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ЕЖЕМЕСЯЧНЫЙ НАУЧНЫЙ ЖУРНАЛ

Медицинские новости Грузии

საქართველოს სამედიცინო სიახლენი

GEORGIAN MEDICAL NEWS

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GMN: Georgian Medical News is peer-reviewed, published monthly journal committed to promoting the science and art of medicine and the betterment of public health, published by the GMN Editorial Board since 1994. GMN carries original scientific articles on medicine, biology and pharmacy, which are of experimental, theoretical and practical character; publishes original research, reviews, commentaries, editorials, essays, medical news, and correspondence in English and Russian.

GMN is indexed in MEDLINE, SCOPUS, PubMed and VINITI Russian Academy of Sciences. The full text content is available through EBSCO databases.

GMN: Медицинские новости Грузии - ежемесячный рецензируемый научный журнал, издаётся Редакционной коллегией с 1994 года на русском и английском языках в целях поддержки медицинской науки и улучшения здравоохранения. В журнале публикуются оригинальные научные статьи в области медицины, биологии и фармации, статьи обзорного характера, научные сообщения, новости медицины и здравоохранения. Журнал индексируется в MEDLINE, отражён в базе данных SCOPUS, PubMed и ВИНИТИ РАН. Полнотекстовые статьи журнала доступны через БД EBSCO.

GMN: Georgian Medical News – საქართველოს სამედიცინო სიახლენი – არის ყოველთვიური სამეცნიერო სამედიცინო რეცენზირებადი ჟურნალი, გამოიცემა 1994 წლიდან, წარმოადგენს სარედაქციო კოლეგიისა და აშშ-ის მეცნიერების, განათლების, ინდუსტრიის, ხელოვნებისა და ბუნებისმეტყველების საერთაშორისო აკადემიის ერთობლივ გამოცემას. GMN-ში რუსულ და ინგლისურ ენებზე ქვეყნდება ექსპერიმენტული, თეორიული და პრაქტიკული ხასიათის ორიგინალური სამეცნიერო სტატიები მედიცინის, ბიოლოგიისა და ფარმაციის სფეროში, მიმოხილვითი ხასიათის სტატიები.

ჟურნალი ინდექსირებულია MEDLINE-ის საერთაშორისო სისტემაში, ასახულია SCOPUS-ის, PubMed-ის და ВИНИТИ РАН-ის მონაცემთა ბაზებში. სტატიების სრული ტექსტი ხელმისაწვდომია EBSCO-ს მონაცემთა ბაზებიდან.

WEBSITE

www.geomednews.com

К СВЕДЕНИЮ АВТОРОВ!

При направлении статьи в редакцию необходимо соблюдать следующие правила:

1. Статья должна быть представлена в двух экземплярах, на русском или английском языках, напечатанная через **полтора интервала на одной стороне стандартного листа с шириной левого поля в три сантиметра**. Используемый компьютерный шрифт для текста на русском и английском языках - **Times New Roman** (**Кириллица**), для текста на грузинском языке следует использовать **AcadNusx.** Размер шрифта - **12**. К рукописи, напечатанной на компьютере, должен быть приложен CD со статьей.

2. Размер статьи должен быть не менее десяти и не более двадцати страниц машинописи, включая указатель литературы и резюме на английском, русском и грузинском языках.

3. В статье должны быть освещены актуальность данного материала, методы и результаты исследования и их обсуждение.

При представлении в печать научных экспериментальных работ авторы должны указывать вид и количество экспериментальных животных, применявшиеся методы обезболивания и усыпления (в ходе острых опытов).

4. К статье должны быть приложены краткое (на полстраницы) резюме на английском, русском и грузинском языках (включающее следующие разделы: цель исследования, материал и методы, результаты и заключение) и список ключевых слов (key words).

5. Таблицы необходимо представлять в печатной форме. Фотокопии не принимаются. **Все цифровые, итоговые и процентные данные в таблицах должны соответствовать таковым в тексте статьи**. Таблицы и графики должны быть озаглавлены.

6. Фотографии должны быть контрастными, фотокопии с рентгенограмм - в позитивном изображении. Рисунки, чертежи и диаграммы следует озаглавить, пронумеровать и вставить в соответствующее место текста **в tiff формате**.

В подписях к микрофотографиям следует указывать степень увеличения через окуляр или объектив и метод окраски или импрегнации срезов.

7. Фамилии отечественных авторов приводятся в оригинальной транскрипции.

8. При оформлении и направлении статей в журнал МНГ просим авторов соблюдать правила, изложенные в «Единых требованиях к рукописям, представляемым в биомедицинские журналы», принятых Международным комитетом редакторов медицинских журналов - http://www.spinesurgery.ru/files/publish.pdf и http://www.nlm.nih.gov/bsd/uniform_requirements.html
В конце каждой оригинальной статьи приводится библиографический список. В список литературы включаются все материалы, на которые имеются ссылки в тексте. Список составляется в алфавитном порядке и нумеруется. Литературный источник приводится на языке оригинала. В списке литературы сначала приводятся работы, написанные знаками грузинского алфавита, затем кириллицей и латиницей. Ссылки на цитируемые работы в тексте статьи даются в квадратных скобках в виде номера, соответствующего номеру данной работы в списке литературы. Большинство цитированных источников должны быть за последние 5-7 лет.

9. Для получения права на публикацию статья должна иметь от руководителя работы или учреждения визу и сопроводительное отношение, написанные или напечатанные на бланке и заверенные подписью и печатью.

10. В конце статьи должны быть подписи всех авторов, полностью приведены их фамилии, имена и отчества, указаны служебный и домашний номера телефонов и адреса или иные координаты. Количество авторов (соавторов) не должно превышать пяти человек.

11. Редакция оставляет за собой право сокращать и исправлять статьи. Корректура авторам не высылается, вся работа и сверка проводится по авторскому оригиналу.

12. Недопустимо направление в редакцию работ, представленных к печати в иных издательствах или опубликованных в других изданиях.

При нарушении указанных правил статьи не рассматриваются.

REQUIREMENTS

Please note, materials submitted to the Editorial Office Staff are supposed to meet the following requirements:

1. Articles must be provided with a double copy, in English or Russian languages and typed or compu-ter-printed on a single side of standard typing paper, with the left margin of **3** centimeters width, and **1.5** spacing between the lines, typeface - **Times New Roman** (**Cyrillic**), print size - **12** (referring to Georgian and Russian materials). With computer-printed texts please enclose a CD carrying the same file titled with Latin symbols.

2. Size of the article, including index and resume in English, Russian and Georgian languages must be at least 10 pages and not exceed the limit of 20 pages of typed or computer-printed text.

3. Submitted material must include a coverage of a topical subject, research methods, results, and review.

Authors of the scientific-research works must indicate the number of experimental biological species drawn in, list the employed methods of anesthetization and soporific means used during acute tests.

4. Articles must have a short (half page) abstract in English, Russian and Georgian (including the following sections: aim of study, material and methods, results and conclusions) and a list of key words.

5. Tables must be presented in an original typed or computer-printed form, instead of a photocopied version. **Numbers, totals, percentile data on the tables must coincide with those in the texts of the articles.** Tables and graphs must be headed.

6. Photographs are required to be contrasted and must be submitted with doubles. Please number each photograph with a pencil on its back, indicate author's name, title of the article (short version), and mark out its top and bottom parts. Drawings must be accurate, drafts and diagrams drawn in Indian ink (or black ink). Photocopies of the X-ray photographs must be presented in a positive image in **tiff format**.

Accurately numbered subtitles for each illustration must be listed on a separate sheet of paper. In the subtitles for the microphotographs please indicate the ocular and objective lens magnification power, method of coloring or impregnation of the microscopic sections (preparations).

7. Please indicate last names, first and middle initials of the native authors, present names and initials of the foreign authors in the transcription of the original language, enclose in parenthesis corresponding number under which the author is listed in the reference materials.

8. Please follow guidance offered to authors by The International Committee of Medical Journal Editors guidance in its Uniform Requirements for Manuscripts Submitted to Biomedical Journals publication available online at: http://www.nlm.nih.gov/bsd/uniform_requirements.html
http://www.icmje.org/urm_full.pdf
In GMN style for each work cited in the text, a bibliographic reference is given, and this is located at the end of the article under the title "References". All references cited in the text must be listed. The list of references should be arranged alphabetically and then numbered. References are numbered in the text [numbers in square brackets] and in the reference list and numbers are repeated throughout the text as needed. The bibliographic description is given in the language of publication (citations in Georgian script are followed by Cyrillic and Latin).

9. To obtain the rights of publication articles must be accompanied by a visa from the project instructor or the establishment, where the work has been performed, and a reference letter, both written or typed on a special signed form, certified by a stamp or a seal.

10. Articles must be signed by all of the authors at the end, and they must be provided with a list of full names, office and home phone numbers and addresses or other non-office locations where the authors could be reached. The number of the authors (co-authors) must not exceed the limit of 5 people.

11. Editorial Staff reserves the rights to cut down in size and correct the articles. Proof-sheets are not sent out to the authors. The entire editorial and collation work is performed according to the author's original text.

12. Sending in the works that have already been assigned to the press by other Editorial Staffs or have been printed by other publishers is not permissible.

Articles that Fail to Meet the Aforementioned Requirements are not Assigned to be Reviewed.

ავტორთა საყურადღებოდ!

რედაქციაში სტატიის წარმოდგენისას საჭიროა დავიცვათ შემდეგი წესები:

1. სტატია უნდა წარმოადგინოთ 2 ცალად, რუსულ ან ინგლისურ ენებზე,დაბეჭდილი სტანდარტული ფურცლის 1 გვერდზე, 3 სმ სიგანის მარცხენა ველისა და სტრიქონებს შორის 1,5 ინტერვალის დაცვით. გამოყენებული კომპიუტერული შრიფტი რუსულ და ინგლისურენოვან ტექსტებში - **Times New Roman (Кириллица)**, ხოლო ქართულენოვან ტექსტში საჭიროა გამოვიყენოთ **AcadNusx.** შრიფტის ზომა – 12. სტატიას თან უნდა ახლდეს CD სტატიით.

2. სტატიის მოცულობა არ უნდა შეადგენდეს 10 გვერდზე ნაკლებს და 20 გვერდზე მეტს ლიტერატურის სიის და რეზიუმეების (ინგლისურ, რუსულ და ქართულ ენებზე) ჩათვლით.

3. სტატიაში საჭიროა გაშუქდეს: საკითხის აქტუალობა; კვლევის მიზანი; საკვლევი მასალა და გამოყენებული მეთოდები; მიღებული შედეგები და მათი განსჯა. ექსპერიმენტული ხასიათის სტატიების წარმოდგენისას ავტორებმა უნდა მიუთითონ საექსპერიმენტო ცხოველების სახეობა და რაოდენობა; გაუტკივარებისა და დაძინების მეთოდები (მწვავე ცდების პირობებში).

4. სტატიას თან უნდა ახლდეს რეზიუმე ინგლისურ, რუსულ და ქართულ ენებზე არანაკლებ ნახევარი გვერდის მოცულობისა (სათაურის, ავტორების, დაწესებულების მითითებით და უნდა შეიცავდეს შემდეგ განყოფილებებს: მიზანი, მასალა და მეთოდები, შედეგები და დასკვნები; ტექსტუალური ნაწილი არ უნდა იყოს 15 სტრიქონზე ნაკლები) და საკვანძო სიტყვების ჩამონათვალი (key words).

5. ცხრილები საჭიროა წარმოადგინოთ ნაბეჭდი სახით. ყველა ციფრული, შემაჯამებელი და პროცენტული მონაცემები უნდა შეესაბამებოდეს ტექსტში მოყვანილს.

6. ფოტოსურათები უნდა იყოს კონტრასტული; სურათები, ნახაზები, დიაგრამები - დასათაურებული, დანომრილი და სათანადო ადგილას ჩასმული. რენტგენოგრამების ფოტოასლები წარმოადგინეთ პოზიტიური გამოსახულებით **tiff** ფორმატში. მიკროფოტოსურათების წარწერებში საჭიროა მიუთითოთ ოკულარის ან ობიექტივის საშუალებით გადიდების ხარისხი, ანათალების შეღებვის ან იმპრეგნაციის მეთოდი და აღნიშნოთ სურათის ზედა და ქვედა ნაწილები.

7. სამამულო ავტორების გვარები სტატიაში აღინიშნება ინიციალების თანდართვით, უცხოურისა – უცხოური ტრანსკრიპციით.

8. სტატიას თან უნდა ახლდეს ავტორის მიერ გამოყენებული სამამულო და უცხოური შრომების ბიბლიოგრაფიული სია (ბოლო 5-8 წლის სიღრმით). ანბანური წყობით წარმოდგენილ ბიბლიოგრაფიულ სიაში მიუთითეთ ჯერ სამამულო, შემდეგ უცხოელი ავტორები (გვარი, ინიციალები, სტატიის სათაური, ჟურნალის დასახელება, გამოცემის ადგილი, წელი, ჟურნალის №, პირველი და ბოლო გვერდები). მონოგრაფიის შემთხვევაში მიუთითეთ გამოცემის წელი, ადგილი და გვერდების საერთო რაოდენობა. ტექსტში კვადრატულ ფჩხილებში უნდა მიუთითოთ ავტორის შესაბამისი N ლიტერატურის სიის მიხედვით. მიზანშეწონილია, რომ ციტირებული წყაროების უმეტესი ნაწილი იყოს 5-6 წლის სიღრმის.

9. სტატიას თან უნდა ახლდეს: ა) დაწესებულების ან სამეცნიერო ხელმძღვანელის წარდგინება, დამოწმებული ხელმოწერითა და ბეჭდით; ბ) დარგის სპეციალისტის დამოწმებული რეცენზია, რომელშიც მითითებული იქნება საკითხის აქტუალობა, მასალის საკმაობა, მეთოდის სანდოობა, შედეგების სამეცნიერო-პრაქტიკული მნიშვნელობა.

10. სტატიის ბოლოს საჭიროა ყველა ავტორის ხელმოწერა, რომელთა რაოდენობა არ უნდა აღემატებოდეს 5-ს.

11. რედაქცია იტოვებს უფლებას შეასწოროს სტატია. ტექსტზე მუშაობა და შეჯერება ხდება საავტორო ორიგინალის მიხედვით.

12. დაუშვებელია რედაქციაში ისეთი სტატიის წარდგენა, რომელიც დასაბეჭდად წარდგენილი იყო სხვა რედაქციაში ან გამოქვეყნებული იყო სხვა გამოცემებში.

აღნიშნული წესების დარღვევის შემთხვევაში სტატიები არ განიხილება.

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THE IMPACT OF VISION 2030 ON PHARMACY STUDENTS' CAREER OUTLOOKS AND SPECIALIZATION CHOICES: A CROSS-SECTIONAL ANALYSIS

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Abstract.

Background: Saudi Arabia's Vision 2030 has introduced substantial reforms aimed at transforming the healthcare sector, including the expansion of advanced clinical roles, digital health integration, and workforce localization. Understanding how these reforms influence pharmacy students' career outlooks and specialization choices is essential for aligning pharmacy education with national workforce priorities.

Objective: This study aimed to examine pharmacy students' career outlooks and specialization preferences in Saudi Arabia, with a particular focus on the perceived influence of Vision 2030 on their professional decision-making.

Methods: A descriptive cross-sectional survey was conducted among pharmacy students enrolled in public and private universities across Saudi Arabia. A structured bilingual (English–Arabic) questionnaire collected data on demographics, awareness of Vision 2030, career preferences, and perceived influence of Vision 2030 using Likert-scale items, along with open-ended qualitative reflections. Quantitative data were analyzed using descriptive and inferential statistics, while qualitative responses underwent thematic content analysis. **Results:** A total of 440 pharmacy students participated. Nearly all respondents (97.7%) reported familiarity with Vision 2030. Clinical pharmacy (24.1%) and hospital pharmacy (21.4%) were the most preferred career pathways, while 4.5% expressed interest in health informatics or digital health. Most students (73.6%) planned to pursue specialization after graduation. Although Vision 2030 was less frequently identified as a direct factor influencing career choice (13.6%), Likert-scale findings indicated a moderate perceived influence on career thinking and preparedness. Qualitative analysis revealed three major themes: perceived expansion of professional opportunities under Vision 2030, opportunities and challenges related to technological advancement (including concerns about artificial intelligence), and the need for curriculum modernization emphasizing practical training and digital competencies.

Conclusion: Pharmacy students in Saudi Arabia perceive Vision 2030 as an important contextual framework shaping the future of pharmacy practice and career opportunities, primarily through system-level changes rather than as a direct personal motivator. These findings highlight the need for continued curriculum reform, expanded postgraduate training pathways, and structured career guidance to ensure alignment between pharmacy education, student aspirations, and national health sector transformation goals.

Key words. Vision 2030, pharmacy education, career choice, specialization, digital health, Saudi Arabia.

Introduction.

Saudi Arabia's Vision 2030 is a comprehensive national framework designed to transform the Kingdom's economy, modernize public services, and strengthen key sectors such as healthcare [1]. A central focus of this initiative is the development of a highly skilled healthcare workforce that is capable of adapting to evolving societal needs while embracing digital transformation, advanced clinical practices, and innovation [2]. For pharmacy, these reforms include expanding traditional roles, promoting specialized practice areas, integrating health informatics and pharmacogenomics, and fostering leadership in research and pharmaceutical innovation [3].

Over the past two decades, pharmacy education in Saudi Arabia has undergone significant reforms, transitioning from a focus on pharmaceutical sciences to a patient-centered, competency-

based model [4]. These reforms align with international trends, but Vision 2030 adds a uniquely national dimension by emphasizing workforce localization, diversification of career opportunities, and alignment of graduate competencies with health sector transformation priorities [5]. This context positions pharmacy students' career aspirations and specialization choices within both individual considerations and broader national strategies.

Previous evidence shows that pharmacy students' career decisions are shaped by a mixture of personal interests, self-efficacy, and professional identity, as well as external factors such as job market demands, salary expectations, and policy frameworks [6]. Within Saudi Arabia, the health goals of Vision 2030—expanding access to clinical services, strengthening the private sector, and integrating digital health—are likely to influence pharmacy students' professional outlooks [7]. Recent studies also suggest that awareness of Vision 2030 correlates with a stronger interest in clinical specializations, research roles, and non-traditional domains such as health informatics [8,9].

Despite these developments, limited research has explored the direct relationship between Vision 2030 awareness and pharmacy students' career trajectories. While some studies have examined career preferences [10,11] or policy awareness [12], few have integrated these dimensions into a single framework. Understanding this relationship is essential for shaping curricula, advising strategies, and workforce planning that support both national priorities and student career fulfillment.

This study aims to address this gap by examining the career outlooks and specialization choices of pharmacy students across Saudi universities, with a particular focus on the perceived influence of Vision 2030. By integrating quantitative and qualitative insights, the research seeks to provide evidence-based recommendations for aligning pharmacy education with national transformation objectives.

Methodology.

Study Design: This study employed a descriptive cross-sectional survey design to examine pharmacy students' career outlooks, specialization preferences, and perceptions of the influence of Saudi Arabia's Vision 2030. A cross-sectional approach was selected to capture participants' perspectives within a defined academic period and to allow comparison across demographic characteristics, educational stages, and institutional contexts [1].

Study Setting and Population:

The study targeted pharmacy students enrolled in public and private universities across the Kingdom of Saudi Arabia. Eligible participants met the following criteria:

1. Enrollment in a Bachelor of Pharmacy (BPharm) or Doctor of Pharmacy (PharmD) program;
2. Current study status ranging from the first academic year to the internship year;
3. Age of 18 years or older.

Students who were on academic leave, studying pharmacy outside Saudi Arabia, or who had already graduated were excluded to ensure relevance to the current Saudi educational context.

Sample Size and Sampling Strategy:

The minimum required sample size was calculated using the Raosoft® online sample size calculator, assuming a 95% confidence level, a 5% margin of error, and an estimated population of 15,000 pharmacy students in Saudi Arabia. This yielded a minimum required sample of 375 participants. To enhance representativeness and account for incomplete or invalid responses, a target of at least 400 completed questionnaires was set.

A non-probability convenience sampling strategy was adopted due to practical feasibility. Participants were recruited through institutional contacts, faculty coordinators, and pharmacy student networks using social media platforms (Twitter/X, WhatsApp, and Telegram).

Survey Instrument:

A structured, bilingual (English–Arabic) questionnaire was developed by the research team based on prior literature addressing pharmacy career preferences and adapted to reflect healthcare transformation priorities under Vision 2030 [3-6]. The questionnaire comprised five sections:

1. **Demographic information:** age, gender, university type, year of study, and program type.
2. **Awareness of Vision 2030:** self-reported familiarity and understanding of Vision 2030 healthcare goals.
3. **Career preferences:** preferred future work setting, intention to specialize, and main factors influencing career choice.
4. **Perceived influence of Vision 2030:** two statements assessed using a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree) measuring perceived impact on career thinking and preparedness to align with Vision 2030 goals.
5. **Qualitative reflection:** three open-ended questions exploring perceived influence of Vision 2030, anticipated opportunities and challenges, and suggested educational reforms.

Instrument Validation:

Content validity was assessed by a panel of five experts in pharmacy education, workforce planning, and Vision 2030 healthcare policy. Feedback focused on clarity, relevance, and cultural appropriateness, and revisions were made accordingly. The bilingual questionnaire underwent back-translation to ensure linguistic equivalence.

A pilot test was conducted with 25 pharmacy students from two universities; these responses were excluded from the final analysis. Minor refinements were made to wording and item sequencing to improve clarity. Internal consistency of the Likert-scale items was evaluated using Cronbach's alpha, yielding a coefficient of 0.83, indicating good reliability.

Data Collection Procedure:

The final questionnaire was administered electronically using Google Forms®. Data collection occurred from 14 July 2025 to 24 September 2025. The survey link was distributed via student groups, faculty coordinators, and university email lists. Before accessing the questionnaire, participants viewed an information and consent statement outlining the study objectives, confidentiality measures, and voluntary nature of participation. Electronic informed consent was obtained by selecting "I Agree" prior to proceeding.

Ethical Considerations:

Ethical approval was obtained from the appropriate Institutional Review Board. Participation was voluntary, with no incentives provided. Responses were collected anonymously, and no identifying information was recorded. All data were securely stored in password-protected files accessible only to the research team.

Data Analysis:

Quantitative data were analyzed using IBM SPSS Statistics® version 29. Descriptive statistics (frequencies, percentages, means, and standard deviations) were used to summarize demographic characteristics, awareness of Vision 2030, and career preferences.

Inferential analyses included:

• Chi-square (χ^2) tests to examine associations between categorical variables (e.g., gender, university type) and career preferences;

• Independent samples t-tests and one-way analysis of variance (ANOVA) to compare Likert-scale perception scores across demographic groups.

Qualitative responses were analyzed using thematic content analysis. An initial coding framework was developed inductively from the data. Two researchers independently coded the responses, after which consensus meetings were held to resolve discrepancies and finalize themes. The resulting themes were interpreted in relation to Vision 2030 healthcare objectives to contextualize student perspectives.

Results.

A total of 440 pharmacy students participated in the study. The largest age group was 20–22 years (38.6%), followed by above 25 years (≈27.5%) and 23–25 years (25.5%). A small proportion of respondents were younger than 20 years (8.2%) or reported other ages (≤0.5% each). The majority of participants were female (68.2%), enrolled in public universities (91.4%), and most commonly in their internship year (42.7%) or third year (17.3%) of study. Most were enrolled in the PharmD program (73.2%), with the remainder in the BPharm program (26.8%) (Table 1).

Table 1. *Demographic Characteristics of Pharmacy Student Respondents (N = 440).*

Variable	Category	Frequency	Percentage
Age	20–22	170	38.60%
	23–25	112	25.50%
	Above 25	116	26.40%
	Less than 20	36	8.20%
Gender	Female	300	68.20%
	Male	140	31.80%
University Type	Public	402	91.40%
	Private	38	8.60%
Year of Study	Internship Year	188	42.70%
	3rd Year	76	17.30%
	5th Year	66	15.00%
	4th Year	62	14.10%
	2nd Year	34	7.70%
	1st Year	14	3.20%
Program	PharmD	322	73.20%
	BPharm	118	26.80%

Nearly all respondents (97.7%) reported being familiar with Saudi Arabia's Vision 2030 (Table 2). Regarding preferred future work settings, clinical pharmacy (24.1%) and hospital pharmacy (21.4%) were the most common choices, while 18.2% were undecided. Other preferences included pharmaceutical industry (13.6%), academia/research (13.2%), community pharmacy (5.0%), and health informatics/digital health (4.5%). Most students (73.6%) planned to specialize after graduation, with 23.6% unsure and only 2.7% indicating no intention to specialize.

Likert-scale analysis revealed that students felt moderately prepared to align with Vision 2030's goals (mean = 3.65, SD = 1.53) and perceived a similar influence on their career thinking (mean = 3.61, SD = 1.39) (Table 3). Median scores of 4 for both items indicate a tendency toward agreement, although standard deviations reflect some variability in responses.

The thematic analysis of the open-ended responses (Table 4) revealed three overarching themes that provide deeper insight into students' perceptions of Vision 2030 and its implications for their professional aspirations, challenges in the job market, and educational needs.

The first theme, Impact of Vision 2030 on Goals, reflected a general sense of optimism among many participants, who perceived Vision 2030 as a catalyst for expanded opportunities for Saudi nationals within the pharmacy sector. Students described an increased availability of roles across various sectors and felt encouraged to pursue more ambitious professional objectives. This sense of motivation was often linked to the broader national vision of modernization and workforce empowerment. However, not all respondents shared this perspective. A smaller group expressed skepticism, stating that they had not yet observed tangible changes in their career prospects attributable to Vision 2030, indicating a possible gap between policy aspirations and their current lived experiences.

The second theme, Opportunities and Challenges, highlighted both the perceived benefits and the anticipated obstacles for pharmacy graduates under Vision 2030. Many participants viewed technological advancements, particularly in the fields of pharmaceutical sciences and healthcare delivery, as a key opportunity for career growth and role diversification. They saw the integration of cutting-edge technologies as a pathway to more specialized and impactful pharmacy practice. Conversely, several students voiced concerns regarding the rapid adoption of artificial intelligence (AI), warning that it could displace traditional pharmacy roles and reduce demand for human expertise. Other challenges included the slow or partial implementation of certain Vision 2030 initiatives, as well as a competitive job market that some feared might limit opportunities for new graduates.

The third theme, Suggested Changes in Education, emphasized students' desire for educational reform to better align with the evolving professional landscape shaped by Vision 2030. Many respondents advocated for a stronger emphasis on practical, hands-on training, arguing that real-world clinical and industry experience would better prepare them for the demands of the modern healthcare sector. Others suggested integrating more technology-focused content, such as courses on digital health, AI applications, and pharmaceutical informatics, to equip

Table 2. *Awareness and Career Preferences.*

Variable	Category	Frequency	Percentage
Familiar with Vision 2030	Yes	430	97.70%
	No	10	2.30%
Preferred Future Work Setting	Clinical Pharmacy	106	24.10%
	Hospital Pharmacy	94	21.40%
	Undecided	80	18.20%
	Pharmaceutical Industry	60	13.60%
	Academia/Research	58	13.20%
	Community Pharmacy	22	5.00%
	Health Informatics/Digital Health	20	4.50%
Plan to Specialize after Graduation	Yes	324	73.60%
	Not sure	104	23.60%
	No	12	2.70%

Table 3. *Descriptive Statistics for Perceptions of Vision 2030 Impact (Likert Scale 1–5).*

Statement	Mean	SD	Min	25%	Median	75%	Max
I feel prepared to align with Vision 2030's goals	3.65	1.53	1	3	4	5	5
Vision 2030 has influenced my career thinking	3.61	1.39	1	3	4	5	5

Table 4. *Thematic Summary of Participant Responses on Vision 2030's Impact, Opportunities and Challenges, and Educational Recommendations.*

Question	Total Responses	Main Themes
Impact of Vision 2030 on Goals	436	Expanded opportunities for Saudis; Motivation for development; No impact for some
Opportunities & Challenges	436	**Opportunities:** Technological growth, role diversification; **Challenges:** AI competition, limited implementation, job market issues
Suggested Changes in Education	432	Increase practical training; Integrate technology; Modernize curriculum; Some see no change needed

Table 5. *Refined Participant Quotes on the Perceived Impact of Vision 2030, Opportunities and Challenges, and Suggested Educational Changes.*

Question	Refined Quotes
How has Vision 2030 influenced your personal or professional goals in pharmacy?	- Vision 2030 has expanded employment sectors for Saudis and created more career opportunities. - It has encouraged me to prepare for a future where artificial intelligence plays a larger role in the workforce. - It has inspired me to set higher professional ambitions.
What opportunities or challenges do you see for pharmacy graduates under Vision 2030?	- Many of the potential opportunities outlined in Vision 2030 have yet to be fully implemented, and job diversity for pharmacy graduates remains limited. - The increasing role of artificial intelligence may pose competition to the human workforce. - Advancements in pharmacy technology present significant opportunities for professional growth.
What changes would you suggest in pharmacy education to better support Vision 2030 goals?	- Pharmacy education should prioritize practical training and hands-on experience rather than relying mainly on theoretical teaching. - The current curriculum is adequate and does not require major changes. - There should be a stronger focus on integrating technological transformation into pharmacy training.

graduates with the skills needed to thrive in a technology-driven environment. Curriculum modernization was also recommended, with calls for updating course content to reflect emerging trends and national priorities. While the majority supported these changes, a minority of students felt that the current educational structure was adequate and did not require major modifications.

Illustrative participant quotes (Table 5) bring these themes to life. One student remarked, "Vision 2030 has expanded employment sectors for Saudis and created more career opportunities," capturing the sense of possibility expressed by many respondents. Another highlighted concerns about technological disruption, stating, "The increasing role of artificial intelligence may pose competition to the human workforce." In terms of education, one participant stressed the importance of applied learning, noting, "Pharmacy education should prioritize practical training and hands-on experience rather than relying mainly on theoretical teaching." Together,

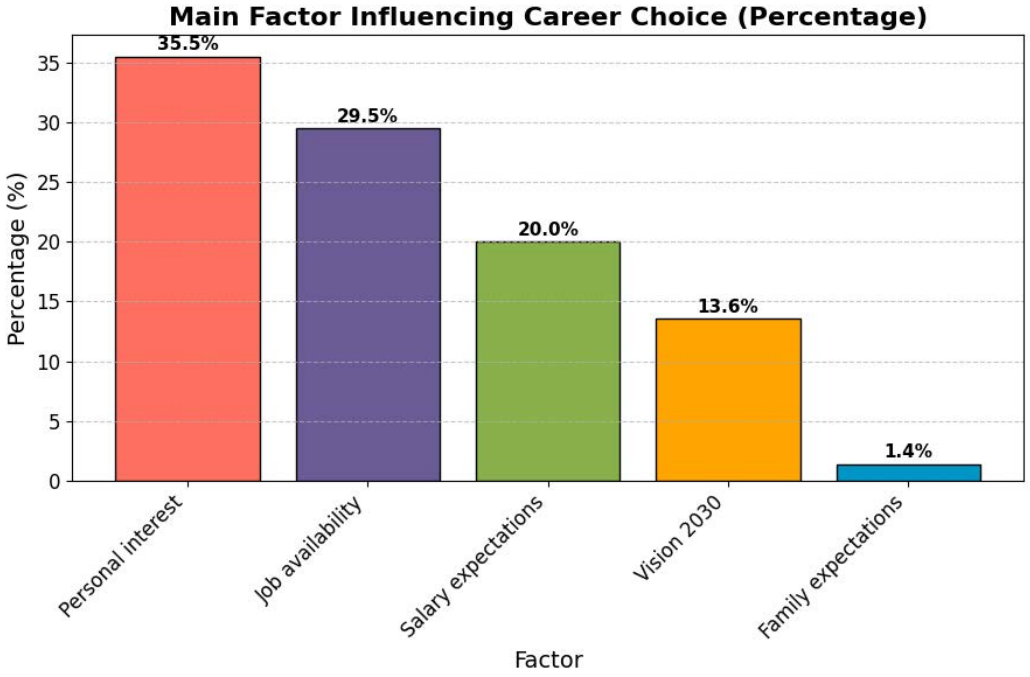

Figure 1. *Main Factors Influencing Pharmacy Students' Career Choices.*

these voices underscore the dual nature of Vision 2030 as both a driver of ambition and a source of apprehension, while also pointing toward clear pathways for educational enhancement to meet the challenges and opportunities of the coming decade.

Discussion.

This study examined how Saudi Arabia's Vision 2030 relates to pharmacy students' career outlooks and specialization preferences. Although nearly all respondents reported familiarity with Vision 2030, its influence appears to operate primarily at a systemic and contextual level rather than as a dominant, explicitly stated driver of individual career decisions. While only a minority of students selected Vision 2030 as the single most influential factor affecting their career choice, many perceived it as shaping the broader professional environment by redefining workforce needs, expanding specialized roles, and elevating expectations for advanced and technology-enabled pharmacy practice. In this sense, Vision 2030 appears to shape career outlooks primarily through perceived system-level changes—such as opportunities, workforce direction, and educational expectations—even when students do not cite it as their main direct motivator.

The strong preference for clinical pharmacy and hospital-based roles observed in this study is consistent with national workforce strategies that emphasize advanced clinical services under Vision 2030 [2,15]. Similar patterns have been reported in prior studies documenting a shift away from traditional dispensing roles toward specialized, patient-centered clinical pathways [19,22]. These preferences likely reflect both global developments in pharmacy practice and local reforms in Saudi pharmacy education that emphasize competency-based training, clinical integration, and alignment with national health priorities [4,15,19]. Within this evolving context, students' reported "personal interest" may partially reflect interests formed in an environment increasingly shaped by Vision 2030-driven reforms.

Overall, respondents expressed optimism regarding professional growth, recognition, and the expansion of career pathways within the transformed healthcare system. Comparable findings have been reported among Saudi medical and nursing students, where national reform initiatives have been associated with increased motivation and higher professional aspirations [18]. Together, these findings highlight the role of large-scale policy frameworks in shaping how health professional students interpret future career prospects, even when such frameworks are not perceived as immediate or personal decision-making factors.

Despite this optimism, students also reported concerns related to workforce saturation, limited postgraduate training opportunities, and uncertainty surrounding employment prospects. These concerns echo earlier analyses that warned of potential misalignment between graduate output and the availability of specialized positions within the healthcare system [19]. Addressing these challenges requires coordinated workforce planning, expansion of residency and fellowship programs, and structured career counselling within colleges of pharmacy to support informed and realistic career decision-making.

A notable mixed-methods finding was the apparent tension between students' concerns regarding artificial intelligence and the relatively low proportion selecting health informatics or digital health as a preferred career pathway. While qualitative responses revealed apprehension about AI-driven competition and potential displacement of traditional roles, other students viewed technological advancement as an opportunity for innovation and professional growth. This divergence suggests heterogeneity in students' readiness and confidence to pursue

technology-oriented careers: for some, AI represents a threat, whereas for others it signals a space for specialization and leadership. This finding underscores the importance of targeted curricular exposure, mentorship, and career guidance to clarify digital health pathways and better prepare pharmacy graduates for emerging roles.

Qualitative findings also emphasized students' calls for curriculum modernization to align pharmacy education with the evolving healthcare landscape. Many advocated for increased experiential learning, stronger integration of digital health and emerging technologies, and greater emphasis on applied training that reflects real-world practice demands. These priorities align with recent studies highlighting the need for curriculum enhancement to prepare graduates for future-oriented pharmacy roles within Saudi Arabia's healthcare transformation [20]. However, a minority of respondents perceived the current curriculum as adequate, indicating variability in expectations and perceived preparedness that should be addressed through targeted rather than uniform educational interventions. To strengthen topical focus, the reference list was refined to prioritize literature directly relevant to pharmacy career choice, workforce planning, and Vision 2030-linked health sector transformation.

Limitations.

The cross-sectional design of this study limits causal inference, and the use of convenience sampling may reduce generalizability. In addition, self-reported awareness of Vision 2030 may be influenced by social desirability or varying interpretations of policy familiarity. Nevertheless, the large, multi-institutional sample and integration of quantitative and qualitative findings provide valuable insights into current pharmacy student perceptions across Saudi Arabia.

Future Directions.

Future research should employ longitudinal designs to examine how pharmacy students' career perceptions and specialization choices evolve as Vision 2030 initiatives continue to expand. Comparative studies across health professions, as well as cross-national analyses involving countries undergoing similar health sector reforms, would further strengthen understanding of policy-driven influences on health workforce development.

Conclusion.

This study demonstrates that Saudi pharmacy students view Vision 2030 as a pivotal framework shaping their career outlooks and specialization choices. The national transformation agenda has fostered enthusiasm for specialized, patient-centered, and technologically integrated pharmacy roles, while also raising expectations for expanded postgraduate training and career mobility.

To maximize the potential of this motivated workforce, policymakers and academic institutions must prioritize initiatives that directly address current gaps and future demands. Expanding clinical residency and fellowship programs will create opportunities for graduates to pursue advanced specializations and meet the increasing need for highly skilled practitioners in clinical and emerging fields. At the same time, strengthening career counseling and mentorship within pharmacy colleges will provide students with structured guidance, helping them make informed decisions, navigate competitive job markets, and align their aspirations with national workforce priorities. Equally critical is the continuous evolution of pharmacy curricula to reflect the transformative goals of Vision 2030, particularly by integrating areas such as pharmacogenomics, digital health, and pharmaceutical informatics. Collectively, these strategies will ensure that pharmacy graduates are well-prepared to contribute to Saudi Arabia's healthcare transformation while remaining competitive in a rapidly changing global context.

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