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The effect of medication and nutrition education on therapy adherence among hypertensive patients in the post-pandemic hospital setting

Pengaruh edukasi obat dan gizi terhadap kepatuhan terapi pasien hipertensi di rumah sakit pascapandemi

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Abstract

Hypertension is a chronic condition that requires long-term adherence to pharmacological treatment and lifestyle modifications. The inadequate integration of drug education and nutrition counseling in clinical settings hinders treatment adherence, particularly after the COVID-19 pandemic. This study aimed to analyze the influence of the quality of drug education and nutrition counseling services on treatment adherence among patients with hypertension. A quantitative analytical study with a cross-sectional design was conducted at the Primaya Inco Sorowako Hospital, South Sulawesi, Indonesia, from May to June 2025. Eighty outpatients with hypertension were selected using purposive sampling based on the predefined inclusion criteria. The data were collected using validated questionnaires. Spearman's correlation and multiple linear regression were used for analysis. The quality of drug education showed a significant positive correlation with treatment adherence ($r = 0,61$; $p < 0,001$), as did nutritional counseling ($r = 0,53$; $p < 0,001$). Both variables jointly influenced adherence ($R^2 = 0,46$), with drug education being the dominant predictor ($\beta = 0,48$; $p < 0,001$). These findings suggest that enhanced interdisciplinary collaboration between pharmacists and nutritionists is essential for improving adherence in patients with hypertension.

Keywords: Counseling, hypertension, inter-professional collaboration, medication adherence, nutrition therapy

Abstrak

Hipertensi merupakan kondisi kronis yang memerlukan kepatuhan jangka panjang terhadap pengobatan farmakologis dan perubahan gaya hidup. Kurangnya integrasi antara edukasi obat dan konseling gizi di layanan klinis menghambat kepatuhan terapi, terutama pascapandemi COVID-19. Penelitian ini bertujuan untuk menganalisis pengaruh kualitas layanan edukasi obat dan konseling gizi terhadap kepatuhan berobat pada pasien hipertensi. Penelitian ini menggunakan pendekatan kuantitatif analitik dengan desain potong lintang yang dilakukan di RS Primaya Inco Sorowako, Sulawesi Selatan, Indonesia, pada Mei–Juni 2025. Sampel sebanyak 80 pasien hipertensi rawat jalan dipilih melalui teknik purposive sampling berdasarkan kriteria inklusi. Data dikumpulkan menggunakan kuesioner terstruktur yang telah tervalidasi. Analisis dilakukan dengan korelasi Spearman dan regresi linear berganda. Terdapat korelasi positif yang signifikan antara kualitas edukasi obat dan kepatuhan berobat ($r = 0,61$; $p < 0,001$), serta antara konseling gizi dan kepatuhan ($r = 0,53$; $p < 0,001$). Kedua variabel berpengaruh secara simultan terhadap kepatuhan ($R^2 = 0,46$), dengan edukasi obat sebagai prediktor dominan ($\beta = 0,48$; $p < 0,001$). Hasil ini menunjukkan pentingnya kolaborasi interprofesional antara apoteker dan nutrisionis dalam praktik edukasi klinis guna meningkatkan kepatuhan pasien hipertensi.

Kata Kunci: Konseling, hipertensi, kepatuhan minum obat, kolaborasi interprofesional, terapi gizi

Introduction

Hypertension, or high blood pressure, is a non-communicable disease that contributes significantly to the number of illnesses and premature deaths worldwide (Upadhyay, 2022). According to the Global Report on Hypertension by the WHO, more than 1,28 billion adults live with hypertension, but only about 21% achieve clinically controlled blood pressure targets (WHO, 2023; Sharma et al., 2017). In middle-income countries, such as Indonesia, the burden of hypertension continues to increase in line with changing demographics, sedentary lifestyles, and low public health awareness.

The prevalence of hypertension in the adult population of Indonesia is 34,1%, and the majority of sufferers do not know their health status. This shows that there is a wide treatment gap between detection, initiation of therapy, and achievement of therapeutic targets (Kemenkes RI, 2018). One of the main determinants of the success of hypertension management is patient adherence to both pharmacological therapies and lifestyle interventions. Low compliance rates were significantly correlated with an increase in complications, such as stroke, coronary heart disease, and kidney failure (Ashoorkhani et al., 2018; Burnier & Egan, 2019).

Adherence to chronic medications, such as hypertension, is a multidimensional phenomenon that is influenced by a combination of internal and external factors (Win et al., 2021). One strategic approach that has proven effective in increasing compliance is quality patient education, both related to drug use and nutrition education. Education provided consistently, evidence-based, and communicative has been proven to improve patients' risk perceptions, increase their understanding of therapy regimens, and strengthen their motivation to change health behaviors (Mentrup et al., 2018; Mentrup et al., 2020).

In Indonesia, the importance of patient education as part of health service standards is regulated by the Regulation of the Minister of Health of the Republic of Indonesia Number 72 of 2016 concerning Pharmaceutical Service Standards in Hospitals (Trianengsih et al., 2019). This regulation mandates that pharmacists be obliged to provide drug education that includes information about indications, dosages, how to use, side effects, and drug interactions to patients or patients' families. However, implementation in the field shows that this educational practice is often administrative and limited to pharmacological aspects alone, without interprofessional involvement, which includes systematic and integrated nutrition education (Jahar et al., 2022; Merel & Paauw, 2017).

A comprehensive hypertension management approach requires the involvement of various disciplines, including pharmacists and clinical nutritionists. Patients' nutritional literacy influences their decisions to manage sodium, saturated fat, and potassium intake, which is directly related to the effectiveness of antihypertensive therapy. Fraser showed that patients who followed a low-sodium, high-potassium diet had more stable blood pressure control, even in economically disadvantaged populations (Fraser, 2022; Lou et al., 2023).

However, collaborative practices between pharmacists and nutritionists in the context of patient education still face a number of structural and cultural challenges, such as the lack of interprofessional training, absence of integrated education SOPs, and limited service time in hospital pharmacy installations (Nour et al., 2018; Livne, 2019). This problem has become more complex after the Covid-19 pandemic, when face-to-face educational services are limited, and the use of digital media and information technology-based approaches has not been fully integrated in the hospital service system (Mogre et al., 2025).

The Covid-19 pandemic has also affected the dynamics of the health service system, including a decline in the quality of interaction between patients and health workers due to social restrictions, the transfer of communication media, and the unpreparedness of health workers to adapt to digital educational media. In this situation, education is increasingly important as a means of therapeutic communication that bridges the information needs of patients with limited time and space in healthcare facilities. Therefore, the integration of drug education services and nutrition education is not only relevant but also a necessity in redesigning an effective, adaptive, and patient-centered care hospital-based hypertension service system.

However, a literature review shows that most studies in Indonesia that assess pharmaceutical or nutrition education still use a

descriptive or qualitative approach, with few explicitly testing the causal or predictive relationship between educational services and therapeutic adherence rates (Rahmawati, 2018). Limited and adequate quantitative evidence on the effectiveness of integrating cross-professional education services in the context of hospitals, especially post-pandemic, is a research gap that needs to be answered empirically and measurably.

Based on this background, this study aimed to analyze the effect of the quality of drug and nutrition education services on the therapeutic adherence of patients with hypertension in post-pandemic hospitals. This study was conducted using a quantitative analytical approach based on national regulations that regulate pharmaceutical service standards in hospitals. The results of this study are expected to contribute to strengthening collaborative policies and practices between professions as well as encourage the formulation of an integrated education model that is effective in improving the success of hypertension therapy at the secondary service level.

Methods

This study employed a quantitative analytical method with a cross-sectional design to examine the effect of drug education and nutrition counseling services on therapeutic adherence in patients with hypertension (Cvetkovic-Vega et al., 2021). Data collection was conducted simultaneously for all variables without researcher intervention, making this design appropriate for capturing real-world conditions in clinical practice, although it does not allow for causal inference (Billah et al., 2022).

This research was conducted at the Outpatient Installation of Primaya Inco Sorowako Hospital, East Luwu Regency, South Sulawesi, between May and June 2025. The hospital provides structured pharmaceutical and nutritional counseling services that enable direct observation and measurement of service quality and patient adherence in an operational clinical setting.

Population and Sample

The population in this study was all outpatients with hypertension who underwent routine therapy at Primaya Inco Sorowako Hospital and received drug and/or nutrition education from pharmacists or nutritionists. Sample withdrawal was carried out by purposive sampling, considering the following characteristics as inclusion criteria:

The inclusion criteria in this study were hypertensive patients who were ≥18 years old, had undergone routine antihypertensive therapy for at least three months, and had received education from pharmacists and/or nutritionists in the past month. In addition, the respondents did not have cognitive or hearing impairments that could hinder their understanding of the content of the questionnaire or the educational process. Respondents were also declared willing to participate in the study voluntarily by signing an informed consent sheet after obtaining a clear explanation of the research objectives, benefits, and procedures.

Based on the statistical strength analysis (power analysis) using the G*Power 3,1 application for multiple linear regression tests (two predictors), assuming a medium effect size (f^2 = 0,15), significance level (α) 0,05, and power of 0,80, a minimum sample size estimate of 68 respondents was obtained. To anticipate the possibility of non-response and to increase the reliability of the data, 80 patients were included in this study (Kang, 2021).

Data Collection Procedures

This study measured three variables: quality of drug education, quality of nutrition education, and treatment adherence. The quality of drug education was defined as patients' perception of the clarity, completeness, and comprehensibility of medication-related information delivered by pharmacists. The quality of nutrition education refers to patients' understanding of the dietary recommendations for hypertension provided by pharmacists or nutritionists. Treatment adherence was defined as patients' consistency in taking prescribed medications and implementing lifestyle modifications as recommended by healthcare providers (Arora et al., 2017).

Data were collected using a structured self-administered questionnaire with 5-point Likert-scale items (1 = strongly disagree, 5 = strongly agree). The questionnaire was developed based on the Indonesian Ministry of Health's Patient Education Guidelines and previously validated instruments in the scientific literature. To ensure

instrument validity, three experts (clinical pharmacy, clinical nutrition, and health research methodology) reviewed the items for their relevance, clarity, and cultural appropriateness. Construct validity was assessed through exploratory factor analysis (EFA), which confirmed three distinct subscales with factor loadings >0,50. Reliability testing using Cronbach's alpha showed satisfactory internal consistency (α = 0,78 for drug education; α = 0,81 for nutrition education; and α = 0,76 for adherence).

Data collection was performed face-to-face by trained enumerators, with the assistance of hospital pharmacists. Patients received a full explanation of the study objectives and procedures, provided informed consent, and completed the questionnaire within 20–25 min.

Data Analysis Techniques

Data were analyzed using IBM SPSS Statistics version 26. Descriptive analysis was first conducted to summarize the respondents' demographic characteristics and the distribution of scores for each study variable. The Kolmogorov–Smirnov normality test showed that the data were not normally distributed; thus, non-parametric statistical methods were applied.

The relationship between the independent variables (quality of drug education and nutrition counseling) and the dependent variable (treatment adherence) was examined using the Spearman correlation analysis. Multiple linear regression analysis was performed to assess the simultaneous influence of the independent variables on treatment adherence. The assumptions of multicollinearity were tested using the Variance Inflation Factor (VIF) and tolerance values. A significance level of $p < 0,05$ was used for all statistical tests.

Research Ethics

This research has obtained an ethical license from the Health Research Ethics Committee, Faculty of Pharmacy, Megarezky University Makassar (Number: 078-FF/KEPK-UNIMERZ/02.25/II/2025).

All respondents signed an informed consent sheet, and data confidentiality was guaranteed in accordance with the principles of Good Clinical Practice (GCP)

Result and Discussion

Respondent Characteristics

This study included 80 outpatients with hypertension at the Primaya Inco Sorowako Hospital who met the inclusion criteria. A total of 85 questionnaires were distributed, of which 80 were returned and completed, resulting in a response rate of 94,1%.

The majority of respondents were female (68,8%), aged 41–60 years (72,5%), and had a secondary education level (high school or equivalent) of 58,8%. More than half of the respondents (65%) had undergone hypertension therapy for more than one year. This shows that the respondents had relatively long therapy experience, making their perceptions and adherence levels a representative reflection of hospital services.

Table 1. Sociodemographic characteristics of outpatient hypertension patients at Primaya Inco Sorowako Hospital

Characteristics	Category	n	%
Gender	Male	25	31,2
	Female	55	68,8
Age (years)	< 40	10	12,5
	41–60	58	72,5
	> 60	12	15
Education	Elementary/Junior High School	18	22,5
	High School/equivalent	47	58,8
	Diploma/Bachelor's	15	18,7
Long Diagnosis of Hypertension	< 1 year	28	35
	≥ 1 year	52	65

Drop-out and Missing Data

Among the 85 questionnaires administered, five were excluded due to excessive nonresponse (>20% items missing), resulting in a final evaluable cohort of 80 participants for statistical analysis.

Missing data at the item level (<5% of cases) were handled using listwise deletion, meaning that only respondents with complete data on all key variables were included in the analysis. This approach ensured the robustness of the correlation and regression results. No systematic pattern of missingness was detected, indicating that data were missing at random (MAR).

Distribution of Research Variable Scores

Descriptive statistical analysis showed that patients' perception of the quality of medicine education services was high, with a mean score of 41,5 (SD = 4,2) out of 50. Nutrition education was in the high category, with a mean of 32,8 (SD = 3,9) out of 40. Therapy adherence was high, with a mean of 24,7 (SD = 2,8) out of 30.

Table 2. Descriptive statistical distribution of the three main variables of the study (n = 80)

Variable	Minimum	Maximum	Mean	SD	Average Category
Medicine Education	30	50	41,5	4,2	High
Nutrition Education	25	40	32,8	3,9	Quite High
Therapy Compliance	18	30	24,7	2,8	High

The relatively low standard deviation (SD) value indicates that the respondents' perceptions of these variables are consistent and homogeneous. This finding indicates that educational services are provided in a relatively uniform form and quality in research facilities.

Correlation Test between Drug and Nutrition Education and Therapy Compliance in Hypertensive Patients

The results of this study revealed a meaningful and positive relationship between the quality of educational services provided and the level of therapy adherence among patients with hypertension. Patients who received clear, complete, and easy to understand drug education tended to be more consistent in taking their medication and following medical advice. Similarly, patients who received nutrition education, particularly regarding appropriate dietary patterns, sodium intake, and food restrictions, were more likely to adhere to the recommended lifestyle changes. These findings suggest that improving the quality of communication and education provided by pharmacists and nutritionists plays a significant role in encouraging patients to comply with long-term hypertension treatment regimens. The stronger the educational support, the better is the patient's therapeutic adherence.

Table 3. Spearman correlation between drug education, nutrition education, age, duration of diagnosis, and therapy adherence

Variable	r (Correlations)	p-value
Drug Education ↔ Therapy Adherence	0,61	< 0,001
Nutrition Education ↔ Therapy Adherence	0,53	< 0,001
Age ↔ Therapy Adherence	0,28	0,012
Duration of Diagnosis ↔ Therapy Adherence	0,22	0,034

Beyond educational determinants, both patient age and duration since hypertension diagnosis were evaluated as potential correlates of therapeutic adherence. Each demonstrated a statistically significant yet modest positive correlation (r = 0.28 and r = 0.22, respectively), suggesting that older individuals and those with longer disease duration exhibited greater consistency in adhering to prescribed antihypertensive regimens.

Determinant Factors of Therapy Adherence in Hypertensive Patients

The findings of this study indicate that both drug and nutrition education significantly contribute to patient adherence in the management of hypertension. Multiple linear regression analysis showed that the overall model was statistically significant $F(2,77) = 32,56$; $p < 0,001$), with an R^2 value of 0,46. This indicates that 46% of the variance in therapy adherence can be explained by a combination of two independent variables.

Among these factors, drug education was the most influential determinant (β = 0,48; p < 0,001), suggesting that clear, complete, and structured communication from pharmacists strongly influences patients' consistency in following their treatment regimen. Nutrition education also had a significant effect (β = 0,34; p = 0,002), helping patients to better understand the role of dietary adjustments in supporting pharmacological treatment.

No signs of multicollinearity were observed, as evidenced by VIF values below two for both variables, confirming that each predictor contributes uniquely to the model. These results underscore the importance of integrating pharmaceutical and nutritional counseling in clinical practice to enhance therapeutic adherence among patients with hypertension.

Table 4. Results of multiple linear regression analysis between drug education and nutrition education on therapeutic adherence of hypertension patients

Independent Variables	β (coefficients)	t count	p-value	VIF
Medicine Education	0,48	4,52	<0,001	1,62
Nutrition Education	0,34	3,17	0,002	1,62
Model Summary	R^2 = 0.46		F (2,77) = 32,56	p < 0,001

The regression model was formulated as follows:

Compliance = 7,63 + 0,48 (Medicine Education) + 0,34 (Nutrition Education)**

This means that every increase in one unit of drug education score is predicted to increase the compliance score by 0,48 points, assuming that the other variables are constant. The results showed that both types of educational services had a positive contribution to patient therapy adherence, and that drug education by pharmacists had a more dominant influence. These findings support the research hypothesis and confirm the importance of the active role of pharmacists in patient therapeutic communication without ignoring the importance of collaboration with nutritionists.

The initial implication of these results is the need for formal integration between the two educational services in the form of joint SOPs and interprofessional training, so that synergistic effects can be maximized in supporting therapeutic adherence for patients with hypertension.

The results of this study confirm that the quality of drug and nutrition education services has a significant influence on the level of therapy adherence in hypertensive patients, both partially and simultaneously (Choudhry et al., 2022). These findings reflect an important dynamic in chronic healthcare practices based on patient education, while reinforcing the main premise that the success of therapy is not only determined by pharmacological interventions alone, but also by the quality of educational interactions between health workers and patients (Wallbach et al., 2019).

With an R^2 value of 0,46, the multiple linear regression model in this study explains that almost half of the variation in patient therapy adherence can be predicted by the quality of drug and nutrition education services. This figure is relatively high in the context of health behavior studies, where psychosocial and environmental factors also affect the level of individual compliance (Sabaté, 2003). These results are in line with the Health Belief Model (HBM) framework, which states that perception of benefits and understanding of treatment are the main determinants of changes in health behavior. Effective educational services can modify these perceptions by increasing patients' knowledge, motivation, and trust in the therapy regimen (Rosenstock et al., 1988).

Drug Education as a Dominant Predictor

The finding that drug education contributes more than nutrition education to therapeutic adherence (β = 0,48 vs. β = 0,34) indicates that pharmacists have a strategic position in patients' clinical communication channels in hospitals. In outpatient service practice, pharmacists are the last healthcare workers to interact directly with patients before they are consumed, making drug education a critical touchpoint. Information provided by the pharmacist, such as dosage, side effects, drug interactions, and consumption schedule, is a direct determinant of how the patient interprets and undergoes therapy.

Ilardo & Speciale (2020) confirmed that pharmaceutical education based on therapeutic communication increases patient trust and satisfaction, which indirectly encourages compliance. In addition, patients who received individualized education from pharmacists were twice as likely to comply with antihypertensive therapy than those who did not. This mechanism is strengthened in the Indonesian context, where health literacy remains a major challenge, especially in groups with lower secondary education that dominate the population of hypertensive patients (Ilardo & Speciale, 2020; Qudah et al., 2016).

Nutrition Education as an Important but Not Optimal Role

Although the contribution of nutrition education to therapy adherence was smaller than that of drug education, the results of the regression test showed that the effect remained statistically significant. This shows that nutritional education continues to play an important role in shaping patients' therapeutic behaviors, especially those related to diet management, sodium consumption, and daily eating habits. The education on low-sodium and high-potassium diets can significantly lower systolic blood pressure in Indonesian hypertensive patients within 8 weeks (Donini et al., 2017).

However, in practice, the limitations of human resources, the workload of nutrition personnel, and the lack of structural integration between pharmaceutical and nutrition units make nutrition education an optional additional service. This gap shows that there is great potential for interprofessional-based educational service system reform, so that nutrition education is not only a complement but also a core part of the integrated hypertension education program in hospitals.

Post-pandemic and Transformation of Education Services

The post-pandemic context provides an important background for interpreting the results of this study. The Covid-19 pandemic has caused major disruptions in the healthcare system, including a reduced intensity of face-to-face education and an increasing need for adaptive educational approaches. Some patients in this study mentioned that the information received after the pandemic was shorter and not always delivered directly by authorized health workers. This reinforces the finding that under conditions of limited resources, the quality of communication becomes increasingly more important than the number of meetings.

A study by the WHO states that the post-pandemic healthcare system must encourage the strengthening of digital and collaborative approaches, including the use of electronic educational media, medication management applications, and online education modules. In the Indonesian context, this approach is still limited in use; therefore, this study emphasizes the urgency of developing educational media that is integrated between pharmacy and nutrition, which can be accessed independently by patients and through the assistance of health workers (WHO, 2024).

Contribution to Clinical Policy and Practice

The results of this study have strategic implications in the realm of both clinical practice and health service policy. First, these findings confirm that the implementation of Permenkes No. 72 of 2016, related to patient education by pharmacists, had a real impact on patients' therapeutic behavior. However, implementation is still not optimal, especially in terms of cross-professional collaboration. Therefore, hospitals need to develop and implement collaborative educational service SOPs between pharmacists and nutritionists supported by educational communication training and active involvement of patients in the educational process (Almalki et al., 2024; Al-Worafi, 2023).

Second, these results can be the basis for the development of an integrated hypertension education service model that combines pharmacological and nutritional educational content in one module delivered synergistically by an interprofessional team. This will make it easier for patients to understand the link between treatment and lifestyle, and accelerate the process of more sustainable behavior change.

Research Limitations and Further Research Directions

Similar to other cross-sectional studies, this study has limitations in terms of its ability to explain causal relationships. In addition, the use of self-report-based instruments carries a risk of perception bias and respondents' desire to please researchers (social desirability bias). Therefore, follow-up studies with longitudinal or quasi-experimental designs are strongly recommended to measure the long-term effectiveness of cross-

professional educational interventions on blood pressure control, complication incidence, and adherence to the application.

Conclusion

This study demonstrates that drug and nutrition education services significantly influence therapeutic adherence in hypertensive patients, with drug education by pharmacists being the dominant predictor. Together, these educational interventions explained 46% of the variation in patient adherence. These findings highlight the critical role of high-quality, contextually relevant communication in shaping patient understanding and commitment to long-term therapy.

Nutrition education remains important, but underutilized because of structural constraints and limited patient interactions. Strengthening the integration of pharmacy and nutrition education through inter-professional collaboration is essential, including implementing joint SOPs, inter-professional training, and digital education modules that patients can access independently.

Policy wise, hospitals should prioritize mandatory training for pharmacy–nutrition teams and develop structured, patient-centered educational programs. Such measures not only fulfill regulatory standards (Permenkes No. 72 of 2016), but also enhance the effectiveness and sustainability of hypertension management in post-pandemic healthcare settings.

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References

Al-Worafi, Y. M. (2023). Quality of Hospital Pharmacies Services in Developing Countries: Status and Future Recommendations. In *Handbook of Medical and Health Sciences in Developing Countries: Education, Practice, and Research* (pp. 1–43). Springer. https://doi.org/10.1007/978-3-030-74786-2_349-1

Almalki, A. Y. A., Alghamdi, A. M. S., Asiri, A. A. J., Alqarni, A. M., Almoshat, Y. A. A., Almohaia, D. M. A., & Albarqi, L. H. M. (2024). Collaborative Roles of Pharmacy, Nursing, and Laboratory Services in Modern Healthcare: A Comprehensive Review. *Journal of International Crisis and Risk Communication Research*, *7*(S11), 1135.

Arora, C., Sinha, B., Malhotra, A., & Ranjan, P. (2017). Development and validation of health education tools and evaluation questionnaires for improving patient care in lifestyle related diseases. *Journal of Clinical and Diagnostic Research: JCDR*, *11*(5), JE06. https://doi.org/10.7860/JCDR/2017/28197.9946.

Ashoorkhani, M., Majdzadeh, R., Gholami, J., Eftekhar, H., & Bozorgi, A. (2018). Understanding non-adherence to treatment in hypertension: a qualitative study. *International Journal of Community Based Nursing and Midwifery*, *6*(4), 314. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6226612/.

Billah, S. M., Ali, N. B., Khan, A. N. S., Raynes-Greenow, C., Kelly, P. J., Siraj, M. S., Askari, S., Menon, P., Arifeen, S. El, & Dibley, M. J. (2022). Factors influencing quality nutrition service provision at antenatal care contacts: Findings from a public health facility-based observational study in 21 districts of Bangladesh. *PloS One*, *17*(1), e0262867. https://doi.org/10.1371/journal.pone.0262867.

Burnier, M., & Egan, B. M. (2019). Adherence in hypertension: a review of prevalence, risk factors, impact, and management. *Circulation Research*, *124*(7), 1124–1140. https://doi.org/10.1161/CIRCRESAHA.118.313220

Choudhry, N. K., Kronish, I. M., Vongpatanasin, W., Ferdinand, K. C., Pavlik, V. N., Egan, B. M., Schoenthaler, A., Houston Miller, N., Hyman, D. J., & Cardiology, A. H. A. C. on H. C. on C. and S. N. and C. on C. (2022). Medication adherence and blood pressure

control: a scientific statement from the American Heart Association. *Hypertension*, *79*(1), e1–e14. https://doi.org/10.1161/HYP.0000000000000203

Cvetkovic-Vega, A., Maguiña, J. L., Soto, A., Lama-Valdivia, J., & Correa López, L. E. (2021). Cross-sectional studies. *Revista de La Facultad de Medicina Humana*, *21*(1), 164–170. https://doi.org/10.25176/RFMH.v21i1.3069

Donini, L. M., Leonardi, F., Rondanelli, M., Banderali, G., Battino, M., Bertoli, E., Bordoni, A., Brighenti, F., Caccialanza, R., & Cairella, G. (2017). The domains of human nutrition: the importance of nutrition education in academia and medical schools. *Frontiers in Nutrition*, *4*, 2. https://doi.org/10.3389/fnut.2017.00002

Fraser, D. R. (2022). Physiological significance of vitamin D produced in skin compared with oral vitamin D. *Journal of Nutritional Science*, *11*, e13. https://doi.org/10.1017/jns.2022.11

Ilardo, M. L., & Speciale, A. (2020). The community pharmacist: perceived barriers and patient-centered care communication. *International Journal of Environmental Research and Public Health*, *17*(2), 536.

Jahar, A. S., Mursalin, A., Subchi, I., & Rahiem, M. D. H. (2022). *ICIIS and ICESTIIS 2021: Proceedings of the 4th International Colloquium on Interdisciplinary Islamic Studies in conjunction with the 1st International Conference on Education, Science, Technology, Indonesian and Islamic Studies, ICIIS and ICESTIIS 2021, 20-21 October 2021, Jambi, Indonesia*. European Alliance for Innovation.

Kang, H. (2021). Sample size determination and power analysis using the G* Power software. *Journal of Educational Evaluation for Health Professions*, *18*. https://doi.org/10.3352/jeehp.2021.18.17

Kemenkes RI. (2018). *Hasil utama Riskesdas 2018. Badan Penelitian dan Pengembangan Kesehatan*. https://www.litbang.kemkes.go.id/laporan-rikesdas-2018

Livne, N. (2019). Need for nutrition education in health professional programs: A review of the literature. *Internet Journal of Allied Health Sciences and Practice*, *17*(1), 5.

Lou, S. P., Han, D., Kuczmarski, M. F., Evans, M. K., Zonderman, A. B., & Crews, D. C. (2023). Health literacy, numeracy, and dietary approaches to stop hypertension accordance among hypertensive adults. *Health Education & Behavior*, *50*(1), 49–57. https://doi.org/10.1177/1090198122110 6787

Mentrup, S., Harris, E., Gomersall, T., Köpke, S., & Astin, F. (2020). Patients' experiences of cardiovascular health education and risk communication: a qualitative synthesis. *Qualitative Health Research*, *30*(1), 88–104. https://doi.org/10.1177/1049732319871689

Merel, S. E., & Paauw, D. S. (2017). Common drug side effects and drug-drug interactions in elderly adults in primary care. *Journal of the American Geriatrics Society*, *65*(7), 1578–1585. https://doi.org/10.1111/jgs.14966

Mogre, V., Abugri, B. A., Amoore, B. Y., Gaa, P. K., Kpebu, S. E. A., Ayanoore, M. A., & Amalba, A. (2025). Optimising interprofessional education through nutrition education: faculty and student perspectives for developing an innovative interprofessional nutrition education intervention. *MedEdPublish*, *15*(19), 19. https://doi.org/10.12688/mep.19850.1

Nour, S. F., Soliman, E. R., Al-Humaidi, S. A., & Abou-Rayan, M. A. (2018). Importance of education and nutrition intervention on drug addiction recovery. *Alexandria Science Exchange Journal*, *39*(OCTOBER-DECEMBER), 676–685.

Organization, W. H. (2023). *Global report on hypertension: the race against a silent killer*. World Health Organization. https://www.who.int/publications/i/item/9789240073872

Organization, W. H. (2024). *Health system resilience indicators: an integrated package for measuring and monitoring health system resilience in countries*. World Health Organization. https://www.who.int/publications/i/item/9789240083147

Qudah, B., Albsoul-Younes, A., Alawa, E., & Mehyar, N. (2016). Role of clinical

pharmacist in the management of blood pressure in dialysis patients. *International Journal of Clinical Pharmacy*, *38*(4), 931–940. https://doi.org/10.1007/s11096-016-0315-2

Rahmawati, R. (2018). *Exploring adherence to hypertension medication in a rural community in Indonesia*. University of Technology Sydney (Australia). https://opus.lib.uts.edu.au/handle/10453/123282

Rosenstock, I. M., Strecher, V. J., & Becker, M. H. (1988). Social learning theory and the health belief model. *Health Education Quarterly*, *15*(2), 175–183. https://doi.org/10.1177/109019818801500203

Sabaté, E. (2003). *Adherence to long-term therapies: evidence for action*. World health organization. https://apps.who.int/iris/handle/10665/42682

Sharma, S. R., Mishra, S. R., Wagle, K., Page, R., Matheson, A., Lambrick, D., Faulkner, J., Lounsbury, D., & Vaidya, A. (2017). Social determinants of common metabolic risk factors (high blood pressure, high blood sugar, high body mass index and high waist-hip ratio) of major non-communicable diseases in South Asia region: a systematic review protocol. *Systematic Reviews*, *6*(1), 183. https://doi.org/10.1186/s13643-017-0588-z

Trianengsih, A. T., Hardisman, H., & Almasdy, D. (2019). Implementasi Permenkes nomor 72 tahun 2016 tentang standar pelayanan kefarmasian di rumah sakit terhadap tatakelola SDM instalasi farmasi RSU Mayjen HA Thalib Kerinci tahun 2018. *Jurnal Kesehatan Andalas*, *8*(2), 356–365. https://doi.org/10.25077/jka.v8.i2.p356–365.2019

Uchmanowicz, B., Chudiak, A., Uchmanowicz, I., Rosińczuk, J., & Froelicher, E. S. (2018). Factors influencing adherence to treatment in older adults with hypertension. *Clinical Interventions in Aging*, 2425–2441. https://doi.org/10.2147/CIA.S174206

Upadhyay, R. K. (2022). Chronic non-communicable diseases: Risk factors, disease burden, mortalities and control. *Acta Scientific Medical Sciences (ISSN: 2582-0931)*, *6*(4).

Wallbach, M., Lach, N., Stock, J., Hiller, H., Mavropoulou, E., Chavanon, M., Neurath, H., Blaschke, S., Lowin, E., & Herrmann-Lingen, C. (2019). Direct assessment of adherence and drug interactions in patients with hypertensive crisis—A cross-sectional study in the Emergency Department. *The Journal of Clinical Hypertension*, *21*(1), 55–63. https://doi.org/10.1111/jch.13428

Win, T., Banharak, S., & Ruaisungnoen, W. (2021). Factors influencing medication adherence among patients with hypertension: a systematic review. *Sys Rev Pharm*, *12*(1), 526–538. https://doi.org/10.31838/srp.2021.1.76