



# Evaluation of the Undergraduate Pharmacy Student Research Projects in Ambo University, Ethiopia: Retrospective Review

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**Background:** Academic research is an essential part of undergraduate Pharmacy education to produce qualified Pharmacists. However, there are no documented studies that examine the nature of undergraduate Pharmacy students' research projects in Ethiopia. Therefore this study aimed to characterize the nature of students' research project conducted for a bachelor of Pharmacy degree program at Ambo University, Ethiopia.

**Methods:** A cross-sectional, retrospective review using data extraction form was conducted on 279 research reports of undergraduate Pharmacy students at Ambo University from 2013/14 to 2018/2019. The National Harmonized Modular Curriculum program for the Bachelor of Pharmacy degree in Ethiopia was used as a framework to group research projects by research topics and domains. Students' profile (gender, program), supervisors profile, research types and topics, a domain of pharmacy curriculum, study setting, study design, target population, data collection strategy and techniques, and therapeutic classes of medicines for each project were extracted to see the characteristics of students' research project. Data were entered and analyzed using Microsoft Excel and SPSS version 25. Descriptive statistics were used to present the data.

**Results:** From 279 Pharmacy undergraduate students' research projects, 83.9% were conducted by male students and 64.1% were by regular program students. Two hundred fifty (89.6%) of the projects were surveys. Slightly less than half (49.8%) of the research projects were clinical researches. One hundred twenty-six (45.2%) of the research projects were focused on the pharmaceutical care domain followed by dispensing (22.6%) and research and education domain (10%). Out of the 250 survey research projects, the majority 226 (90.4%) of them were used cross-sectional study design, 205 (82%) were conducted at hospitals and 187 (74.8%) were done on the clinical population.

**Conclusion:** The study showed that the majority of the abstracted projects were surveyed type quantitative clinical researches focused on the Pharmaceutical care domain and takes place at hospitals affiliated with the University. On the contrary, a lower proportion of the research projects were laboratory-based researches, focused on Pharmaceuticals manufacturing, drug information service, regulation, and supply chain management domains, and takes place at community Pharmacy and educational institutions. Thus, it is highly recommended the University has to devise a system for expansion of the study settings other than its affiliated hospitals, and the research topics would encompass all areas and domains of Pharmacy Practice and Pharmaceutical sciences.

**Keywords:** research project, pharmacy, undergraduate student, curriculum, B.Pharm degree

## Background

Research is a quest for knowledge through diligent search or investigation or experimentation aimed at the discovery and interpretation of new knowledge.<sup>1</sup>

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Health research has an impact on the prevention, diagnosis, and treatment of diseases and especially on health care programs policy.<sup>2</sup> The research in Pharmacy focusing more on evidence-based information (eg, scientific, pharmacy practice, health system), which is a key to modern health-care. Considering a broad and multidisciplinary aspect of drug therapy and outcome, there is a need for Pharmacy and Pharmacy practice-based research to optimize confirm the value of a new service, inform policy, and result in practice changes.<sup>3,4</sup>

Research skill development is increasingly being seen as “an underlying principle” of undergraduate programs.<sup>5</sup> Conducting a research project requires generating a hypothesis, performing a systematic literature review, developing study methods, and collecting and analyzing data, and summarizing and disseminating the results. These allow students to acquire all elements of higher-order learning such as remembering, understanding, applying, analyzing, evaluating, and creation of new knowledge.<sup>6,7</sup> A research project also facilitates learning in-depth and provides opportunities for independence not offered in a standardized curriculum. These opportunities to develop self-directed learning skills and problem-solving promote life-long learning, which will benefit the student in his or her future career as a Pharmacist.<sup>8,9</sup> Moreover, the participation of undergraduate Pharmacy students in research projects is important in producing Pharmacists better accustomed to increase the accessibility of unbiased health and medicines-related information to the public and other health care professionals.<sup>10</sup>

Currently, in Ethiopia (with a population of approximately 110 million), there are more than a dozen of public institutions that train students in Pharmaceutical education at different levels, Ambo University being one. All of these institutions offer their degree programs in the English language. All Pharmacy schools are located within comprehensive, research-intensive universities located in urban centers, and all are directly affiliated with medical and other health care professional programs within the university structure. The Bachelor of Pharmacy (B. Pharm) degree is an undergraduate academic degree in the field of Pharmacy that served as a prerequisite to practice as a Pharmacist in the country.<sup>11,12</sup>

In 2008, all public Pharmacy schools in Ethiopia revised their undergraduate Pharmacy curriculum to focus on clinical Pharmacy or patient care aspects.<sup>11</sup> In the 2009/10 Academic Year, Ambo University launched the new undergraduate patient-oriented Pharmacy program

and adopted the National Harmonized Modular Curriculum program for the Bachelor of Pharmacy degree.<sup>13</sup> Currently, these National Harmonized Modular Curriculum program is serving as the guiding principle of the country’s Pharmaceutical education. It trained students to understand the properties of medicines, how they work, and how to provide Pharmaceutical care for patients. The general objective of the B.Pharm program is to train highly qualified Pharmacists who fulfill the essential, minimum common expectations of health care systems worldwide while fulfilling local needs. And the main rationale for modularization is the need to enhance students’ competency through a competency-based curriculum.<sup>10</sup>

The curriculum comprises various core competencies including research education as a part of pharmacy training. These courses contain different research development topics that are conducted in various departments and include Epidemiology (3 credit hours), Biostatistics (3 credit hours), Pharmacoepidemiology (3 credit hours), and Health research methods (3 credit hours). Also, the fifth year of the curriculum has six months of the academic research project (directed study) and team training program (action research training) with other health sciences students in hospital as well as in community setup.<sup>10</sup>

The main focus of these research-related courses is to enable undergraduate Pharmacy students to understand the conceptual, theoretical, and empirical components of research. It covers their ability to analyze and synthesize information from Pharmaceutical works of literature, identify and respond to gaps in the evidence base by conducting research, share research findings, and apply evidence in practice.<sup>10</sup> Pharmacy students are not awarded a degree until they have developed and presented a research project on a selected and agreed topic of the research problem and scored a minimum of “C” grade in his/her thesis report.<sup>10</sup> Being a final year course, the academic research project was first presented at Ambo University in 2013/14 and is now in its seven-year implementation. To ensure the success of these research projects particular care has been taken to address its aims and objectives, the type of the research topics, the domain or thematic areas covered by the projects and the study setting, design, data collection strategy and techniques, and study participant utilized and involved for research projects.

To date, there have been no studies evaluating the nature of undergraduate Pharmacy students’ research projects in Ethiopia. Hence, the main aim of this study was to characterize the nature of students’ research conducted for

a B.Pharm degree program at Ambo University, Ethiopia. The study, therefore, might establish a baseline understanding of undergraduate Pharmacy students' research project scope that will be used in the planning and promotion of department research activities and for future reference.

## Methods

### Description of the Study Area

The study was conducted at Ambo University, established in 1947. It is one of the higher learning institutions found in Ethiopia mandated to undertake academic, research, and community services. Presently the University runs 51 graduate and 85 undergraduate programs which are divided into nine colleges/institutes/schools and 82 academic departments. In 2010, the University launched the department of Pharmacy and accepted its first batch with the general objectives of training highly qualified pharmacists having the required knowledge, skill and attitude with standard pharmaceutical care service ethics to work in different pharmaceutical settings. The Department launched advanced-standing summer and continuous educational B. Pharm programs in the 2011/2012 academic year to mainly upgrading Pharmacy technicians in its catchment area. Currently, the department has a total of 25 academic staff under four-course units (Pharmacology, Clinical Pharmacy, Pharmaceutical Chemistry, and Pharmaceutics & Social Pharmacy) and 275 students enrolled in both regular and non-regular undergraduate pharmacy programs.<sup>14</sup>

### Study Design and Period

A cross-sectional, retrospective review of research reports from 2013/2014 to 2018/2019 academic year of undergraduate Pharmacy students was conducted at Ambo University. Data was collected from 02 March up to 27 March 2020.

### Data Collection and Analysis

Data extraction forms were prepared using National Harmonized Modular Curriculum and previous research literature.<sup>6,10</sup> A six-year data (2013/14 to 2018/19) were taken from final paper reports. Students profile (gender, program), supervisors profile, research types and topics, a domain of Pharmacy curriculum, study setting, study design, target population, data collection strategy and techniques, and therapeutic classes of medicines for each

project were extracted to see the characteristics of students' research. To optimize the consistency of abstraction, a glossary of terms was developed. The pre-test was done by two authors (ETG and DAG) from 10 research projects to check the applicability of the data abstraction tool and make necessary adjustments. The pretested research project was excluded from the study. The authors discussed the discrepancies among the responses until consensus was reached and final revisions were made. All projects were divided equally between the two authors for abstraction. After the data were checked for completeness and accuracy, it was entered into and analyzed using Microsoft Excel and SPSS version 25. Descriptive statistics (frequency, mean, percentage, and standard deviation) were used to summarize the results.

### Operational Definitions

We grouped research projects by research topics and curriculum domains or thematic areas as described by the National Harmonized Modular Curriculum program for the Bachelor of Pharmacy degree in Ethiopia.<sup>10</sup>

#### Research Topics

Basic pharmaceutical sciences, including the development and testing of new dosage forms or medication-administration modalities (ie includes topics in the fields of Pharmaceutics, medicinal chemistry, Pharmaceutical analysis).

Clinical research concerning the efficacy, safety, and pharmacokinetics of drugs (includes topics in the fields of Pharmacotherapy and Pharmacology).

Pharmacy practice research addressing various issues such as the evaluation of new and existing services, workload measurement, Pharmacoeconomics, and quality management.

Behavioral research deals with the interaction of man and the environment in a manner reflecting the beliefs, attitudes, and practices of the individual in society (ie includes topics in the fields of social Pharmacy).

#### Pharmacy Curriculum Domains

Pharmaceutical Care is a responsible provision of drug therapy to achieve definite outcomes that improve or maintain a patient's quality of life.

A dispensing domain is concerned with the skill, attitude, and knowledge of preparing, packaging, labeling, and record-keeping and transfer of drug information to

a patient or an intermediate who is responsible for the administration of the pharmaceutical drugs.

Pharmaceutical manufacturing is the process of producing raw materials and conversion of raw materials to finished products in small and large scale industries.

Pharmaceutical regulation is a process of performing regulatory functions that include licensing, an inspection of manufacturing facilities and distribution channels, product assessment and registration, adverse drug reaction (ADR) monitoring, scientific assessment of all product quality specifications, control of drug promotion and advertising, and control of clinical trials to promote and protect public health.

Pharmaceuticals supply chain management is a set of approaches utilized to efficiently integrate suppliers, manufacturers, wholesalers, distributors, and retailers to minimize system-wide costs while satisfying service level requirements.

Pharmaceutical Public health is the application of pharmaceutical knowledge, skill, and resource in preventing disease, prolonging life, promoting, protecting, and improving health for all through organized efforts of the society.

Drug information concerned with providing drug information resources used in the healthcare system to extract information from primary, secondary, and tertiary kinds of literature and to evaluate the biomedical literature using a systematic approach.

Professionalism and ethics encompass a set of attitudes, knowledge, and skills based on clinical competence, ethics, societal and legal requirements resulting in the application of a range of behaviors.

Research and education refer to the principle of scientific inquiry to investigate a medicine or pharmacy practice related issue.

## Ethical Clearance

Ethical approval was obtained from the Ethics Review Committee of the Department of Pharmacy, College of Medicine and Health Sciences, Ambo University with reference number ERC/PHAR/69/2020. Confidentiality and anonymity of the information was maintained by avoiding any personal identifiers in the data presentations.

## Results

### Project Characteristics

A total number of 279 Pharmacy undergraduate students' research projects were abstracted from final papers that completed over 6 academic years (76 in 2013/14, 20 in 2014/15, 68 in 2015/16, 24 in 2016/17, 30 in 2017/18, and 61 in 2018/19). Of these, 83.9% of research projects were

conducted by male students, 64.1% were by regular program students and 26.2% were by the continuing education program. Projects conducted under the supervision of MSc and above holder advisors account for 87.1% of the total research projects (Table 1).

### Project Distribution Based on Its Types and Topics

Out of the total projects, 255 (91.4%) of the projects were original researches that consisted of survey and laboratory (in vitro) study and 8.6% of the projects were literature review. Among these, the majority 139 (49.8%) of the research projects were clinical researches (Table 2).

### Project Distribution Based on Pharmacy Curriculum Domain

Out of the total projects, the majority 126 (45.2%) of the research projects were focused on the Pharmaceutical care domain followed by dispensing (22.6%) and Research and education (10%). And only 2.9%, 2.2%, 1.8%, and 0.7% of the research projects focused on Pharmaceutical supply chain management, Regulatory, Drug information service, and Pharmaceutical manufacturing domain respectively (Figure 1).

**Table 1** Characteristics of Undergraduate Pharmacy Students' Research Projects Over 6 Years (2013/14–2018/19) Based on Students and Advisors Profile at Ambo University, Ethiopia (n=279)

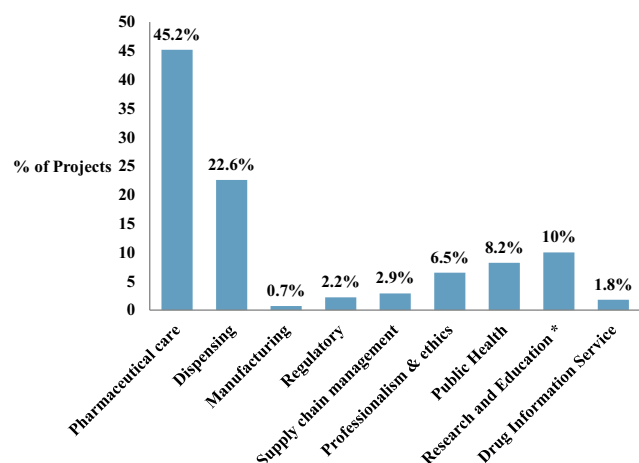
| Characteristics              | n (%) of Projects |
|------------------------------|-------------------|
| <b>Students profile</b>      |                   |
| Gender                       |                   |
| Male                         | 234 (83.9)        |
| Female                       | 45 (16.1)         |
| Program                      |                   |
| Regular                      | 179 (64.1)        |
| Continuing education program | 73 (26.2)         |
| Summer education program     | 27 (9.7)          |
| <b>Advisors profile</b>      |                   |
| Gender                       |                   |
| Male                         | 257(92.1)         |
| Female                       | 22(7.9)           |
| Level of education           |                   |
| B.Pharm                      | 25(9.0)           |
| MSc                          | 243(87.1)         |
| PhD                          | 11(3.9)           |
| <b>Language</b>              |                   |
| English                      | 279 (100)         |
| <b>Total</b>                 | 279 (100)         |

**Table 2** Characteristics of Undergraduate Pharmacy Students Research Projects Based on Its Types and Topics Completed Between 2013/14 and 2018/19 at Ambo University, Ethiopia (n=279)

| Project Types and Topics     | No. (%) of Projects |
|------------------------------|---------------------|
| <b>Types</b>                 |                     |
| Survey                       | 250(89.6)           |
| Laboratory (in vitro) study  | 5(1.8)              |
| Literature review            | 24(8.6)             |
| <b>Topics</b>                |                     |
| Clinical researches          | 139(49.8)           |
| Basic pharmaceutical science | 30(10.8)            |
| Pharmacy practice research   | 28(10.0)            |
| Behavioural research         | 82(29.4)            |

## The Study Design and Data Collection Techniques Used Across the Research Projects

Out of the 250 survey research projects, the majority 226 (90.4%) them have used a cross-sectional study design. 248 (99.2%) of the projects were employed a quantitative data collection strategy, while only 2 (0.8%) of them were utilized both quantitative and qualitative data collection strategy. The percentages of research projects involving document review, interviewing, and administering written questionnaires data collection techniques were 52.8%, 28.0%, and 13.4%, respectively (Table 3).



**Figure 1** Distribution of undergraduate pharmacy student projects based on pharmacy curriculum domain completed between 2013/14-2018/19 in (%) at Ambo University, Ethiopia (n=279). \*Those researches to improve scientific theories for better understanding and prediction of pharmaceutical phenomena.

**Table 3** Characteristics of Undergraduate Pharmacy Students Research Projects Based on Study Design and Data Collection Techniques Completed Between 2013/14 and 2018/19 (n=250)

| Study Design and Data Collection Method     | No. (%) of Projects |
|---|---------------------|
| <b>Study design</b>                         |                     |
| Cross-sectional                             | 226(90.4)           |
| Longitudinal                                | 24(9.6)             |
| <b>Data collection strategy</b>             |                     |
| Quantitative                                | 248(99.2)           |
| Qualitative                                 | 0                   |
| Mixed                                       | 2(0.8)              |
| <b>Data collection techniques</b>           |                     |
| Using available information (record review) | 132(52.8)           |
| Interviewing                                | 70(28.0)            |
| Administering written questionnaires        | 34(13.6)            |
| Interviewing+ Observing                     | 14(5.6)             |

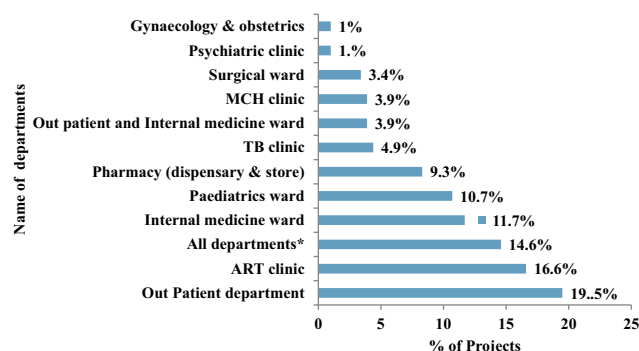
## The Study Settings Were Used Across the Research Projects

Out of the 250 surveys (cross-sectional and longitudinal) research projects, 82% were conducted at hospitals, 3.6% at community Pharmacy, 5.6% at households, and 4.4% conducted at educational institutions ie high school, college, and university (Table 4).

On the other hand, of the 205 research projects conducted at hospitals, 175 (85.4%) were conducted at different hospital departments and clinics. These are: Pharmacy (dispensary and store) 8.8%, ART clinic 16.6%, Out Patient department 21.9%, Internal medicine ward 11.7% and Paediatrics ward 10.7%. While 14.6% of the research projects were done at all units of the hospitals (the whole hospital setting) (Figure 2).

**Table 4** Distribution of Undergraduate Pharmacy Student Projects Based on Study Settings Completed Between 2013/14 and 2018/19 at Ambo University, Ethiopia (n=250)

| Study Settings             | N (%) of Projects |
|----------------------------|-------------------|
| Hospital                   | 205(82.0)         |
| Health center              | 5(2.0)            |
| Hospital and health center | 7(2.8)            |
| Community pharmacy         | 9(3.6)            |
| Household                  | 14(5.6)           |
| Educational institution    | 10(4.0)           |



**Figure 2** Distribution of undergraduate pharmacy students research projects conducted at hospitals based on their units completed in 2013/14–2018/19 at Ambo University, Ethiopia (n=205). \* Those researches considering the whole hospital settings.

## The Study Participants Used Across the Research Projects

As reported in the final papers, the clinical population (74.8%), general population (5.6%), health professionals (12%), and students (4%) were the study populations involved in research projects. Of the 187 projects conducted on the clinical population, 72.7% were conducted on adults and 18.2% were on the HIV/AIDS population (Table 5).

## Therapeutic Classes of Medicines Were Assessed Across the Research Projects

On the other hand, 53 (21.2%) of the research projects were assessed records of medical charts, prescription papers, and medicine registry books to see the treatment outcome, pattern, and use evaluation of different medicines. Antibiotics (37.7%), ARV medicines (20.7%), and Central nervous system agents (16.9%) were the top three classes of medicines studied on research projects (Figure 3).

## Discussion

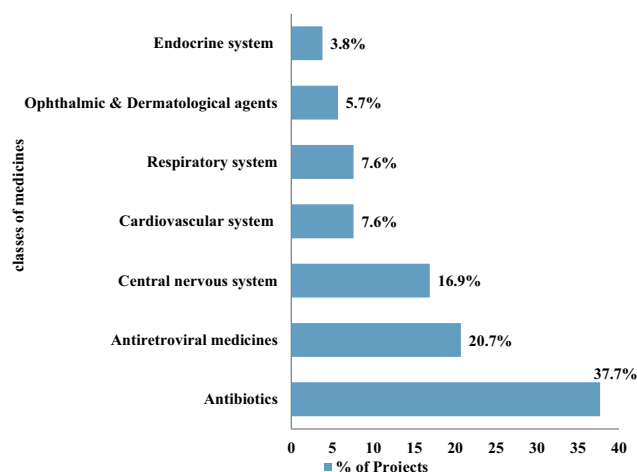
The present study attempted to give a picture of the undergraduate Pharmacy students' research project at Ambo University found in Ethiopia.

The study examined 279 research projects completed over 6 academic years. It was found that only 8.6% of the abstracted project type was a literature review. Although the study discipline and scope were different for making a comparison, this was much lower than the findings from the University of Porto where 72.6% of the project type systematic review.<sup>15</sup> This difference might be because undergraduate training institutions in developing countries

**Table 5** Distribution of Undergraduate Pharmacy Student Projects Based on Study Population Type and Characteristics Completed Between 2013/14 and 2018/19 (n=250)

| Study Population Type and Characteristics | N (%) of the Project |                    |
|---|----------------------|--------------------|
|   | By Type              | By Characteristics |
| <b>Clinical population</b>                | 187(74.8)            |                    |
| <b>Age</b>                                |                      |                    |
| Pediatrics (<15 years)                    |                      | 22(11.7)           |
| Adult (15–65 years)                       |                      | 136(72.7)          |
| Geriatrics (> 65 years)                   |                      | 4(2.2%)            |
| Adult and Geriatrics                      |                      | 25(13.4)           |
| <b>Health status</b>                      |                      |                    |
| HIV/AIDS                                  |                      | 34(18.2)           |
| TB  |                      | 9(4.8)             |
| Malaria                                   |                      | 5(2.7)             |
| Other infectious diseases                 |                      | 32(17.1)           |
| Diabetes mellitus                         |                      | 29(15.5)           |
| Hypertension                              |                      | 24(12.8)           |
| Heart failure                             |                      | 5(2.7)             |
| Asthma                                    |                      | 11(5.9)            |
| Pregnant                                  |                      | 8(4.3)             |
| Other non-infectious diseases             |                      | 30(16.0)           |
| <b>Health professionals</b>               | 30(12)               |                    |
| Pharmacists                               |                      | 8(26.6)            |
| Pharmacists and Physicians                |                      | 2(6.7)             |
| All health professionals                  |                      | 20(66.7)           |
| <b>General population</b>                 | 14(5.6)              |                    |
| <b>Students</b>                           | 10(4)                |                    |
| Pharmacy students only                    |                      | 2(20)              |
| All health sciences students              |                      | 5(50)              |
| Non-health science students               |                      | 3(30)              |
| <b>Not applicable</b>                     | 9(3.6)               |                    |
| <b>Total</b>                              | 100                  | 100                |

like Ethiopia are substandard with inadequate training facilities. Observed in these institutions are outdated and under-resourced library stocks, lack of computers, poor internet, and e-libraries limiting access to research literature.<sup>1,16</sup> Good research questions, protocols, appraisal, and review of current literature are unrealizable without easy access to the literature. On the other hand, only 1.8% of the total projects were laboratory-based researches. A possible reason for this finding may be due to laboratory-based research in pharmaceuticals, pharmacology, or medicinal chemistry mainly conducted at the post-graduate education level.<sup>17</sup> In designing the curriculum, it was agreed that key criteria for the project would be that it addressed a research question and that sufficient data could be obtained for meaningful analysis in the time allowed



**Figure 3** Distribution of undergraduate pharmacy student projects based on therapeutic classes of drugs completed between 2013/14–2018/19 at Ambo University, Ethiopia (n=53).

for the project.<sup>10</sup> The project types would therefore include some that were laboratory-based, some that were literature-based, and some that were survey-based.

The study also showed that half (49.8%) of the abstracted projects were clinical researches. This might be because the research in Pharmacy focusing more on evidence-based medicine, which is a key to modern healthcare.<sup>3</sup> Clinical research is essential in developing evidence-based interventions that will make a difference in mitigating health problems, promoting health, and ultimately improving the quality of life of the patients.<sup>1</sup>

In Ethiopia, the undergraduate Pharmacy curriculum shifted towards patient-focused practice by including a mandatory 1-year clerkship program as part of the academic training. The research course is often introduced late during training and directed towards the final year project.<sup>10,18</sup> The present study indicated that the majority (45.2%) of the research projects focused on the Pharmaceutical care domain followed by dispensing 22.6%. The reason that led many students to focus on Pharmaceutical care and dispensing researches might be because students conducted research projects concurrently with their clinical practice in affiliated institutions. On the contrary, only (5.8%) of the research projects were focused on Pharmaceutical manufacturing, regulation, and supply chain management. This could be due to a lack of students' awareness, motivation, and experience in these fields of practice researches, and these courses are offered before three years of conducting their research. A previous study conducted in Ethiopia reported that 8.9% and 13.2% of

undergraduate pharmacy students choose the manufacturing industry and regulatory affairs as their future area of practice respectively.<sup>19</sup> While pharmacy research is normally associated with the Pharmaceutical industry and academia, pharmacy schools must integrate with the Pharmaceutical companies and other research institutions for the sake of improving the quality of Pharmacy education and research to enrich the practice of Pharmacy in the future in Ethiopia. For example, in the United States Pharmacy academic institutions established partnerships with the Pharmaceutical industry for sustainability and positive research outcomes and many academic institutions serve as a central hub for fostering entrepreneurial culture through collaboration with Pharmaceutical companies.<sup>20</sup>

In the current study, a majority (82%) of the research projects were taking place at hospitals affiliated with the university. A possible reason for this may be due to the recent pharmacy students' attitude and future career choices in Ethiopia, where many (44%) of the students had a desire to work in hospital pharmacy after graduation.<sup>19</sup> On the other hand, most of the projects were conducted in the outpatient departments, internal medicine, and pediatrics wards as well as a dispensary of these hospitals. This may be due to the high prevalence of drug-related problems in internal medicine and pediatrics wards and the vulnerability of the patient population in the outpatient department. Indeed, drug-related problems observed inwards such as Surgery, Gynaecology & Obstetrics, and Psychiatry, where few research projects were conducted, speaks for the importance of conducting more researches in the future.

One of the surprising findings in this study was although more than 100 public health centers, 25 community pharmacies, and both private and public educational institutions are available under catchment areas of the university.<sup>21</sup> Only 9.6% of the 250 projects included in the survey were conducted at these facilities. The exact reason for this difference is unknown. Further investigation is needed to determine whether this is due to a lack of awareness of the students and their supervisor or a lack of external support and cooperation to conduct the projects in these settings.

Also, the present study revealed that the majority of the research projects used a cross-sectional study design. This design provides a snapshot of the prevalence or the characteristics of the study subjects in a single time point. The study investigator measures the outcomes and the exposures in the study subjects simultaneously and data are often collected through surveys.<sup>22</sup> The type of study design chosen depends on, the type of problem, the knowledge already available

about the problem, and resources available for the study.<sup>1</sup> In this finding, lack of previous research experience, absence of financial support, and shortage of time allocated to research in the undergraduate pharmacy curriculum may limit projects to cross-sectional study designs with primarily descriptive analyses, which may not generate a reliable result to affect policy that requires more advances longitudinal study designs. Cross-sectional design cannot provide cause and effect relationships between certain exposures and outcomes of interest like that of longitudinal study designs.<sup>22</sup>

As problems in Pharmacy education become more complex, qualitative approaches may provide researchers with a set of tools to better position them to explore these phenomena.<sup>23</sup> Nevertheless, in this study, almost all (98.2%) of the projects were employed quantitative data collection methods. This finding mirrors other studies, which indicated that research in Pharmacy education has historically been conducted from a quantitative approach.<sup>24,25</sup> A wide range of quantitative methods is commonly applied in Pharmacy practice research. These methods are widely used in published Pharmacy practice literature to explore the appropriateness of medicines use, appropriateness and quality of prescribing, and medication safety, through analyzing existing datasets, direct observation, or self-report.<sup>26</sup>

Research studies in Pharmacy practice usually use single-method data collection strategies. However, often these report a lot of limitations and may not adequately answer the research question. Therefore, the combination of more than one research method to answer certain research questions has become increasingly common in pharmacy practice research.<sup>26</sup> In this study, it was found that only 2 (0.8%) of the projects were utilized mixed methods of data collection strategy. The mixed-method approach provides an expanded understanding of the phenomenon under investigation through the comparison between qualitative and quantitative data.<sup>27,28</sup>

The study also identified that majority (78.4%) of the research projects were conducting on clinical populations, particularly on HIV/AIDS, DM, and hypertension populations. This might be because Ethiopia, like many other sub-Saharan African countries, is experiencing an epidemiological transition with human immunodeficiency virus (HIV) infection, hypertension, cardiovascular disease, and diabetes mellitus becoming increasingly prevalent.<sup>29</sup> On the other hand, Antibiotics (37.7%) were the most prevalent class of medicines studied by the research projects. One of the studies done in Ethiopia reported that prescribers in public health facilities were found prescribing an antibiotic to 73.89% of patients visiting the facilities.<sup>30</sup>

Research must have a value-added impact on the quality of service given to the local community.<sup>31</sup> Since the majority of research projects in this study were clinical researches conducted at different departments of University-affiliated hospitals, using the findings of these research projects would impact patients, health professionals, and a wider segment of the local community through strengthening Pharmaceutical care practice by educating staff and patients, validating Pharmaceutical care assessment tools, and informing aspects of Pharmaceutical care and Pharmacy service delivery. Furthermore, investigations of the undergraduate Pharmacy students' research projects have formed the basis for future work in this area, which will motivate other schools of Pharmacy in Ethiopia to characterize the nature of students' research projects.

The limitations of the present study are that as it was conducted in a single institution, it cannot be generalized to other institutions in Ethiopia. Additionally, it did not show the publication rate of students' research projects.

## Conclusion

This study showed that the majority of the undergraduate Pharmacy students' research projects were a cross-sectional survey that takes place on the clinical population at hospitals affiliated with the university. Slightly less than half of the abstracted projects were clinical researches focused on the Pharmaceutical care domain. And almost all of the projects were employed quantitative data collection methods. On the contrary, a lower proportion of the research projects were laboratory-based researches, focused on Pharmaceutical manufacturing, drug information service, regulation, and supply chain management domains, and takes place at community Pharmacy and educational institutions. Thus, it is highly recommended to have a conducive environment and facilities for all types of research projects in the university. Besides, it would be important to conduct qualitative or mixed-method researches to address new challenges in Pharmacy practice. Moreover, the university has to devise a system for expansion of the study settings other than its affiliated hospitals. Future research that aims at assessing different Pharmacy practice areas and domains should be done by the students in line with clinical researches.

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## Disclosure

The authors of this manuscript declare that they have no conflicts of interest for this work.

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