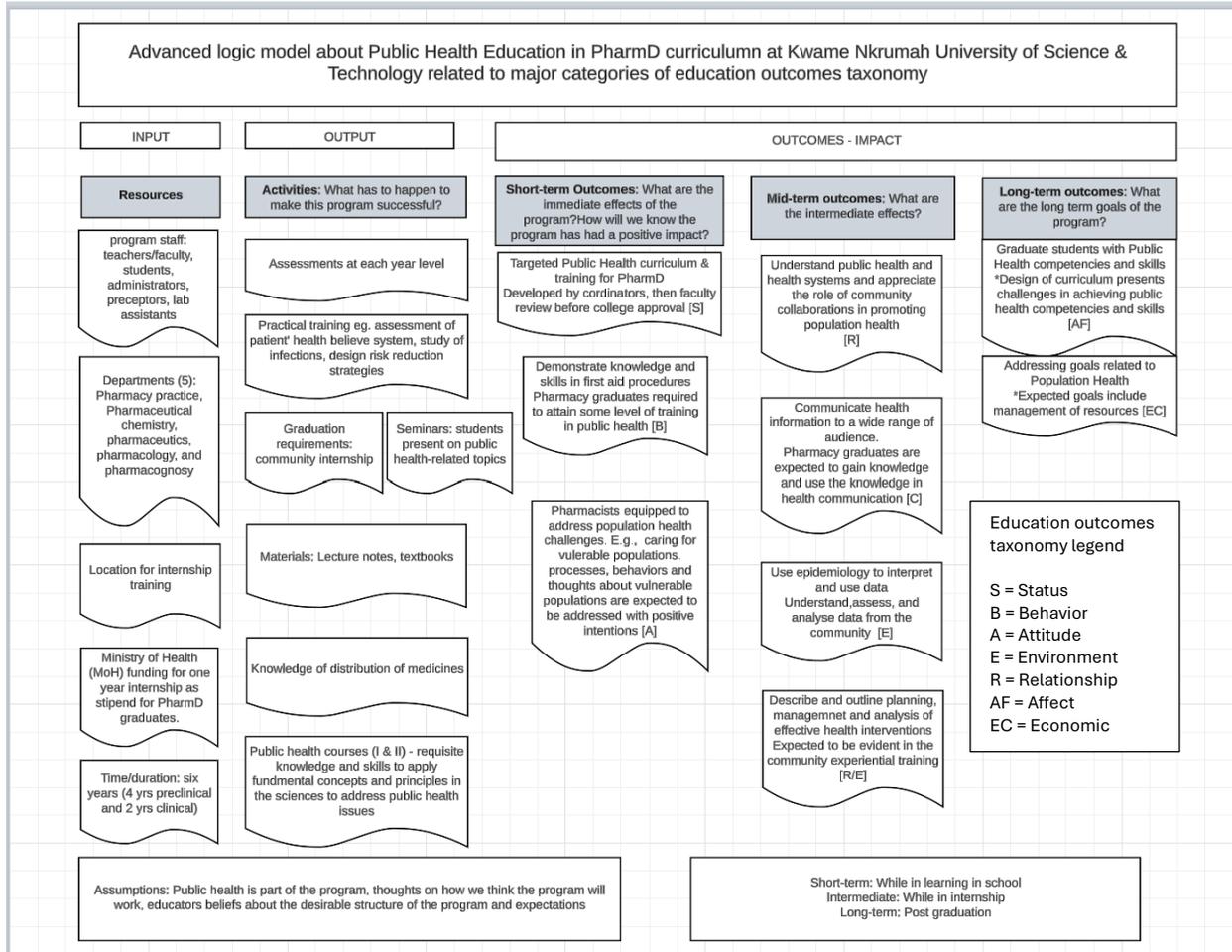
**Table 13.** Categories Education Outcome and Themes (Pass3) (Deductive Approach)

<b>Education Outcomes<sup>111</sup></b>	<b>Themes</b>
MEO1	Graduate pharmacists expressed readiness for public health roles within their communities
MEO2	The PharmD program prepared students in class and during training to apply their knowledge and skills
MEO3	Participants built long lasting relationships in the field
MEO4	Early career graduates developed skills for managing resources in diverse settings
MEO5	The PharmD program structure and activities helped students to grow professionally
EO1. Cognition	<p>EO1.1 Early career practitioners reported knowing they could use their skill developed in school to assist in outreach programs against disease outbreaks. EP</p> <p>EO1.2 Seasoned pharmacists reported believing they could use their knowledge and skill in planning community health education activities to assist local and national organizations. SP</p>
EO2. Behavior	<p>EO2.1 Seasoned pharmacists and early career practitioners stated applying the knowledge they learned in school in the care of patients and in assisting their colleagues. SP/EP</p> <p>EO2.2 KNUST faculty worked together with their colleagues to develop the public health courses and training activities. FC</p>
EO3. Attitude	<p>EO3.1 Early career practitioners described voicing their desire for introduction to more career opportunities within public health before graduation. EP</p> <p>EO3.2 FIP members/officers reported that experiential training with special populations was energizing for practice readiness. FL</p>
EO4. Economic	<p>EO4.1 Seasoned pharmacists discussed growth in maximizing resources in community pharmacies, including providing cost effective care. SP</p> <p>EO4.2 Seasoned pharmacists reported having many job opportunities with their PharmD degree positioning them for work in diverse pharmacy settings. SP</p>
EO5. Affect	<p>EO5.1 Seasoned pharmacists reported satisfaction learning about the public health competencies embedded in the curriculum. SP</p> <p>EO5.2 Early career practitioners reported excitement in learning how to store and inject vaccines. EP</p>

EO6. Relationship	<p>EO6.1 Seasoned pharmacists and early career practitioners discussed building positive relationships with community members and work colleagues. SP/EP</p> <p>EO6.2 Early practitioners' narrated networking with community leaders for mentorship and strengthening relationships. EP</p> <p>EO6.3 Early career practitioners reported completing their degree with learned skills in public health to support others' goals. EP</p>
EO7. Environment	<p>EO7.1 Early career practitioners communicated that the supportive learning environment in both the classroom and at training sites helps students to participate in activities that ultimately benefit the public when they come to the pharmacy for care. EP</p> <p>EO7.2 KNUST faculty described opportunities given to students working towards the PharmD degree to take electives to help them develop their own specialty interest. FC</p>
EO8. Status	<p>EO8.1 Early career practitioners reported experiencing growth during their experiential training and improving their interprofessional skills, such as teamwork and communication, making them ready for professional practice. EP</p> <p>EO8.2 Early career practitioners stated that participating in various professional activities made them grow professionally. EP</p>

EO = education outcomes; EP = early practitioners; SP = seasoned pharmacists; FL = FIP members/officers ; FC = KNUST faculty; MEO = "Major Educational Outcome" theme

**Figure 8.** Enhanced Logic Model about the Public Health Curriculum at KNUST



The researcher/evaluator identified 13 themes describing the “*how and why*” the PharmD program works (Table 14). Analysis also examined responses by participant group. Quotes were coded and collections of codes were described within each participant group. Tables 15 – 19 show additional evidence from each participating group about “*how*” and “*why*” the program works.

**Table 14.** Themes for “How” and “Why” the Program Works (Pass 2) (Inductive Approach)

<b>The program works by...</b>	<b>Codes</b>
<b>HPW1.1</b> frequent organization of seminars about public health in pharmacy, providing tools and sharing knowledge that are meaningful for caring for diverse populations.	Empowering
<b>HPW1.2</b> testing students on specific public health related questions about the competencies that they are expected to know which further triggers interest in knowing more about the competencies.	Stimulating
<b>HPW1.3</b> mandating pharmacists to take continuing professional development (CPDs) courses in areas of public health concern as a requirement for retention, creating a path for deepening their understanding and their experience in public health.	Enriching
<b>HPW1.4</b> encouraging students to use their knowledge, skills, and qualifications to perform public health duties to help students build confidence in themselves.	Empowering
<b>The program works because...</b>	
<b>WPW1.1</b> certain elements, such as understanding basic social, economic, political, and ethical concepts within the core of their public health training, supports students’ learning in taking control of the choices they make during public health activities.	Empowering
<b>WPW1.2</b> the teaching and training design for the public health competencies (emergency response, health promotion, medicine information and advice) helps students to integrate and get involved in public health related activities ,which is evident in the student’s improvement in developing community interventions.	Transformation
<b>WPW1.3</b> minimum qualification for registering as pharmacists requires attaining some level of public health training, assessed through practical test and case study.	Demonstrating
<b>WPW1.4</b> as part of accreditation requirements, there is provision of conducive environment for specialized <sup>a</sup> activities like vaccine storage and administration, which students pay particular attention to during labs.	Engaging
<b>WPW1.5</b> the program promotes students’ involvement in policy development in support of public health and safety interventions at their experiential sites.	Transformation
<b>WPW1.6</b> public health practice training enhances students’ hands-on experience, and the application reinforces ongoing interest and curiosity in students to be more involved in local and international projects.	Engaging

<sup>a</sup>Public health is considered a specialized area of training

**Table 15.** Evidence from Program Directors about How and Why the Program Works

<b>Code</b>	<b>Description(s)</b>	<b>Sample Quotes</b>
<b>PDF1.</b> Empowering	Students have the tools, knowledge, and confidence in learning the theory in class and gain some hands-on experience in training to apply the competencies they learn.	<p>“As part of public health, immunizations and disease prevention, the theory class is within the curriculum. However, students go down to the hospitals to experience how vaccines are given.” (academic setting)</p> <p>“Students who incorporate the theoretical learning into the practical gets more involved in using the competencies” (academic/hospital setting)</p>
<b>PDF2.</b> Enriching	The program directors have years of experience developing the competencies in the curriculum and they bring a lot of experience to instruction, which gives the students an in depth understanding of the public health competencies in the curriculum.	“Curricula development of the competency areas includes work from multiple stakeholders, bringing their expertise in public health to put together quality curricula” (academic setting)
<b>PDF3.</b> Transforming	Practical training in public health courses should be used to improve the students’ learning experience by teaching different aspects of public health.	“It is important that we strengthen what we teach in class so that the experience the students get will be relevant” (academic setting)

<p><b>PDF4.</b> Demonstrating</p>	<p>Faculty create opportunities to show students more clearly how the theoretical concepts learned in class are used in practice, but more is needed.</p>	<p>“I took them to a place nearby, where the students knew they had to go and find information and work on a topic, and then present it. That was practical for them.” (academic setting)</p> <p>“I have been involved in some other aspects of teaching competencies, but I think there is a practice component that I agree requires measures for implementation. Example, US and other places, have elective areas in public health, but we do not have that yet.” (academic setting)</p>
<p><b>PDF5.</b> Communicating</p>	<p>Vital information about preparedness for public health roles is taught in various classes repeatedly, although not stated in curriculum as emergency preparedness.</p>	<p>“We are teaching aspects of pharmacists’ preparedness as part of public health...after COVID, it became necessary to mention it in almost every class we were teaching... Almost every example brought up the essence of preparing for future pandemics. I mean, the Ghana case was used all the time when, in March 2020, we were given the impression that we are prepared for it. But then when we had two cases, there was a lot of panic. So, it is something that I have talked about repeatedly in class.” (academic setting)</p>

<p><b>PDF6.</b> Stimulating</p>	<p>Seeing the activities being done at the public health outpatient units will provoke students' interest in developing their own skills.</p>	<p>“Students have as part of the elective - they do community pharmacy practice. [But] they would not go out to the community unless you have given them some research and they are collecting data. I am thinking that if they get exposure to the public health unit, they will have that skill and be better prepared. Because when you go to the public health unit in the hospitals, apart from the activities that they do on an outpatient basis, they go to the community, to see patients or to collect data or to organize a program of some sort. And I think that they (students) will certainly get some skill developed if they are attached to the public health unit of the hospitals since they go to the community.” (academic setting)</p>
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PDF=program directors-faculty

Several of the members interviewed for FIP had experience with schools in Ghana. They were involved in international projects that provided them with experience with pharmacy education at KNUST and other pharmacy schools in Ghana. For some, their personal experiences at KNUST prompted their comments (Table 16).

**Table 16.** Evidence from FIP members/officers about How and Why the Program Works

<b>Code</b>	<b>Description(s)</b>	<b>Sample Quotes</b>
FIP1.Enriching	<p>Understanding the competencies adds value, depth, and quality to the experience, creating a desire to know more.</p> <p>The PharmD programs cover a wide range of public health competency, enhancing students understanding and experiences.</p>	<p>“Definitely be aware of all of the competencies, you do not have to be competent as soon as you graduate. But at least having that understanding enables you to then pursue it further.”</p> <p>“Health promotion in terms of identifying health priorities or providing initiatives -pharmacists, or pharmacy students are well aware of that. Definitely, things like vaccination programs that you should do, or healthy lifestyle, I think that is pretty good covered in the degree, or even, disease prevention or control. And especially, because of COVID.”</p> <p>“There has been a lot of disease prevention and informing healthy lifestyles, including things from wash your hands to exercise and get vitamins etc. I think they are really about health, promoting and offering advice and services. As I mentioned, on disease awareness days, students check your blood pressure and check your glucose. I do think the PharmD programs are aware, and they train pharmacy students to do that. And recent graduates are aware of that too.”</p> <p>“And definitely health promotion. And I am thinking that has been strengthened more and more in the past, especially because health promotion is not only about the medication itself, but it is also about the patient. It is looking at a patient perspective or a population perspective. And I think that is where</p>

	Gaps are filled in certain key areas in the curriculum relating to public health procurement and supply chain management, which are critical to emphasize.	the role of the pharmacist has been growing.”  “Talking about public health, we cannot ignore the supply element of medicines because medicines are the premium intervention for community health needs. In training pharmacists, we should cover procurement of medicines, elements of supply of quality medicines”
<b>FIP2.Engaging</b>	Interest in applying public health competencies can be certain with a PharmD degree regardless of previous background.	“It is about counseling, the patient on medication information or giving advice. And that comes with the degree as well. I think there are a couple of things that indirectly or directly connect to public health, regardless of the setting.”
<b>FIP3.Empowering</b>	The PharmD program provides pharmacists with the necessary tools and knowledge to make informed decisions regardless of any emerging crises.	“I think emergency response is a good one because if FIP, a global organization, thinks about ways in which pharmacists step up to the call of duty so to speak, we see that a lot of crises whether they're manmade or natural disasters, pharmacists do step up and they help out.”

FIP=FIP members/officers

**Table 17.** Evidence from Pharmacy Council, Ghana About How and Why the Program Works

<b>Codes</b>	<b>Description</b>	<b>Sample Quotes</b>
<b>PCG1.</b> Stimulating	<p>Some level of training in public health is required of graduates with a PharmD degree.</p> <p>Mandatory continuing professional development in public health for PharmD’s builds interest in the field.</p> <p>Requirements for PharmD program accreditation call for specialized programs like public health which sparks interest.</p>	<p>“The educational curriculum for training pharmacy students in universities in Ghana has been reviewed for graduates to come out with PharmD as the minimum required qualification for registration. As part of the training, it is required that pharmacy graduates attain some level of training in public health.”</p> <p>“Mandatory CPD – All pharmacists are mandated to undertake CPD in areas of public health concern. This is a requirement for the retention of the name of the pharmacist in the register.”</p> <p>“Specialized programs have been introduced in the post-graduate training at the Ghana Postgraduate College of Pharmacists to train pharmacists to offer specialized services, such as vaccination in pharmacies. These pharmacies have been accredited and as part of the accreditation requirements are required to provide conducive environments to undertake these specialized activities, such as storage and administration of vaccines. Public Health is one of the specialized areas of training at the Ghana College of Pharmacists.”</p>
<b>PCG2.</b> Engaging	<p>As an expectation from the Pharmacy Council, attention given to public health increased interests.</p>	<p>“Pharmacy Council expects pharmacists to play an active role in health education and promotion. From patient counselling through community engagement and organize events to promote the well-being of the community.”</p>

	The Pharmacy Council expects continuous learning and community engagement activities to strengthen focus and interest in public health.	“ Pharmacists are expected to carry out research work in their place of work or communities where they find themselves. They should liaise with other stakeholders to identify and prompt relevant agencies to handle emerging diseases within the communities.”
<b>PCG3.Communication</b>	The Pharmacy Council expects exchange of information using acceptable methods of communication meets requirements for pharmacists to lead in health advocacy.	“The Pharmacy Council expects pharmacists to play a leading role in health advocacy for the right of individuals to quality and accessible health care. Pharmacists have to use relevant and acceptable medium of communication to carry their messages.”

PCG=pharmacy council, Ghana

**Table 18.** Evidence from Seasoned Pharmacists About How and Why the Program Works

<b>Codes</b>	<b>Description(s)</b>	<b>Sample Quotes</b>
<b>SPP1.Transforming</b>	Having the opportunity to educate the community is an initiative towards community health improvement.	“Going through the program, I learned self-education. I read from various pharmacy resource sites about the diseases causing outbreaks, how that can impact the community and then create an opportunity to educate patients within the community.” (community/hospital setting)
<b>SPP2.Empowering</b>	Acquiring the knowledge in certain courses within the PharmD program builds confidence in making decisions about public health areas.	“Public health competencies in the curriculum covered problems in the community such as affordability, access to healthcare, education, and immunization. Content also covered problems, challenges, and opportunities in healthcare.” (community setting)
<b>SPP3.Engaging</b>	Knowing the theoretical aspects of public health, students are able to maintain interest by finding opportunities for work and practical experience.	“...you find yourself getting involved in some of these public health activities by virtue of learning it on the job. we learned to get ourselves in the door.” (hospital setting)
<b>SPP4.Communicating</b>	Participating in activities involving public health competencies (i.e., health promotion) is shared among various stakeholders, such as community leaders, lecturers, students.  Lack of sharing information about pharmacists’ roles in public health and clearly defining it makes it difficult to communicate	“We organize ourselves with the help of some patrons, of course, we have lecturers who are with us, then we move to part of those regions, we see patients. Then we communicate with the elders of those communities, about the specific condition, how to go about it, how to prevent it, how to live with it, and all those things as a form of health promotion.” (community/organization setting)  “There is a problem with the whole public health system in Ghana. I think we have public health physicians, we have public health nutritionists, public health nurses, but then there is no public health pharmacist. Even the

	the description of a public health pharmacist.	description is not there. So as to how to train the people to fit/fill certain gaps or spaces within the public health arena that is a bit missing.” (community setting)
<b>SPP5.Demonstrating</b>	Illustrations from different organizations about handling emergency situations explain practical skills.	<p>“And when it comes to emergency response, that I remember we had a class during our fifth year, we had a class about ID (infectious disease) and we had the Ambulance Association of Ghana come and take us through seminars as to how to respond in case of an accident, how to do CPR, how to prep people who have broken or fractured limbs, when it comes to emergency response.” (community/hospital setting)</p> <p>“We learn as students, we learn after school, we sort of apply the basics that we learn in class, then go out with associations, speak to people and we teach them the right things to do...the school helped us with especially the emergencies, and I think FDA sometimes with the students’ association, and most of the time these are organized by the student’s association. Sometimes during the Student Association week, we have the FDA come and talk about safety and medication safety, how to report adverse drug reactions.” (community/academic setting)</p>

SPP=seasoned pharmacist participant

**Table 19.** Evidence from Early Career Practitioners Said About How and Why the Program Works

<b>Codes</b>	<b>Description(s)</b>	<b>Sample quotes</b>
ECP1.Communication	Learning about health promotion (a public health competency)	“someone will come to you or call upon you to maybe meet a group of people and then advise them on medications. You always try to stay on top of your game, always update yourself with the current information... This allows me to teach the community about drug safety and disease prevention.”
ECP2.Demonstrating	<p>Students are given opportunities to practice taught skills (e.g., vaccination) in communities and show evidence of training.</p> <p>Having a chance to show proof of practical learning helps to solidify the learned skill.</p>	<p>“In this training we're taking they took us through the immunology, of vaccines to the public health aspects of vaccination, and the practical aspects included us learning how to store these vaccines and also inject. We underwent some form of health outreaches in our various communities to give COVID-19 vaccines to the community.”</p> <p>“My favorite part was probably the injections, doing this was more hands-on so we got to have a feel of it. That was the highlight of my vaccination program. The fact that I got to inject the vaccinations myself and everything.”</p>
ECP3.Transforming	Using informed decisions based on public health practice principles, students are open to change when necessary.	“In theory, we are told for this condition, these are some of the medications that we can give and is given at this dose or maximum dose or these routes. [But] every patient is different, every individual is different. So, just because the books are saying that we should go this way, doesn't necessarily mean that it's going to work for every patient.”
ECP4.Interdisciplinary	Decisions about the scope of practice depend on various leaders in multiple fields of study, eg, policy makers,	“No matter how prepared you are or our understanding of the corporate competencies and theoretical concepts of public health, if we don't

	government officials, institutional heads, hence students' preparedness for roles in public health need policy support to show their preparedness in practice.	have any enabling environment, we cannot really practice. If we want to do something about public health, we can do it. But then if you don't get people to advocate or create a condition where we are free to practice, I don't think whatever knowledge or how prepared we are, we can actually do it. That is what I would see, my preparedness would be towards the environment.”
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ECP = Early Career Practitioner

## Aim 2

**To assess new practitioners' perceptions of readiness for the various Pharmaceutical Public Health competencies set forth in the Global Competency Framework (GbCF).**

Nine (9) themes relating to perceptions of readiness of the three pharmaceutical public health competencies (emergency response, health promotion and medicine information and advice) in the GbCF were generated (Table 20). The themes have been aligned with quotes to give further explanation.

**Table 20.** Themes Representing Evidence of Readiness for Public Health Competencies in the GbCF<sup>8</sup> (Pass 1) (Deductive Approach)

<b>GbCF pharmaceutical public health competencies</b>	<b>Readiness Themes</b>	<b>Sample Quotes</b>	<b>Reporting participants</b>
ER1.Emergency response	<b>ER1.1</b> Knowing the concepts of public health empowered early career practitioners to assist in emergency response within their communities.	“We discussed disease prevention, promoting healthy lifestyles, responding to health issues etc. in our communities. The discussion solidified the knowledge...” (community/retail setting)	FC + SP +PC
	<b>ER1.2</b> There is evidence of participants’ use of the concepts of epidemiology to interpret and use reported/research data in their assessments to assist in multidisciplinary teams.	“I try as much as possible to be involved with anything that increases the range of the community about health. I try and give talks in my church, I try and pass on knowledge to the community about conditions about their health, even about how to, or when to visit the hospital, how often they should go for checkups. I know people are there that have better knowledge of some of these disease states, but they just don’t want to get involved with all these programs. I try as much as possible to gain knowledge from everywhere. I read, I listen to programs, I join associations, they teach all those things or go for conferences that helped me to understand.” (community/retail and hospital setting)	FC + SP
	<b>ER1.3.</b> Early experiential training in various settings creates opportunities for better interdisciplinary interactions with	“The emergency response that we added, especially in version two of the GbCF might be a little bit more specific to the setting. Although I think the importance in that is, really thinking about the	SP + FC + EP

	healthcare professionals and skilled pharmacists.	multidisciplinary healthcare teams in those kinds of situations.” (academic setting/global experience)	
HP1.Health promotion	<b>HP1.1</b> By engaging in initiatives like health promotion, vaccination, screening programs, students were transformed in their abilities to do the interventions within their communities.	“Every year that we go out to the community or the district to educate people about a specified condition. And that practice sort of sets up some fire in them. And they get to be responsible for learning something to teach others. it’s working very well. It looks stressful, but after they go and come back, they’re much interested in helping the community. They’re much more interested in participating in these health promotion exercises and all of those things.” (academic setting)	SP + EP + FC
	<b>HP1.2</b> Seasoned pharmacists and early career practitioners actively engaged in disease awareness day celebrations locally and nationally.	“The health programs, world health days, I’m quite involved in those things. It depends on the team. And the day we actually do it. And the month too is not specified. And it depends on the region, and how to make it there, because of the busy schedules it’s hard to be in multiple regions and organize those meetings effectively.” (community/association setting)	SP + FC + EP + PC
	<b>HP1.3</b> Students were stimulated by experience in rapid testing and treatment of common diseases , especially in their use of technology and patient communication.	“In these communities, pharmacists and student interns are able to do rapid testing, diagnose and treat common diseases like STD’s, malaria, upper respiratory infections etc. an important role of pharmacies and pharmacists in the community.” (community setting)	FC + EP

MI1.Medication information and advice	<b>MI1.1</b> There is evidence of skills in communicating health information to a wide range of audiences using several types of media sources.	“Any public health issue of relevance, we try as much as possible to find a program and we do the public education, either through the media or through face-to-face interaction with the interest groups” (academic/community setting)	FC + SP
	<b>MI1.2</b> Mini laboratory testing services onsite at pharmacies provide more training in medication review, vaccinations, and monitoring parameters, patient education and disease prevention measures, empowering students to participate.	“when results from the mini laboratory comes in, pharmacists use that to educate patient on the disease and preventative measures.” (community setting)	SP + FC
	<b>MI1.3</b> There is practice experience in demonstrating skills in assisting pharmacists in dispensing cost effective medications to patients in their communities.	“Some activities engaged in that prepared pharmacists for public health roles are learning how to use google documents to manage data, communication with other colleagues, follow-up home visits ...” (academic setting)	SP + FC + EP

ER= emergency response; HP= health promotion; MI= medicine information and advice; EP = early practitioners; SP = seasoned pharmacists; FC = KNUST faculty; PC = pharmacy council

## Chapter 5: Discussion

The intent of this research is to describe pharmacists' core public health competencies following graduation. While other studies have explored pharmacists' involvement in public health roles,<sup>6,27,30,32,33</sup> none has explicitly addressed core public health competencies and career readiness. To the best of our knowledge, this is the first study exploring pharmacists' core public health competencies after graduation and the educational processes and outcomes that contribute to readiness of pharmacists to take on public health roles in LMICs. In this research, the key findings describe the following: education processes and outcomes, describing “*how*” and “*why*” the PharmD program works and new practitioners' perceptions of readiness for public health competencies.

### Education Processes and Outcomes

Educational outcomes (knowledge, skills, attitudes and values) are the “observable results or achievements of an educational process” that students acquire through their educational experiences.<sup>112</sup> They help in measuring the effectiveness of an educational system and provide guidance for future improvements.<sup>112</sup> However, in current evaluation practice, there is no one agreed upon definition of “outcome”.<sup>86</sup> LaVelle and Dighe<sup>86</sup> describes an outcomes taxonomy for evaluating educational programs and interventions. For the evaluation study portion of the PharmD educational program, this taxonomy of outcomes was used to describe the outcomes of program participants (i.e., pharmacists) related to public health. In pharmacy, cognition and behavioral outcomes are usually assessed, that is, knowledge base and skill based assessment, respectively. In this study, other education outcomes in addition to cognition and behavior were investigated.

Biological outcomes were excluded because of its concentration on the components of life,<sup>86</sup> which was not in the scope of this inquiry.

The evaluation portion of the PharmD program in this study generated five (5) major themes developed from the data analysis and the education outcomes taxonomy (Table 7): 1) *MEO1 – Graduate pharmacists expressed readiness for public health roles within their communities;* 2) *MEO2 – the PharmD program prepared students in class and during training to apply their knowledge and skills;* 3) *MEO3 – Participants built long lasting relationships in the field;* 4) *MEO4 – Graduate pharmacists developed skills for managing resources in diverse settings;* and 5) *MEO5 – the PharmD program structure and activities helped students to grow professionally.* The evidence of educational outcomes (i.e., attitude, affect, cognition, behavior, status, relationship, economic and environment) were combined to form the major education themes.

### ***Attitude***

Attitude is defined as what participants like or dislike that influences their behavior towards a person or a thing.<sup>86</sup> *Early career practitioners described voicing their desire for introduction to more career opportunities within public health before graduation (EO3.1).* This request may be due to a desire to know career options to look out for or pursue after graduation. Participants reported on how they are already involved in some public health areas of practice, like mental health, but they also discussed areas they were less exposed to in the PharmD program, such as supply chain management, procurement and managing population data. By articulating these needs, participants were advocating for curriculum revision and expansion to include the less exposed areas. Krasna et al., suggested additional analyses of collaborations needed to fill skill

gaps to determine whether core competencies of public health curricula reflect the needs of employers hiring public health graduates today.<sup>113</sup> This may help streamline the curriculum processes for content additions. Participants also reported that such exposure will increase students' interest in public health roles.

The areas of study reported as less emphasized, such as supply chain management and procurement, are important because in Ghana, for example, the majority of medications are imported from the international community (e.g., India, China, UK, US). English is the preferred security language in Ghana, which allows access to medications from English speaking countries. However, it becomes challenging for the public to use medications when it is not in English. This creates further difficulty for providers to ensure timely supply and access to the medications. Notably, drugs on the US and UK markets are sometimes from China and India. But with checks and balances, the US and UK ensure imported drugs are held to their high standards and not counterfeit.

*FIP members/officers reported that experiential training with special populations is emerging for practice readiness. (EO3.2) They requested seminars (lecture for discussing identified topics that are relevant) stating, “it is very important” (FC) to incorporate public health seminars in the curriculum to bring awareness to the roles in public health in the healthcare system where pharmacists can be of most help. Likewise, Agomo et al., suggest increasing public health content in the PharmD curriculum so that students are “well informed” before graduation.*<sup>114</sup>

### ***Affect***

Affect is an experience associated with emotions (a reaction pattern through which an individual experiences an event).<sup>86</sup> Seasoned pharmacists reported satisfaction in learning about

the public health competencies embedded in the curriculum (EO5.1). They explained that, as practicing pharmacists, what they had learned in their PharmD program about the route of vaccine administration, the reasons for choosing that route and why that choice was appropriate, made them feel enthusiastic about taking roles in public health. It appears that the process in learning a skill or a technique associated with competencies is essential and participants described it as a good experience. Similarly, Gerges et al. showed pharmacists reporting satisfaction in their new role as vaccinators, despite the associated increased workload in their community practice sites.<sup>115</sup>

Early career practitioners reported excitement in learning how to store and inject vaccines, (EO5.2) They explained further how knowledge in storing and injecting vaccines allowed them to assist in public health interventions especially during the COVID pandemic.

### ***Cognition***

Cognition is the process of thinking, gaining knowledge and dealing with knowledge.<sup>86</sup> Early career practitioners reported knowing they could use their skill developed in school to assist in outreach programs against disease outbreaks (EO1.1). The data showed the beneficial impact of knowledge in public health acquired through their PharmD program. However, practical training opportunities within the curriculum were limited. Students assigned to complete experiential training at district hospitals had more public health exposure compared to those who were at hospitals in urban areas, who had little to no public health exposure. Agomo et al., findings also showed that broadening pharmacists knowledge about public health helps to expand roles in the field especially when supported with education, awareness, and a triage system.<sup>114</sup>

Seasoned pharmacists reported believing they could use their knowledge and skills in planning community health education activities to assist local and national organizations. (EO1.2)

Even though these skills and knowledge were not mainly for public health roles but were rather general pharmacy practice skills and knowledge, they allowed pharmacists to contribute to support of public health interventions.

### ***Behavior***

Behavior is observable conduct towards one's self or towards another in response to internal or external stimuli.<sup>86</sup> Seasoned pharmacists and early career practitioners stated applying the knowledge they learned in school in the care of patients and in assisting their colleagues. (EO2.1). Also in this research, participants mentioned identifying areas where patients and colleagues needed help and extending such help. For instance, during outbreaks, they researched the specific disease and shared information among colleagues and among patients to educate family members on the disease and its prevention. Communication technologies can change behavior towards areas of health concerns by allowing health-related information to flow broadly and strengthen decision making.<sup>116</sup> Communication plays a key role to ensure medications used are safe and effective.<sup>117</sup>

KNUST faculty worked together with their colleagues to develop the public health courses and training activities (EO2.2). After the lecturers develop the courses in public health, the document is passed onto the College of Health Science for further discussion and approval. Lots of coordination occurs between the teaching team and the college board for final approval.

### ***Status***

Status is the perceived quality of someone or something in relation to others.<sup>86</sup> Early career practitioners reported experiencing growth during their experiential training and improved their

interprofessional skills, such as teamwork and communication, making them ready for professional practice (EO8.1). Some participants shared how pharmacists use relevant and acceptable methods of communication to advocate for quality and accessible health care for their patients. Evidence of readiness in the study includes skills in communicating health information to a wide range of audiences using several types of media sources. This finding is not surprising given that in Africa, exposure to mass communication channels tends to be high. Using radio and television to spread health awareness news in Sub-Saharan Africa has been extensive and its impact has been significant.<sup>118</sup>

Early career practitioners stated that participating in various professional activities made them grow professionally (EO8.2). Through their involvement in health monitoring during internship, students joined organizations to create awareness of recent diseases of public health interest.

### ***Relationship***

Relationship is the way in which two or more concepts, or people are connected, or the state of being connected.<sup>86</sup> Seasoned pharmacists and FIP members/officers discussed building positive relationships with community members and work colleagues. (EO6.1). Creating connections between communities and the pharmacists who serve those communities strengthens access to urgent/first aid treatments prior to hospital or clinic follow up. Within those communities, pharmacists turn to do rapid tests, diagnose, and treat diseases that are common amongst them like malaria, STDs, and upper respiratory tract infections in collaboration with other healthcare teams. Agomo et al. suggested that enhancing public health roles of community pharmacists could

encourage collaboration among health professionals, enhance the pharmacist's profile and extend their role in healthcare delivery."<sup>114</sup>

Early career practitioners' narrated networking with community leaders for mentorship and strengthening relationships. (EO6.2) Participants commented on how such relationships births leadership, shared decision making and resources into the communities. As a result, Early career practitioners reported completing their degree with learned skills in public health to support others' goals. (EO6.3).

### ***Economic***

An economic outcome involves the generation of wealth, understanding scarcity and the decisions that drive behaviors.<sup>86</sup> Seasoned pharmacists discussed their growth in maximizing resources in community pharmacies, including providing cost effective care. (EO4.1). They mentioned certain communities not having affordable health care. In such situation, pharmacists provide alternative medications that are cheaper. However, such practices may be seen as not sustainable due to brain drain, mainly because of favorable professional opportunities that could be offered in other countries. Frustration with healthcare system issues can sometimes lead to pharmacists traveling abroad or considering other job opportunities in other fields.

Seasoned pharmacists reported having many job opportunities with their PharmD degree and that positioned them for work in diverse pharmacy settings. (EO4.2) They also commented on getting effective medications to the diverse but marginalized communities at cost effective prices.

## ***Environment***

An environment outcome is the physical and psychological surroundings or conditions in which a person operates, including the social environment.<sup>86</sup> Early career practitioners communicated that the supportive learning environment in both the classroom and at training sites helps students to participate in activities that ultimately benefit the public when they come to the pharmacy for care. (EO7.1) For instance, at the national level, some pharmacy organizations in Ghana - like the Pharmaceutical Society of Ghana (PSGH) and the Pharmacy Students Federation involve PharmD students and graduate pharmacists in their public health activities like community outreach, disease education and proper use of medications. Exposure to the aforementioned activities, according to participants, opened up and confirmed areas of specialty for their consideration. KNUST faculty described opportunities given to students working towards the PharmD degree to take electives to help them develop their own specialty interest. (EO7.2) Participants hinted at the PharmD program design that it was intended to give pharmacists a good foundation to build upon. Going through the PharmD program, students learn a bit about all aspects of pharmacy education and choosing electives, gives them more information about specific interest areas.

The discussions above demonstrate the need to understand the internal processes (that is, “*how*” and “*why*” the program works).

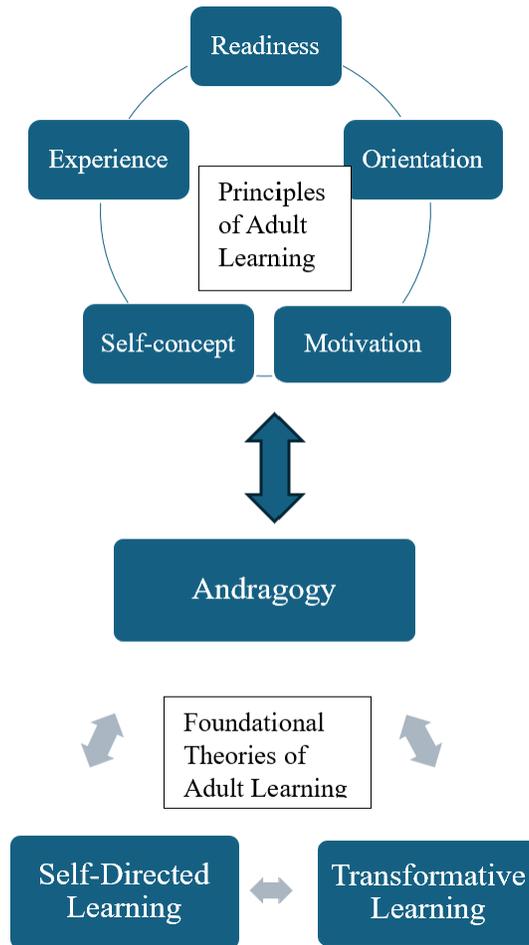
## **Describing “*How*” and “*Why*” the PharmD Program Works**

Using an evaluation model by Haji et al., researchers sought to explore answers to the questions “*how does the program works?*” and “*why does it work?*” and move beyond the “imperative proof” to incorporate clarification of the process.<sup>1</sup> Applying the new evaluation model

was advantageous because it gave new perspectives on the process of “*how*” the planned outcomes were achieved. Having a better understanding of how particular outcomes were achieved or not (i.e., the process), allows a focus on areas the program that could benefit from more oversight, may require prompt action, and/or need improvement. By asking the question “*why does the program work?*”, certain insights are revealed about the internal functioning of the program that may not be visible or explicit. This question enables further identification of the most significant components of the program. Additionally, asking “*how*” and “*why*” questions gives more nuanced detail to share with the KNUST educators. Instead of focusing on only the final results, the additional details give scholars and educators important facts for developing and operating a successful and efficient program.

In drawing understanding and insight from the study through a different lens, three foundational adult learning theories (andragogy, self-directed learning, and transformative learning) were used, along with the principles of andragogy developed by Knowles about how adults learn which are; self-concept, experience, readiness, orientation, and motivation<sup>119</sup> (Figure 9).

**Figure 9.** Summary of Foundational Theories and Principles of Adult Learning<sup>119</sup>



Developed from The adult learner<sup>119</sup>

In this research, explanation for “*how the program works*” is represented by four major themes (Table 13). These include how the program works by *frequent organization of seminars about public health in pharmacy, providing tools and sharing knowledge that are meaningful for caring for diverse populations.* (HPW1.1) One of the three foundational adult learning theories, transformative learning, supports this finding as it focuses on the cognitive process of meaning making described in Merriam.<sup>120</sup> Through seminars organized by program directors, participants

are able to make sense of their experience resulting in a change in perspective, attitude, or belief<sup>120</sup> creating transformation. The findings also revealed the importance of testing students on specific public health related questions about the competencies they are expected to know, which further triggers interest in knowing more about the competencies. The evidence showcases an instance where through assessment by testing, adults are being helped to learn, i.e., andragogy in adult learning theory.<sup>121</sup> Adult learners are described based on the assumptions underlying andragogy, including independent self-concept, life experiences (rich resources for learning), learning needs closely related to changing social roles, and motivation by internal factors to learn.<sup>121</sup>

Knowles suggests that the testing environment in this case should make participants feel accepted, respected, and supported.<sup>121</sup> Further, there should be mutuality between teachers and the class as joint inquirers.”<sup>121</sup> Hence, even though testing specific public health areas triggers interest, *the practical experience in applying the competencies is empowering.* (PDF1.1)

In addition, *mandating pharmacists to take continuing professional development (CPDs) courses in areas of public health concern as a requirement for retention*, creates a path for deepening their understanding and their experience in public health. (HPW1.3) This finding speaks to the characteristics of adult learners described by Knowles as changing their perspective from one which postpones the application of knowledge to one which sees the immediacy of knowledge application.<sup>119</sup> Instruction should allow adult learners to discover knowledge for themselves without depending on others because adults are self-directed. Learners should be offered guidance and help when mistakes are made, but it’s important to take “participants into consideration when determining their needs.”<sup>121</sup>

Encouraging students to use their knowledge, skills, and qualifications to perform public health duties to help students build confidence in themselves, (HPW1.4) was another finding.

Using the knowledge and skill repeatedly is an advantage for the learner since the experience makes them conversant and comfortable to perform the public health roles.

The second major adult learning theory helps to distinguish adult learners from others, in that their self-directed nature allows them to perform public health duties as part of everyday life.<sup>122</sup> They undertake learning opportunities in a systematic way without dependence on instructor or the classroom, but continuously build assurance in themselves with encouragement.<sup>122</sup> The findings in this research shows this under “stimulating”, where students activities in public health provoked students interest in developing their own skills.

The key elements describing “*why the program works*” are represented by six major themes (Table 13). These show the program works because:

First, certain elements, such as understanding basic social, economic, political, and ethical concepts within the core of the public health training, supports students’ learning in taking control of the choices they make during public health activities. (WPW1.1) The expertise and years of experience the program directors have influences the content of the curriculum. By bringing their experience to classroom instruction on key public health issues, it enriches learning and use of the public health competencies.

Second, the teaching and training design for the public health competencies (emergency response, health promotion, medicine information and advice) helps students to integrate and get involved in public health related activities, which is evident in the student’s improvement in developing community interventions. (WPW1.2) Even though the theoretical aspect of teaching is evidently clear, participants expressed a need for curriculum review to fill the gap for more practical training and exposure. Some suggested introduction of public health electives in the curriculum, which is currently not an option. New pharmacy programs can adopt curriculum from

existing ones with years of experience. Perhaps, Ghana and other new pharmacy programs in the LMICs can consider developing curriculums that focuses more on local needs assessment outcomes if their initial curriculum was adopted from existing pharmacy program(s). This will allow the addition of public health courses that are of interest to the program and the community.

Third, the minimum qualification for registering as pharmacists requires attaining some level of public health training, assessed through practical test and case study. (WPW1.3) This form of assessment could show students' knowledge and understanding in the tested areas as they continuously learn about the competencies.

Fourth, Pharmacy Council, Ghana mandate requirements related to public health for institutions and pharmacists proving to be stimulating interest in public health roles. These activities ensure further engagement to post graduation, which is an important part of the learner's process. For that reason, there may be changes in practice that would require more learning and practice training.

Fifth, the program promotes students' involvement in policy development in support of public health and safety interventions at their experiential sites. (WPW1.5) Although time spent at experiential sites may not be enough for complete policy development, findings show participants built confidence in making decisions about affordability, access to healthcare, education, and immunization. (SPP1.2) They also describe their involvement in these public health opportunities as empowering. (SPP1.2)

Sixth, public health practice training enhances students' hands-on experience, and the application reinforces ongoing interest and curiosity in students to be more involved in local and international projects. (WPW1.6) The theme highlights what early career practitioners describe as

demonstrating, to show proof of practical learning and to solidify skills. (ECP1.2) This should inform educators and policy makers about expanding opportunities for practice experiences.

## New Practitioners' Perceptions of Readiness for Public Health Competencies

Many advocates of learner readiness use different terms and concepts to describe the learner. A few that predominate are self-directed learner, learner attitudes and beliefs, learner intellectual character, self-regulation, self-efficacy and learning strategies.<sup>119,122</sup> To some extent, the expectation is that readiness integrates and intertwines with learner autonomy and self-regulated learning to effectively control and monitor learners' motivation, cognition, and behaviors.<sup>119</sup> Knowles argues that adults are motivated, oriented and go through experiences differently and these ideas are particularly critical in professional education.<sup>119</sup> Because, the experiences focuses on identifying and dealing with differences between what the learners already know and what they learn within the experiential components of the program.<sup>119,122</sup>

The findings in the study show evidence of readiness for public health competencies in the GbCF (i.e., emergency response, health promotion, and medicine information and advice). Of the five adult learning theory principles used in this study, experience, readiness, and motivation were more visible. For example, participants reported how *they were stimulated by experience in rapid testing and treatment of common diseases, especially in their use of technology and patient communication*. (HP1.3) Program directors also *mentioned how students training at the hospital gave students some experience in how vaccines are given*. (PDF1)

The results indicate early career graduates' readiness for public health competencies in the GbCF, for instance under emergency response, there is evidence of participants using concepts of

epidemiology to interpret and use reported data in assessing where help is needed in multidisciplinary teams. (Table 19) This speaks to the principle of self-concept where learners are autonomous and self-directing in their learning. Knowing the competencies, the results show they are able to take initiative and assist in emergency response within their communities. (ER1.1)

In the findings, early career graduates have responded positively to experiential learning. They bring prior experience in addition to resources to identify opportunities for better ways of engaging with interdisciplinary teams professionally in all settings. Some of their responses also show *proof of transformation in their involvement in public health initiatives like vaccinations and screening programs*. (HP1.1)

Despite the fact that there are some reported gaps in having more practice experience in public health, *participants reported their active involvement in disease awareness day celebrations around the world*. (HP1.2) Locally, *their exposure to rapid testing and treatment of common diseases within the community increased their use of technology and communication with patients*. (HP1.3) They explained how this motivates them to value what they have learned.

When it comes to medicine information and advice, the result in this study is distinct in illustrating areas early career graduates were influential. For example, they shared how opportunities in some community pharmacy's allowed them to practice in a mini laboratory setting within the pharmacy. They receive extra training in medication review, vaccinations, disease prevention measures, monitoring parameters and patient education. (MI1.2)

## Recommendations

The audience for these recommendations will be KNUST educators, early career practitioners, seasoned pharmacists, FIP members/officers and researchers.

### KNUST Educators

Faculty members advocated for more practice training in public health that is strategically designed to give students more hands-on experiences in the field. *Public health program directors argued that when students see and participate in more public health activities, it provokes their interest in developing more skills* (PDF6) and to be better prepared.

Participants from the program expressed limited exposure to career options in public health. (EO3.1). Educators at KNUST should consider introducing early career practitioners to more career opportunities as an avenue to showcase a variety of possible areas of employment for the students in the program after graduation.

Participants also found it challenging to apply the theoretical knowledge in some practice areas. For instance, those interested in research acknowledged learning about epidemiology, data collection, and analysis of data, which was helpful. Yet, they could not manage data when they started practicing because there were aspects of the work that they fell short in to conduct full research in the community, when needed. This could be a good opportunity for collaboration with other healthcare providers with knowledge and skills in those deficient areas. Collaboration could also create a learning environment for developing certain skills that were previously missing.

KNUST could consider advanced training, including dual degree programs, with the PharmD degree. This would be an opportunity to fill some of the gaps in skills and in knowledge. It would also broaden the scope of career paths for graduates from the program and further assist in unemployment/workforce development. Shannon et al. suggests more support to advanced

training opportunities to enhance the future of the profession.<sup>123</sup> Exposure to other fields in collaboration with a PharmD degree presents options in careers, to avoid the idea of practicing in pharmacy only. DiPiro recommends pharmacy programs to establish and promote dual degrees to meet student needs and interests, as well as to expand career opportunities.<sup>124</sup>

Training can be extended to offer students a chance to repeat and test their knowledge as they become empowered and build certainty and ease in using their public health skills. From the study, *students have the knowledge, tools, and the confidence in learning the theory while gaining some experience in applying the competencies.* (PDF1) This may be a way of improving their confidence during health emergencies when they are needed to assist in caring for a community or population.

Authors have pointed out benefits of using simulations and also proposed the use of simulation-based education in pharmacy curriculum.<sup>125-129</sup> Korayem et. al., suggest simulation-based education methods as crucial for developing skills such as teamwork, decision making, and communication that are difficult to achieve by conventional methods.<sup>125</sup> Using simulations as part of the curriculum may support the call for more hands-on training and be an additional training tool for students to develop their professional skills especially in emergency preparedness.

### Early Career Practitioners and Seasoned Pharmacists

This duo could be the voice of pharmacy practitioners in pharmacy organizations, citing their personal public health competency experiences within the PharmD program and in practice. In such organizations, they are positive change agents, mentors, and role models for others in the field, while advocating for those yet to complete the program. One area in the program where mentoring can be beneficial is in *guiding new students through various activities and engagement*

*to improve relationships with community leaders.* (EO6.2) As an organization, practitioner voices could be stronger in suggesting areas for improvement in the program. Being part of the programs' stakeholders, they can support KNUST in reviewing the public health competency areas periodically.

### FIP Members/Officers in the Academic Section

Policy development and implementation is critical for change to effectively have an impact. The position of FIP as an international organization can be influential in holding schools of pharmacy accountable for addressing curriculum issues. The organization can do this by helping the schools to enhance the public health competencies within their program. Knowing the importance of addressing these competencies in PharmD programs efficiently and understanding the impact on training pharmacists to be ready for public health roles worldwide, it is imperative for the organization to keep making recommendations to pharmacy schools.

### Researchers

Future research should seek the perspectives of current students. Researchers should also identify evidence concerning the addition and teaching of specific content areas, such as supply chain management, procurement, and counterfeit drugs.

Researchers may also consider the impact of technology advancement in pharmacy practice and its benefit on public health interventions within communities or even within country. Compared to the United States, there are robots, which help with medication preparation, pulling medications and also doing deliveries. That is not currently an option in Ghana, but it will be beneficial for the government agencies (i.e., Ministry of Health) and private entities to consider incorporating its use in dispensing processes.

## Limitations

First, the proposed data collection method (i.e., focus group discussion) was adjusted as the research evolved, to be able to include all the participant groups. This was a limitation because we did not benefit from cross participant conversation, which could have allowed for contrasting views and sufficient difference in perspectives among participants.

This study did not include students. There could be additional information that may have been missed from that group of participants. Being one of the main stakeholders, students are directly and indirectly impacted by the programs curriculum and their perspectives could have shared more light on their experiences.

Adding administrators as one of the study groups without recognizing their roles in different educational institutions did not benefit the study. Researchers learned that the structure at KNUST positioned administrators in a different role than what they were used to in other institutions outside Ghana.

## Conclusion

An evaluation approach was used to describe how and why the program works (Aim 1). This approach included development of an initial logic model, document review that guided stakeholder inquiry, and an enhanced logic model including evidence of educational outcomes. Pharmacists readiness for public health roles is evident in their cognition, behavior, and attitudes, among other education outcomes. However, knowing the competencies alone is not adequate. Practical training in addition to theoretical knowledge is essential for public health roles. Evidence was provided that supports adequate theoretical knowledge, the impact of program directors years of experience in developing competency-based curriculum and in teaching, and overall support for

learners. Although the public health competencies are fairly covered in the PharmD program, there are gaps in key public health areas, such as supply chain management, procurement, and more practice.

# Bibliography

1. Haji F, Morin M, Parker K. Rethinking programme evaluation in health professions education: beyond 'did it work?' *Med Educ.* 2013;47(4):342-351. doi:10.1111/medu.12091
2. Jungnickel PW, Kelley KW, Hammer DP, Haines ST, Marlowe KF. Addressing competencies for the future in the professional curriculum. *Am J Pharm Educ.* 2009;73(8):156. doi:10.5688/aj7308156
3. Koster A, Schalekamp T, Meijerman I. Implementation of competency-based pharmacy education (CBPE). *Pharmacy.* 2017;5(1):10. doi:10.3390/pharmacy5010010
4. Medina M. Does competency-based education have a role in academic pharmacy in the United States? *Pharmacy.* 2017;5(1):13. doi:10.3390/pharmacy5010013
5. Lucey CR, Thibault GE, ten Cate O. Competency-based, time-variable education in the health professions: crossroads. *Acad Med.* 2018;93(3S):S1-S5. doi:10.1097/ACM.0000000000002080
6. Allan J, Barwick TA, Cashman S, et al. Clinical prevention and population health. *Am J Prev Med.* 2004;27(5):471-476. doi:10.1016/j.amepre.2004.08.010
7. Strand MA. *Public Health and the CAPE 2013 Educational Outcomes.*; 2017. Accessed November 27, 2024. <https://www.aacp.org/sites/default/files/2017-10/PublicHealthSIGCAPEpaper.pdf>
8. International Pharmaceutical Federation. *Executive Summary. FIP Global Competency Framework. Supporting the Development of Foundation and Early Career Pharmacists Version 2.*; 2020. <https://www.fip.org/file/5127>
9. International Pharmaceutical Federation. About FIP education. Accessed November 6, 2021. <https://www.fip.org/fip-education>
10. Bruno AF. *The Feasibility, Development and Validation of a Global Competency Framework for Pharmacy Education.* 2011. <https://www.proquest.com/dissertations-theses/feasibility-development-validation-global/docview/1794080393/se-2?accountid=135034>
11. Hill LH, Delafuente JC, Sicat BL, Kirkwood CK. Development of a competency-based assessment process for advanced pharmacy practice experiences. *Am J Pharm Educ.* 2006;70(1):01. doi:10.5688/aj700101
12. Palomba CA, Banta TW. *Assessing Student Competence in Accredited Disciplines: Pioneering Approaches to Assessment in Higher Education.* Stylus Publishing; 2001.

13. Zeitoun A. *Global Development of Pharmacy Education.*; 2011. Accessed November 26, 2024.  
<https://archivepp.com/storage/models/article/qTUxE89VbTuMaDIkoRCwctYEjviLJ2fS4otFGih0euuLU9zFdBOms2PQtVwJ/global-development-of-pharmacy-education.pdf>
14. Cipolle RJ, Strand LM MP. *Pharmaceutical Care Practice: The Clinician's Guide.* McGraw Hill; 2012.
15. Hepler CD, Strand LM. Opportunities and responsibilities in pharmaceutical care. *Am J Health Syst Pharm.* 1990;47(3):533-543. doi:10.1093/ajhp/47.3.533
16. Joint Commission of Pharmacy Practitioners J. *The Pharmacists' Patient Care Process.*; 2014. <https://jcpp.net/wp-content/uploads/2016/03/PatientCareProcess-with-supporting-organizations.pdf>
17. Hall K, Musing E, Miller DA, Tisdale JE. Experiential training for pharmacy students: Time for a new approach. *Can J Hosp Pharm.* 2012;65(4). doi:10.4212/cjhp.v65i4.1159
18. Shaun E. Gleason, Jordan R. Covvey, Jeanine P. Abrons, Yen Dang, See-Won Seo, Toyin Tofade, Gina M. Prescott, Emily P. Peron, Santhi Masilamani NZA. *Global Pharmacy Education SIG CAPE Paper.*; 2015. [https://www.aacp.org/sites/default/files/2017-10/GPE\\_CAPE\\_Paper\\_November\\_2015.pdf](https://www.aacp.org/sites/default/files/2017-10/GPE_CAPE_Paper_November_2015.pdf)
19. Rhoney DH, Singleton S, Nelson NR, Anderson SM, Hubal R. Forces driving change in pharmacy education: Opportunities to take academic, social, technological, economic, and political into the future. *J AM COLL CLIN PHARM.* 2021;4(5):639-651. doi:10.1002/jac5.1407
20. Park YS, Riddle J, Tekian A. Validity evidence of resident competency ratings and the identification of problem residents. *Med Educ.* 2014;48(6):614-622. doi:10.1111/medu.12408
21. Katoue MG, Schwinghammer TL. Competency-based education in pharmacy: a review of its development, applications, and challenges. *J Eval Clin Pract.* 2020;26(4):1114-1123. doi:10.1111/jep.13362
22. Chuenjitwongsa S, Oliver RG, Bullock AD. Competence, competency-based education, and undergraduate dental education: a discussion paper. *Eur J Dent Educ.* 2018;22(1):1-8. doi:10.1111/eje.12213
23. Koduah A, Kretchy I, Sekyi-Brown R, Asiedu-Danso M, Ohene-Agyei T, Duwiejua M. Education of pharmacists in Ghana: evolving curriculum, context and practice in the journey from dispensing certificate to doctor of pharmacy certificate. *BMC Med Educ.* 2020;20(1):475. doi:10.1186/s12909-020-02393-x
24. Pharmacy Council - Ghana. Accredited pharmacy programs & schools. Accessed September 3, 2022.  
[pcghana.org/education\\_and\\_training/pharmacy\\_schools\\_programs/](http://pcghana.org/education_and_training/pharmacy_schools_programs/)

25. Accreditation of tertiary institutions. Ghana tertiary education commission. 2020. Accessed July 10, 2024. <https://gtec.edu.gh/>
26. Ghana Public Health Act 851. *Public Health Act, 2012.*; 2012.
27. Mager ND, Moore TS. Healthy people 2030: Roadmap for public health for the next decade. *Am J Pharm Educ.* 2020;84(11):8462. doi:10.5688/ajpe8462
28. American Public Health Association. The role of the pharmacist in public health. APHA. 2006. Accessed August 18, 2022. <https://www.apha.org/policies-and-advocacy/public-health-policy-statements/policy-database/2014/07/07/13/05/the-role-of-the-pharmacist-in-public-health>
29. Strand MA, Mager NAD, Hall L, Martin SL, Sarpong DF. Pharmacy contributions to improved population health: Expanding the public health roundtable. *Prev Chronic Dis.* 2020;17:200350. doi:10.5888/PCD17.200350
30. U.S Department of Health and Human Services; Increase core clinical prevention and population health education in pharmacy schools. Healthy People 2030. 2020. Accessed August 18, 2022. <https://health.gov/healthypeople/objectives-and-data/browse-objectives/schools/increase-core-clinical-prevention-and-population-health-education-pharmacy-schools-ecbp-d12>
31. Institute of Medicine. *The Future of the Public's Health in the 21st Century.* Washington (DC): National Academies Press (US); 2002. <https://www.ncbi.nlm.nih.gov/books/NBK221239/>
32. Boyd RP, DeVold TA, DiPietro Mager NA, Burke WJ. Healthy people and interested students: Medical and pharmacy students' knowledge and attitudes regarding public health. *Pharmacy.* 2021;9(4):176. doi:10.3390/pharmacy9040176
33. Alfadl AA, Siddeeg K, Anaam MS, Alharbi RA, Aljutayli MA, Alsaheed HM. Saudi pharmacy students' perceived knowledge and attitude on their role in public health services. *Int J Pharm Pract.* 2022;30(5):472-478. doi:10.1093/ijpp/riac029
34. Accreditation Council For Pharmacy Education. *Accreditation Standards and Key Elements for the Professional Program in Pharmacy Leading to the Doctor of Pharmacy Degree.*; 2015. <https://www.acpe-accredit.org/pdf/Standards2016FINAL2022.pdf>
35. Scriven M. *Evaluation Thesaurus.* Sage Publications; 1991.
36. King JA. Bringing evaluative learning to life. *Am J Eval.* 2008;29(2):151-155. doi:10.1177/1098214008316423
37. Patton MQ. A utilization-focused approach to contribution analysis. *Eur Eval Soc.* 2012;18(3):364-377. doi:10.1177/1356389012449523

38. Preskill H. Evaluation's second act. *Am J Eval.* 2008;29(2):127-138. doi:10.1177/1098214008316896
39. Weiss CH. Have we learned anything new about the use of evaluation? *Am J Eval.* 1998;19(1):21-33. doi:10.1177/109821409801900103
40. Fitzpatrick, J.L, Sanders, J.r, & Worthen BR. *Program Evaluation: Alternative Approaches and Practical Guidelines.* Pearson Education, Inc; 2004.
41. Weiss CH. Evaluation and poverty reduction. In: *Theory-Based Evaluation: Theories of Change for Poverty Reduction Programs.* 1st ed. Routledge; 2001.
42. Funnell S, Rogers P. *Purposeful Program Theory: Effective Use of Theories of Change and Logic Models.* 1st ed. Jossey-Bass; 2011.
43. Rogers PJ, Weiss CH. Theory-based evaluation: Reflections ten years on: theory-based evaluation: Past, present, and future. *New Dir Eval.* 2007;2007(114):63-81. doi:10.1002/ev.225
44. Weiss CH. How can theory-based evaluation make greater headway? *Eval Rev.* 1997;21(4):501-524. doi:10.1177/0193841X9702100405
45. Secretariate TB of C. Theory-based approaches to evaluation: Concepts and practices. Government of Canada. 2021. <https://www.canada.ca/en/treasury-board-secretariat/services/audit-evaluation/evaluation-government-canada/theory-based-approaches-evaluation-concepts-practices.html>
46. Birckmayer JD, Weiss CH. Theory-based evaluation in practice. *Eval Rev.* 2000;24(4):407-431. doi:10.1177/0193841X0002400404
47. Reinholz DL, Andrews TC. Change theory and theory of change: what's the difference anyway? *Int J STEM Educ.* 2020;7(1):2. doi:10.1186/s40594-020-0202-3
48. Belcher BM, Davel R, Claus R. A refined method for theory-based evaluation of the societal impacts of research. *MethodsX.* 2020;7:100788. doi:10.1016/j.mex.2020.100788
49. Lawton B, Brandon P, Cicchinelli L, Kekahio W. Logic models: A tool for designing and monitoring program evaluations. Accessed August 24, 2022. [https://ies.ed.gov/ncee/edlabs/regions/pacific/pdf/reL\\_2014007.pdf](https://ies.ed.gov/ncee/edlabs/regions/pacific/pdf/reL_2014007.pdf)
50. Funnell S, Rogers P. *Purposeful Program Theory: Effective Use of Theories of Change and Logic Models.* 1st ed. John Wiley & Sons, Inc. ; 2011.
51. Gullickson AM. The whole elephant: defining evaluation. *Eval Program Plann.* 2020;79:101787. doi:10.1016/j.evalprogplan.2020.101787
52. Wanzer DL. What is evaluation?: perspectives of how evaluation differs (or not) from research. *Am J Eval.* 2021;42(1):28-46. doi:10.1177/1098214020920710

53. Barker C, Pistrang N, Elliott R. *Research Methods in Clinical Psychology: An Introduction for Students and Practitioners*. John Wiley & Sons; 2016.
54. Hackbarth D, Gall GB. Evaluation of school-based health center programs and services: The whys and hows of demonstrating program effectiveness. *Nur Clin North Am*. 2005;40(4):711-724. doi:10.1016/j.cnur.2005.07.008
55. Montrosse-Moorhead B, Bellara AP, Gambino AJ. Communicating about evaluation: A conceptual model and case example. *J MultiDiscip Eval*. 2017;13(29):16–30. [https://journals.sfu.ca/jmde/index.php/jmde\\_1/article/view/473](https://journals.sfu.ca/jmde/index.php/jmde_1/article/view/473)
56. Weiss C. Rooting for evaluation. In: *Evaluation Roots Tracing Theorists Views and Influences*. Sage; 2004.
57. LaVelle JM. Planning for evaluation's future. *Am J Eval*. 2011;32(3):362-375. doi:10.1177/1098214011398953
58. Levin-Rozalis M. Evaluation and research: Differences and similarities. *Can J Program Eval*. 2003;Vol. 18 No:1-31. <https://levin-rozalis.com/wp-content/uploads/2015/05/evaluation-and-research.pdf>
59. Patton MQ. *Qualitative Research and Evaluation Methods*. 3rd ed. Sage; 2002.
60. Mathisone S. What is the difference between evaluation and research - and why do we care? In: *Fundamental Issues in Evaluation*. Smith & Brandon; 2008:183-196.
61. Guenther J, Arnott A. Legitimising evaluation for vocational learning: From bastard sibling to equal brother. In: *AVETRA 14th Annual Conference*. ; 2011. [http://www.covaluator.net/docs/S2.3\\_legitimising\\_evaluation\\_VET.pdf](http://www.covaluator.net/docs/S2.3_legitimising_evaluation_VET.pdf)
62. Davidson EJ. How “beauty” can bring truth and justice to life. *New Dir Eval*. 2014;2014(142):31-43. doi:10.1002/ev.20083
63. Cleland J, Durning S. *Researching Medical Education*. John Wiley & Sons; 2015.
64. Regehr G. It's NOT rocket science: Rethinking our metaphors for research in health professions education. *Med Educ*. 2010;44(1):31-39. doi:10.1111/j.1365-2923.2009.03418.x
65. Cook DA, Bordage G, Schmidt HG. Description, justification and clarification: A framework for classifying the purposes of research in medical education. *Med Educ*. 2008;42(2):128-133. doi:10.1111/j.1365-2923.2007.02974.x
66. Faculty of Pharmacy and Pharmaceutical Sciences. *KNUST Doctor of Pharmacy (PHARM D) Syllabus*; 2021.
67. DailyGuideNetwork. First batch of KNUST PharmD graduates.<https://dailyguidenetwork.com/first-batch-of-knust-pharm-d-students-graduates/>. July 27, 2018. Accessed November 25, 2024.

68. Esseku YY. Ghana college of pharmacists. PowerPoint slideshow. Presented at: The 89<sup>th</sup> Annual General Meeting (AGM) of the Pharmaceutical Society of Ghana; September 24<sup>th</sup> to 27<sup>th</sup>, 2024, Kumasi, Accessed November 28, 2024.
69. Yin RK. How to do better case studies. In: *The SAGE Handbook of Applied Social Research Methods*. SAGE Publications Inc.; 2009:261.
70. Yin R. *Case Study Research: Design and Methods*. SAGE Publications Inc.; 2009.
71. Stake RE. *The Art of Case Study Research*. SAGE Publications Inc.; 1995.
72. Yin R. *Case Study Research; Design and Method*. 3rd ed. SAGE Publications Inc.; 2003.
73. Creswell JW. *Qualitative Inquiry & Research Design: Choosing among Five Approaches*. 2nd ed. SAGE Publications; 2007.
74. Birks M, Chapman Y, Francis K. Memoing in qualitative research. *J Res Nurs*. 2008;13(1):68-75. doi:10.1177/1744987107081254
75. Cassell C, Cunliffe A, Grandy G. *The SAGE Handbook of Qualitative Business and Management Research Methods: History and Traditions*. SAGE Publications Ltd; 2018. doi:10.4135/9781526430212
76. Morgan DL, Ataie J, Carder P, Hoffman K. Introducing dyadic interviews as a method for collecting qualitative data. *Qual Health Res*. 2013;23(9):1276-1284. doi:10.1177/1049732313501889
77. Seale C, Charteris-Black J, Dumelow C, Locock L, Ziebland S. The effect of joint interviewing on the performance of gender. *Field methods*. 2008;20(2):107-128. doi:10.1177/1525822X07313837
78. Taylor B, De Vocht H. Interviewing separately or as couples? Considerations of authenticity of method. *Qual Health Res*. 2011;21(11):1576-1587. doi:10.1177/1049732311415288
79. Morgan DL. Focus groups and social interaction. In: Gubrium J, Holstein J, eds. *Handbook of Interview Research*. 2nd ed.; 2012:161-176.
80. Leung FH, Savithiri R. Spotlight on focus groups. *Can Fam Physician*. 2009;55(2):218-219. <http://www.cfp.ca/content/55/2/218.abstract>
81. Tong A, Sainsbury P, Craig J. Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. *Int J Qual Health C*. 2007;19(6):349-357. doi:10.1093/intqhc/mzm042
82. Tolley EE, Ulin PR, Mack N, Robinson ET, Succop SM. *Qualitative Methods in Public Health: A Field for Applied Research*. 2nd ed. John Wiley & Sons; 2016.

83. Saldana J. *The Coding Manual for Qualitative Researchers*. 2nd ed. SAGE Publications Ltd; 2021.
84. Campbell JL, Quincy C, Osserman J, Pedersen OK. Coding in-depth semistructured interviews. *Sociol Method Res*. 2013;42(3):294-320. doi:10.1177/0049124113500475
85. Lingard L. Beyond the default colon: effective use of quotes in qualitative research. *Perspect Med Educ*. 2019;8(6):360-364. doi:10.1007/S40037-019-00550-7
86. LaVelle J, Dighe S. A transdisciplinary model of program outcomes for enhanced evaluation practice. *Can J Program Eval*. 2020;35(1):20-34. doi:10.3138/cjpe.61660
87. Fereday J, Muir-Cochrane E. Demonstrating rigor using thematic analysis: A hybrid approach of inductive and deductive coding and theme development. *Int J Qual Methods*. 2006;5(1):80-92. doi:10.1177/160940690600500107
88. Braun V, Clarke V. Using thematic analysis in psychology. *Qual Res Psychol*. 2006;3(2):77-101. doi:10.1191/1478088706qp063oa
89. Lamba N, Van Tonder A, Raghavan A. Unpacking qualitative methodology to explore experiences of mothers with children with autism spectrum disorder in the UAE: A thematic analysis inquiry. *Int J Qual Methods*. 2022;21:160940692211102. doi:10.1177/16094069221110295
90. Brady SR. Utilizing and adapting the delphi method for use in qualitative research. *Int J Qual Methods*. 2015;14(5):160940691562138. doi:10.1177/1609406915621381
91. Naeem M, Ozuem W, Howell K, Ranfagni S. A step-by-step process of thematic analysis to develop a conceptual model in qualitative research. *Int J Qual Methods*. 2023;22. doi:10.1177/16094069231205789
92. de Kleijn R, Van Leeuwen A. Reflections and review on the audit procedure. *Int J Qual Methods*. 2018;17(1):160940691876321. doi:10.1177/1609406918763214
93. Akkerman S, Admiraal W, Brekelmans M, Oost H. Auditing quality of research in social sciences. *Qual Quant*. 2008;42(2):257-274. doi:10.1007/s11135-006-9044-4
94. Cooksy LJ, Gill P, Kelly PA. The program logic model as an integrative framework for a multimethod evaluation. *Eval Program Plann*. 2001;24(2):119-128. doi:10.1016/S0149-7189(01)00003-9
95. Van Rijswijk M, Akkerman SF, Schaap H, van Tartwijk J. Past perceptions and future expectations: Sensed dis/continuity at the start of teacher education. *Teach Teach Educ*. 2016;58:99-108. doi:10.1016/j.tate.2016.05.002
96. Dobber M, Akkerman SF, Verloop N, Admiraal W, Vermunt JD. Developing designs for community development in four types of student teacher groups. *Learn Environ Res*. 2012;15(3):279-297. doi:10.1007/s10984-012-9116-4

97. Ehlen CGJM, van der Klink MR, Boshuizen HPA. Unravelling the social dynamics of an industry–school partnership: social capital as perspective for co-creation. *Stud Contin Educ.* 2016;38(1):61-85. doi:10.1080/0158037X.2015.1030610
98. Van der Wal MM, de Kraker J, Kroeze C, Kirschner PA, Valkering P. Can computer models be used for social learning? A serious game in water management. *Environ Model Softw.* 2016;75:119-132. doi:10.1016/j.envsoft.2015.10.008
99. Poria Y, Reichel A, Brandt Y. The flight experiences of people with disabilities: An exploratory study. *J Travel Res.* 2010;49(2):216-227. doi:10.1177/0047287509336477
100. Akkerman S, Admiraal W, Brekelmans M, Oost H. Auditing quality of research in social sciences. *Qual Quant.* 2008;42(2):257-274. doi:10.1007/s11135-006-9044-4
101. Poduthase H. Rigor in qualitative research: Promoting quality in social science research. *Res J Recent Sci.* 2015;Vol. 4:25-28.
102. Rose J, Johnson CW. Contextualizing reliability and validity in qualitative research: Toward more rigorous and trustworthy qualitative social science in leisure research. *J Leis Res.* 2020;51(4):432-451. doi:10.1080/00222216.2020.1722042
103. Lewis J. Redefining qualitative methods: Believability in the fifth moment. *Int J Qual Methods.* 2009;8(2):1-14. doi:10.1177/160940690900800201
104. National University. Trustworthiness of qualitative data. In. Chapter 4 data and statistics. April 19, 2024. Accessed July 18, 2024. <https://resources.nu.edu/c.php?g=1007180&p=7392379>
105. Birt L, Scott S, Cavers D, Campbell C, Walter F. Member checking. *Qual Health Res.* 2016;26(13):1802-1811. doi:10.1177/1049732316654870
106. Varpio L, Ajjawi R, Monrouxe L V, O'Brien BC, Rees CE. Shedding the cobra effect: Problematising thematic emergence, triangulation, saturation and member checking. *Med Educ.* 2017;51(1):40-50. doi:10.1111/medu.13124
107. Johnson R, Christensen L. *Educational Research: Quantitative, Qualitative, and Mixed Approaches.* 7th ed. SAGE Publications Inc; 2019.
108. Thurmond VA. The point of triangulation. *J Nurs Scholarsh.* 2001;33(3):253-258. doi:10.1111/j.1547-5069.2001.00253.x
109. Olmos-Vega FM, Stalmeijer RE, Varpio L, Kahlke R. A practical guide to reflexivity in qualitative research: AMEE Guide No. 149. *Med Teach.* 2023;45(3):241-251. doi:10.1080/0142159X.2022.2057287
110. Varpio L, Paradis E, Uijtdehaage S, Young M. The distinctions between theory, theoretical framework, and conceptual framework. *Acad Med.* 2020;95(7):989-994. doi:10.1097/ACM.0000000000003075

111. LaVelle J, Dighe S. A transdisciplinary model of program outcomes for enhanced evaluation practice. *Can J Program Eval.* 2020;35(1):92-103. doi:10.3138/CJPE.61660
112. Naskath J, Rajakumari R, Rabiya MS, Shali A, Sampathkumar N. Outcome-Based Education Through E-Learning Pedagogy. In: *Innovative Frameworks and Inclusive Models for Online Learning.* ; 2023:326-346. doi:10.4018/978-1-6684-9072-3.ch017
113. Krasna H, Kornfeld J, Cushman L, Ni S, Antoniou P, March D. The new public health workforce: employment outcomes of public health graduate students. *J Public Health Man.* 2021;27(1):12-19. doi:10.1097/PHH.0000000000000976
114. Agomo CO, Ogunleye J, Portlock J. Strategies enhancing the public health role of community pharmacists: A qualitative study. *J Pharm Health Serv Res.* 2016;7(2):97-104. doi:10.1111/jphs.12131
115. Gerges S, Peter E, Bowles SK, et al. Pharmacists as vaccinators: An analysis of their experiences and perceptions of their new role. *Hum Vaccin Immunother.* 2018;14(2):471-477. doi:10.1080/21645515.2017.1403695
116. Iacoella F, Gassmann F, Tirivayi N. Which communication technology is effective for promoting reproductive health? Television, radio, and mobile phones in sub-Saharan Africa. Olapeju BB, ed. *PLoS One.* 2022;17(8):e0272501. doi:10.1371/journal.pone.0272501
117. Kow CS, Hasan SS. Pharmacist-patient communication amid COVID-19 pandemic: A review of available options and potential impact. *Br J Pharm.* 2021;6(1). doi:10.5920/bjpharm.836
118. Iacoella F, Gassmann F, Tirivayi N. Which communication technology is effective for promoting reproductive health? Television, radio, and mobile phones in sub-Saharan Africa. Olapeju BB, ed. *PLoS One.* 2022;17(8). doi:10.1371/journal.pone.0272501
119. Knowles M, Holton E, Swanson R. *The Adult Learner.* 6th ed. Elsevier
120. Merriam S. Adult learning theory: Evolution and future direction. *PAACE J Lifelong Learn.* 2017;26, 21-37.
121. Merriam SB. Andragogy and Self-Directed Learning: Pillars of Adult Learning Theory. *New Dir Adult Contin Educ.* 2001;(89):3-14. doi:10.1002/ace.3
122. Merriam SB. Adult learning theory. In: *Contem Theories Learn.* Routledge; 2018:83-96. doi:10.4324/9781315147277-6
123. Shannon SB, Bradley-Baker LR, Truong HA. Pharmacy residencies and dual degrees as complementary or competitive advanced training opportunities. *Am J Pharm Educ.* 2012;76(8):145. doi:10.5688/ajpe768145
124. DiPiro JT. Dual degrees and career paths. *Am J Pharm Educ.* 2012;76(8):141. doi:10.5688/ajpe768141

125. Korayem GB, Alshaya OA, Kurdi SM, et al. Simulation-based education implementation in pharmacy curriculum: a review of the current status. *Adv Medical Educ Pract*. Published online July 2022:649-660. doi:10.2147/AMEP.S366724
126. Mesquita AR, Souza WM, Boaventura TC, et al. The effect of active learning methodologies on the teaching of pharmaceutical care in a Brazilian pharmacy faculty. Dalby AR, ed. *PLoS One*. 2015;10(5):e0123141. doi:10.1371/journal.pone.0123141
127. Bradley P. The history of simulation in medical education and possible future directions. *Med Educ*. 2006;40(3):254-262. doi:10.1111/j.1365-2929.2006.02394.x
128. Lin K, Travlos D V., Wadelin JW, Vlasses PH. Simulation and introductory pharmacy practice experiences. *Am J Pharm Educ*. 2011;75(10):209. doi:10.5688/ajpe7510209
129. Seybert AL. Patient simulation in pharmacy education. *Am J Pharm Educ*. 2011;75(9):187. doi:10.5688/ajpe759187

# Appendices

## **APPENDIX A. LETTER TO IRB COMMITTEE AT KNUST**

UNIVERSITY OF MINNESOTA  
Twin Cities Campus  
Department of Pharmaceutical Care & Health Systems  
7-159 Weaver Densford Hall  
308 Harvard Street S.E.  
College of Pharmacy, Minneapolis, MN 55455  
Office: 612-626-9938  
Fax: 612-265-9931

February 16, 2023

Committee on Human Research and Publication Ethics (CHRPE)  
Kwame Nkrumah University of Science and Technology  
College of Health Sciences

Re: Confirming Graduate Student Status

Dear Sir/Madam,

I am a professor at the University of Minnesota College of Pharmacy in the Department of Pharmaceutical Care and Health System and I am the advisor and supervisor of Akua Appiah-Num Safo. She is undertaking the project: Describing Pharmacists' Core Public Health Competencies During Post-Graduate Early Career Readiness.

Akua is a PhD candidate and a pharmacist with strong interest in pharmacy education, global health and program evaluation. Her continuous work in these areas, and graduate studies have prepared her to undertake this project to a successful completion.

She has collaborated and engaged with faculty at the KNUST department of pharmacy practice for several years and her current work on this study is anticipated to support ongoing work within the department and the college on both local and international levels.

Should there be any questions, please feel free to contact me at [janke006@umn.edu](mailto:janke006@umn.edu).

Sincerely,

Kristin Kari Janke, Ph.D.  
Director, Wulling Center for Innovation & Scholarship in Pharmacy Education  
Professor, Pharmaceutical Care & Health Systems

## **APPENDIX B. INVITATION EMAILS (EARLY CAREER PRACTITIONERS)**

Subject: Readiness for Public Health Practice (RPHP) study

Dear [INSERT NAME],

You are being invited to participate in a study of pharmacy graduates' readiness for public health within practice.

You have been identified based on your recent experiences with competencies in your education and training. To begin this process, we would like to conduct a focus group with early career practitioners. As an early career practitioner, we believe you will have critical insights into the various competencies and your input is valuable in this evaluation. This discussion will be in-person at the Faculty of Pharmacy, KNUST campus and anticipated to be about 60-90minutes.

The results will be influential in helping pharmacy educators understand Public Health preparedness and readiness for practice.

In order to make the most of the discussion and participation, here are three (3) dates for your consideration:

[DATE/TIME 1]

[DATE/TIME 2]

[DATE/TIME 3]

We request that you please indicate your preference of the date and time of the focus group by [DATE]. Kindly click and give your consent [HERE].

Thank you for the consideration to participate in this unique conversation that will have an impact on core public health competencies for pharmacists globally.

I look forward to discussing pharmacist's core public health competencies with you. In the meantime, please do not hesitate to contact me if you have any questions.

Sincerely,

Akua Appiah-Num Safo

--

Akua A. Appiah-Num Safo, PharmD, MS  
PhD Candidate - Social and Administrative Pharmacy  
University of Minnesota College of Pharmacy  
7-191 Weaver-Densford Hall  
308 Harvard St. SE

## **APPENDIX C. INVITATION EMAILS (KNUST FACULTY)**

Subject: Readiness for Public Health Practice (RPHP) study

Dear [INSERT NAME],

You are being invited to participate in a study of pharmacy graduates' readiness for public health within practice.

You have been identified for your knowledge of competencies in the curriculum and for creating syllabi.

To begin this process, we would like to conduct a focus group with faculty members at the Faculty of Pharmacy and Pharmaceutical Sciences. As a faculty member, we believe you will have critical insights into the various competencies and your input is valuable in this evaluation. This discussion will be in-person at the Faculty of Pharmacy, KNUST campus and anticipated to be about 60-90minutes.

The results will be influential in helping pharmacy educators understand Public Health preparedness and readiness for practice.

In order to make the most of the discussion and participation, here are three (3) dates for your consideration:

[DATE/TIME 1]

[DATE/TIME 2]

[DATE/TIME 3]

We request that you please indicate your preference of the date and time of the focus group by [DATE]. Kindly click and give your consent [HERE].

Thank you for the consideration to participate in this unique conversation that will have an impact on core public health competencies for pharmacists globally.

I look forward to discussing pharmacist's core public health competencies with you. In the meantime, please do not hesitate to contact me if you have any questions.

Sincerely,

Akua Appiah-Num Safo

--

Akua A. Appiah-Num Safo, PharmD, MS  
PhD Candidate - Social and Administrative Pharmacy  
University of Minnesota College of Pharmacy  
7-191 Weaver-Densford Hall  
308 Harvard St. SE

## **APPENDIX D. INVITATION EMAILS (SEASONED PHARMACISTS)**

Subject: Readiness for Public Health Practice (RPHP) study

Dear [INSERT NAME],

You are being invited to participate in a study of pharmacy graduates' readiness for public health within practice.

You have been identified because of the years of experience you have in practice.

To begin this process, we would like to conduct a focus group with seasoned pharmacists. As a seasoned pharmacist, we believe you will have critical insights into the various competencies and your input is valuable in this evaluation. This discussion will be via zoom and anticipated to be about 60-90minutes.

The results will be influential in helping pharmacy educators understand Public Health preparedness and readiness for practice.

In order to make the most of the discussion and participation, here are three (3) dates for your consideration:

[DATE/TIME 1]

[DATE/TIME 2]

[DATE/TIME 3]

We request that you please indicate your preference of the date and time of the focus group by [DATE]. Kindly click and give your consent [HERE].

Thank you for the consideration to participate in this unique conversation that will have an impact on core public health competencies for pharmacists globally.

I look forward to discussing pharmacist's core public health competencies with you. In the meantime, please do not hesitate to contact me if you have any questions.

Sincerely,

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Akua A. Appiah-Num Safo, PharmD, MS  
PhD Candidate - Social and Administrative Pharmacy  
University of Minnesota College of Pharmacy  
7-191 Weaver-Densford Hall  
308 Harvard St. SE

## **APPENDIX E. INVITATION EMAILS (ADMINISTRATORS)**

Subject: Readiness for Public Health Practice (RPHP) study

Dear [INSERT NAME],

You are being invited to participate in a study of pharmacy graduates' readiness for public health within practice.

You have been identified for your role in providing resources, assessing the students and/or evaluating the program.

To begin this process, we would like to conduct a focus group with administrators at KNUST. As an administrator, we believe you will have critical insights into the various competencies and your input is valuable in this evaluation. This discussion will be in-person at the Faculty of Pharmacy, KNUST campus and anticipated to be about 60-90minutes.

The results will be influential in helping pharmacy educators understand Public Health preparedness and readiness for practice.

In order to make the most of the discussion and participation, here are three (3) dates for your consideration:

[DATE/TIME 1]

[DATE/TIME 2]

[DATE/TIME 3]

We request that you please indicate your preference of the date and time of the focus group by [DATE]. Kindly click and give your consent [HERE].

Thank you for the consideration to participate in this unique conversation that will have an impact on core public health competencies for pharmacists globally.

I look forward to discussing pharmacist's core public health competencies with you. In the meantime, please do not hesitate to contact me if you have any questions.

Sincerely,

Akua Appiah-Num Safo

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Akua A. Appiah-Num Safo, PharmD, MS  
PhD Candidate - Social and Administrative Pharmacy  
University of Minnesota College of Pharmacy  
7-191 Weaver-Densford Hall  
308 Harvard St. SE

## **APPENDIX F. INVITATION EMAILS (LEADERS OF PHARMACY COUNCIL, GHANA)**

Subject: Readiness for Public Health Practice (RPHP) study

Dear [INSERT NAME],

You are being invited to participate in a study of pharmacy graduates' readiness for public health within practice.

You have been identified for your input in current practice expectations, path forward and an understanding of what is being tried at the system and policy level. To begin this process, we would like to conduct a focus group with leaders of Pharmacy Council, Ghana. As a member of the council, we believe you will have critical insights into the various competencies and your input is valuable in this evaluation. This discussion will be in-person at the Pharmacy Council premises and anticipated to be about 60-90minutes.

The results will be influential in helping pharmacy educators understand Public Health preparedness and readiness for practice.

In order to make the most of the discussion and participation, here are three (3) dates for your consideration:

[DATE/TIME 1]

[DATE/TIME 2]

[DATE/TIME 3]

We request that you please indicate your preference of the date and time of the focus group by [DATE]. Kindly click and give your consent [HERE].

Thank you for the consideration to participate in this unique conversation that will have an impact on core public health competencies for pharmacists globally.

I look forward to discussing pharmacist's core public health competencies with you. In the meantime, please do not hesitate to contact me if you have any questions.

Sincerely,

Akua Appiah-Num Safo

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Akua A. Appiah-Num Safo, PharmD, MS  
PhD Candidate - Social and Administrative Pharmacy  
University of Minnesota College of Pharmacy  
7-191 Weaver-Densford Hall  
308 Harvard St. SE

## **APPENDIX G. INVITATION EMAILS (LEADERS OF FIP ACADEMIC SECTION)**

Subject: Readiness for Public Health Practice (RPHP) study

Dear [INSERT NAME],

You are being invited to participate in a study of pharmacy graduates' readiness for public health within practice.

You have been identified based on your global perspective and involvement in pharmacy education worldwide.

To begin this process, we would like to conduct a focus group with leaders in FIP academic section. As a member of the FIP academic section, we believe you will have critical insights into the various competencies and your input is valuable in this evaluation. This discussion will be via zoom and anticipated to be about 60-90minutes.

The results will be influential in helping pharmacy educators understand Public Health preparedness and readiness for practice.

In order to make the most of the discussion and participation, here are three (3) dates for your consideration:

[DATE/TIME 1]

[DATE/TIME 2]

[DATE/TIME 3]

We request that you please indicate your preference of the date and time of the focus group by [DATE]. Kindly click and give your consent [HERE].

Thank you for the consideration to participate in this unique conversation that will have an impact on core public health competencies for pharmacists globally.

I look forward to discussing pharmacist's core public health competencies with you. In the meantime, please do not hesitate to contact me if you have any questions.

Sincerely,

Akua Appiah-Num Safo

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Akua A. Appiah-Num Safo, PharmD, MS  
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University of Minnesota College of Pharmacy  
7-191 Weaver-Densford Hall  
308 Harvard St. SE

## APPENDIX H. FOCUS GROUP DISCUSSION AND INTERVIEW PROMPTS: EARLY CAREER PRACTITIONERS

### *Questions for early career practitioners*

Categories	Questions
Icebreakers	<p>What year did you receive your PharmD?</p> <p>What is your favorite public health content in pharmacy school?</p>
<b>First phase:</b> Didactic experience	<p>In your PharmD program, what are some of the classes or courses that were public health related?</p> <p>How have those classes helped you in practice?</p> <p>What specific public health competencies were covered in your classes?</p>
<b>Second phase:</b> Internship	<p>What new public health experiences have you participated in during practice that are different from those you learned in school? Why did you respond to that call?</p> <p>How did your training get you ready for public health roles?</p> <p>What additional training would have been helpful?</p>
<b>Third phase:</b> Post-graduate/External	<p>Are there public health activities you are involved in?</p> <p>Why do you participate or volunteer in such events?</p> <p>How prepared do you feel for these activities?</p> <p>What more could have been done to support your readiness?</p>

\*Haji F, Morin MP, Parker K. Rethinking programme evaluation in health professions education: Beyond “did it work?” *Med Educ.* 2013. doi:10.1111/medu.12091

## APPENDIX I. FOCUS GROUP DISCUSSION AND INTERVIEW PROMPTS: KNUST FACULTY MEMBERS

### *Questions for KNUST faculty members*

<b>Categories</b>	<b>Questions</b>
<b>Internal</b>	What public health competencies do you have in the curriculum?  What specific public health topics do you teach in your class?  How do you assess students on the public health competencies you teach?
<b>External</b>	Are there public health competencies you wish you could add to your class? Why?  How do you envision that helping the students in practice or in their learning?

\*Haji F, Morin MP, Parker K. Rethinking programme evaluation in health professions education: Beyond “did it work?” *Med Educ.* 2013. doi:10.1111/medu.12091

## APPENDIX J. FOCUS GROUP DISCUSSION AND INTERVIEW PROMPTS: KNUST ADMINISTRATORS AT FACULTY OF PHARMACY AND PHARMACEUTICAL SCIENCES

### *Questions for administrators*

<b>Categories</b>	<b>Questions</b>
<b>Institutional expectations/goals</b>	<p>What resources do you provide for students' activities in public health roles? eg, Materials for training on vaccinations</p> <p>How are students assessed or evaluated in public health content areas within the curriculum?</p> <p>What internal or external public health activities are available for students' engagement?</p> <p>Are there any specific students' public health involvements within the communities that were not planned by the school?</p>

\*Haji F, Morin MP, Parker K. Rethinking programme evaluation in health professions education: Beyond "did it work?" *Med Educ.* 2013. doi:10.1111/medu.12091

## APPENDIX K. FOCUS GROUP DISCUSSION AND INTERVIEW PROMPTS: SEASONED PHARMACISTS

### *Questions for seasoned pharmacists*

<b>Categories</b>	<b>Questions</b>
<b>Ice breaker</b>	Tell me about the public health activities you are engaged in?
<b>Educational/formal training</b>	What preparation did you receive through your education and training that prepared you for public health roles?  What specific classes and/or activities do you think prepared you for such a role?
<b>Practice experience/traditional training</b>	How has your own preparation helped in participating in public health activities?  How do you think further education or training would have helped? If so, what specific educational content and/or training would you recommend?  What public health roles are you involved in that you did not have knowledge of or get training for?

\*Haji F, Morin MP, Parker K. Rethinking programme evaluation in health professions education: Beyond “did it work?” *Med Educ.* 2013. doi:10.1111/medu.12091

## APPENDIX L. FOCUS GROUP DISCUSSION AND INTERVIEW PROMPTS: LEADERS OF THE PHARMACY COUNCIL, GHANA

### *Questions for leaders of the pharmacy council, Ghana*

<b>Categories</b>	<b>Questions</b>
<b>Policy/practice guidelines</b>	<p>What are the council's guidelines about pharmacist's role in practice?</p> <p>What are the councils' expectations for pharmacists in public health roles?</p> <p>How are public health competencies incorporated into current policies for pharmacy practice?</p> <p>What were the initial public health competencies expected of pharmacists in practice?</p> <p>If none, what public health competencies does the board hope to add to pharmacists' education and training to ensure preparedness and readiness for future healthcare at the community or population level?</p>

\*Haji F, Morin MP, Parker K. Rethinking programme evaluation in health professions education: Beyond "did it work?" *Med Educ.* 2013. doi:10.1111/medu.12091

## APPENDIX M. FOCUS GROUP DISCUSSION AND INTERVIEW PROMPTS: LEADERS IN FIP ACADEMIC SECTION

### *Questions for leaders in FIP academic section*

<b>Categories</b>	<b>Questions</b>
<b>Global prospect/anticipation</b>	<p>On a global scale, what public health competencies should pharmacists be educated and trained on?</p> <p>From your perspective, where are programs stronger and weaker in relation to these competencies?</p> <p>What strategies have been successful in strengthening public health preparedness and readiness?</p> <p>What recommendations do you have for schools in the education and training of pharmacists in public health competencies?</p>

\*Haji F, Morin MP, Parker K. Rethinking programme evaluation in health professions education: Beyond “did it work?” *Med Educ.* 2013. doi:10.1111/medu.12091

## **APPENDIX N. COPY OF AUDITOR’S FINAL REPORT**

### **AUDITOR REPORT**

*Date Submitted:* August 19, 2024

*Auditor:* Bernard Appiah, *DrPH, MS, MDC, B.Pharm*

*Auditee:* Akua Appiah-Num Safo, a doctoral candidate in Social and Administrative Pharmacy at the University of Minnesota College of Pharmacy, Department of Pharmaceutical Care & Health Systems.

*Audited Document:* “Describing Pharmacists’ Core Public Health Competencies During Post-Graduate Early Career Readiness: A Case Study in Ghana”, a dissertation to be submitted for the award of PhD in Social and Administrative Pharmacy at the University of Minnesota College of Pharmacy, Department of Pharmaceutical Care & Health Systems.

### ***STAGES OF AUDITING***

The auditee and the auditor followed the seven stages for auditing of qualitative studies as suggested by Akkerman, Admiraal, Brekelmans, and Oost (2008).

#### **Stage 1: Orientation to the audit procedure**

*Definition:* The auditee and auditor negotiate and agree upon goals, roles and rules of the audit.

*What occurred:* The auditee and auditor had a WhatsApp call to discuss the procedure, including agreeing upon goals, roles and rules of the audit.

#### **Stage 2: Orientation to the study**

*Definition:* Auditee arranges the logistics for the auditor, explains the audit trail, and auditor becomes familiar with the study.

*What occurred:* The auditee sent key materials — methodology and results. In addition, the auditee provided a) codebook for process coding on how and why the program works, b) codebook for Public Health Competencies within the FIP Global Competency Framework, and c) codebook for education outcome categories. The methodology included a systematic report on data collection and data analysis. The results document provided information that were linked to the methods. The auditee explained the audit trail, and also submitted a reference paper with the key auditing stages explained.

### **Stage 3: Auditability of the study**

*Definition:* Auditor determines the completeness, comprehensibility and utility of the audit trail. Auditee and auditor discuss the auditability.

*What occurred:* Upon examining the materials, the auditor determined the documents to be not complete for audit trail. This is because the materials did not include the final document (typically the full dissertation because the literature review, discussion and conclusion were not added), and the whole chapter on methodology. During a Zoom meeting with the auditee, the auditor called for more information, including a document with study rationale and theoretical perspectives. Thus, the auditee quickly provided the whole methodology chapter, which had such information. In addition, the auditee provided the data collection tools (interview and focus group guides). Upon getting the information asked for, the auditor determined that the audit trail components were complete, comprehensible and useful for the audit trail.

### **Stage 4: Negotiating the contract:**

*Definition:* Auditee and auditor establish timeline, determine goals, specify roles, arrange logistics, determine outcomes and format and identify renegotiation criteria

*What occurred:* During the Zoom meeting, both the auditee and auditor determined goals, specified roles, and determined outcomes and format for the audit. The auditee and the auditor followed the methodology suggested by Akkerman, Admiraal, and Brekelmans (2008).

### **Stage 5: Actual assessment**

*Definition:* Based on the audit trail auditor assesses the research process in terms of the specific quality criteria

*What Occurred:* The auditor assessed the research process and the results using the quality criteria — visibility, comprehensibility and acceptability.

### **Stage 6: Regeneration**

*Definition:* Auditor presents findings and discusses discrepancies; Auditee assesses the accuracy of the auditor claims and adherence to the agreement

*What occurred:* The Auditor discussed the audit findings with the auditee during a Zoom meeting. At the meeting, the auditee assessed accuracy of the auditor claims and adherence to the agreement.

## Stage 7: Final audit report

*Definition:* Auditor writes a confirmed assessment on the trustworthiness of the study.

*What occurred:* Auditor wrote assessment on the trustworthiness of the study as shown in the table below, and discussed it with the auditee in a Zoom meeting. The auditee and auditor confirmed the assessments.

Table 1: Basic structure of the assessment scheme.

Audit Trail Components		Quality		
		Visibility	Comprehensibility	Acceptability
Data gathering	Planned	<p><b>Document review</b></p> <p>The decision to use document review was clearly communicated, including using the document review to create a logic model, and to inform creation of questions for the other data collection tools (example, focus group discussion).</p>	<p>Table 11 provides a list of documents reviewed, what was retrieved and how the information was used.</p>	<p>The process for obtaining the documents has been adequately provided, making it acceptable.</p>
		<p><b>Logic model</b></p> <p>The reason for creating the logic model as a methodology was provided</p>	<p>The logic model has detailed information on inputs, outputs and outcomes. However, the author should consider minor edits suggested.</p>	<p>The logic model is acceptable in its current form, but the minor suggestions should be considered.</p>
		<p><b>Individual interviews</b></p> <p>The information provides reason for</p>		<p>The study should clearly articulate eligibility criteria</p>

		<p>using individual interviews and indicate how many individual interviews were planned (five participants) based on saturation.</p> <p><b>Dyadic interviews</b></p> <p>The information provides reason for using individual interviews but does not indicate how many dyadic interviews were planned, and whether the dyads will be homogenous (e.g., early practitioner + early practitioner) or heterogenous (e.g., early practitioner + seasoned practitioner)</p> <p><b>Focus group discussions (three or more participants)</b></p> <p>The information provides reasons for using focus group discussion and indicated how many focus groups were planned (five</p>	<p>The decision to have five participants was based on saturation.</p> <p>Table 5 provides useful information on the methods used for selecting participants. Sociodemographic information on respondents appears missing.</p> <p>The decision to have five participants was based on saturation.</p> <p>Table 5 provides useful information on the methods used for selecting participants. Sociodemographic information on interviews appears. For example, although author indicated that early career practitioners are those who completed the program not more than 5 years, it is unknown who the seasoned pharmacists are (e.g, how many years post-graduation, the setting where they work). Pharmacy Council leaders too have not been well defined. Did the study interview</p>	<p>for those who participated in the interviews and focus group discussions. Although it is clear that early career practitioners were those who had completed their program within the past 5 years, it was not clear who qualified as “seasoned pharmacists”.</p> <p>The study should clearly articulate eligibility criteria for those who participated in the interviews and focus group discussions. Although it was clear that early career practitioners were those who had completed their program within the past 5 years, it was not clear who</p>
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		<p>participants) based on saturation.</p>	<p>pharmacy council staff in regions or at the headquarters? What are their key positions? Although a position like registrar can identify the interviewee (which can be a problem), there could be ways to indicate the category of pharmacy council staff to be engaged. Pharmacy council leaders seem a little vague.</p>	<p>qualified as “seasoned pharmacists”.</p>
Realized	<p>Table 10 provides information on number of participants who participated in the study. Reasons for low participation rates were given.</p> <p>Table 11 lists the documents reviewed. However, no reason was provided about the nonavailability of the preceptor manual.</p>	<p>Out of the 5 proposed directors, 4 participated in the interviews.</p> <p>Out of at least 5 early career practitioners, 5 took part in the interviews</p> <p>6 FIP academic section leaders took part but an activity that occurred on March 27, 2024 for 2 FIP participants is listed as focus group discussion. This should be considered as dyadic interview.</p> <p>Out of at least 5 seasoned pharmacists, 4 participated.</p>	<p>The participants who participated in the study were diverse, contributing to robust data. However, it may be helpful to indicate whether data saturation occurred for those with fewer than 5 participants given that the goal for saturation per group was 5.</p> <p>Overall, this is acceptable, especially if saturation could be highlighted.</p>	

			<p>5 KNUST administrators participated.</p> <p>4 leaders of Pharmacy Council participated.</p>	
Data Analysis	Planned	Reasons for the analytic processes such as deductive analysis and inductive analysis were clearly articulated.	Figure 7 comprehensively provides a summary of the analytic process, thus aiding understanding of the process.	Overall, the data analysis processes were clearly described, making the process acceptable.
	Realized	The themes arising from inductive and deductive analysis were clearly indicated.	Inclusion of representative quotes for key themes helps enrich the findings. However, the representative quotes lack basic demographic information of respondents, making it difficult to know a little about respondents whose quotes were highlighted.	Overall, the results of the data analysis accurately reflect the data collected. However, the author should consider providing a little more information on respondents whose quotes were highlighted.

**KNUST:** Kwame Nkrumah University of Science and Technology; **FIP:** The International Pharmaceutical Federation

## ***ASSESSMENT SCHEME***

Using standards for reporting qualitative research (O'Brien et al, 2014) and another approach for assessing quality in qualitative studies (Mays & Pope, 2000), the following are some key assessment outcomes.

**Worth or relevance**—This study adequately contributes to knowledge, and is very useful.

**Appropriateness of the design to the question**— The use of qualitative approach for the study is appropriate given that more context is needed to explore the subject.

**Context**— The setting is adequately described, making it helpful for the reader relate the findings to the setting.

**Sampling**— The sampling includes the full range of possible cases to be used. However, the author should consider providing a reason for not including current pharmacy students despite indicating that they are key stakeholders. Reasons for selecting the participants and documents were provided. The criteria for reaching saturation were provided (sampling saturation).

**Data collection and analysis**—Data collection was conducted in a systematic manner, with document review providing additional context for use in interviews and focus group discussions. Triangulation of sources/methods, and modification of procedure when necessary were indicated. Units of study (participants) were clear in some cases (for example, early career practitioners were clearly defined as those within 5 years of completing Pharm D) but seasoned pharmacists were not clearly defined. More importantly, characteristics of participants were largely lacking, with quotes not attributed to particular participants.

The key codes or themes created were based on relevant frameworks (deductive). Also, the study included themes resulting from inductive analysis. However, it was not clear whether the researcher searched for disconfirming cases.

**Reflexivity of the account**— The author provided adequate her own background and other characteristics that may influence the research, including personal attributes, qualifications/experience, relationship with participants, and assumptions.

## ***REFERENCES***

Akkerman, S., Admiraal, W., Brekelmans, M., & Oost, H. (2008). Auditing quality of research in social sciences. *Quality & quantity*, 42, 257-274.

O'Brien, B. C., Harris, I. B., Beckman, T. J., Reed, D. A., & Cook, D. A. (2014). Standards for reporting qualitative research: a synthesis of recommendations. *Academic medicine*, 89(9), 1245-1251.

Mays, N., & Pope, C. (2000). Assessing quality in qualitative research. *BMJ* 320(7226), 50-52.