



Determinants of adherence to antihypertensive medication among outpatients in a mountainous province of Vietnam: A cross-sectional study

[Determinantes de la adherencia a la medicación antihipertensiva entre pacientes ambulatorios en una provincia montañosa de Vietnam: un estudio transversal]

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Abstract

Context: Adherence to antihypertensive medication is essential for blood pressure control. However, adherence patterns in mountainous areas of Vietnam, where socioeconomic and access barriers may differ, remain insufficiently described.

Aims: To evaluate adherence to antihypertensive medication and associated factors among hypertensive outpatients in a mountainous province of Vietnam.

Methods: A cross-sectional study was conducted among 662 outpatients (September–November 2023). Sociodemographic information was collected using a structured questionnaire, and treatment information was extracted from medical records. Adherence was measured using the Vietnamese version of the General Medication Adherence Scale (GMAS); adherence was defined as GMAS ≥ 30 . Factors associated with adherence were explored using multivariable logistic regression.

Results: Overall adherence was 90.9% (GMAS = 33: 59.1%; GMAS = 30–32: 31.9%). Receiving medication counseling from healthcare staff was associated with higher adherence (OR = 2.31; 95% CI = 1.25–4.27; $p = 0.008$). Self-management of the dosing schedule, regular follow-up attendance, absence of reported side effects, and belief in treatment effectiveness were also associated with adherence.

Conclusions: High self-reported adherence was observed among hypertensive outpatients in this mountainous setting. Counseling and patient beliefs were associated with adherence, supporting the need for structured counseling and follow-up reinforcement in outpatient care.

Keywords: hypertension; general medication adherence scale; medication adherence; outpatients; Vietnam.

Resumen

Contexto: La adherencia a la medicación antihipertensiva es esencial para el control de la presión arterial. Sin embargo, los patrones de adherencia en las zonas montañosas de Vietnam, donde las barreras socioeconómicas y de acceso pueden ser distintas, aún no se han descrito con suficiente detalle.

Objetivos: Evaluar la adherencia a la medicación antihipertensiva y los factores asociados en pacientes hipertensos ambulatorios de una provincia montañosa de Vietnam.

Métodos: Se realizó un estudio transversal con 662 pacientes ambulatorios (de septiembre a noviembre de 2023). Se recopiló información sociodemográfica mediante un cuestionario estructurado y se extrajo información sobre el tratamiento de las historias clínicas. La adherencia se midió mediante la versión vietnamita de la Escala General de Adherencia a la Medicación (GMAS); se definió como GMAS ≥ 30 . Se exploraron los factores asociados a la adherencia mediante una regresión logística multivariable.

Resultados: La adherencia general fue del 90,9 % (GMAS = 33: 59,1 %; GMAS = 30-32: 31,9 %). Recibir asesoramiento sobre la medicación por parte del personal sanitario se asoció con una mayor adherencia (OR = 2,31; IC del 95% = 1,25–4,27; $p = 0,008$). El autocontrol de la pauta posológica, la asistencia regular a las citas de seguimiento, la ausencia de efectos secundarios notificados y la creencia en la eficacia del tratamiento también se asociaron con la adherencia.

Conclusiones: Se observó una alta adherencia autoinformada entre los pacientes hipertensos ambulatorios de esta zona montañosa. El asesoramiento y las creencias de los pacientes se asociaron con la adherencia, lo que respalda la necesidad de un asesoramiento estructurado y un seguimiento reforzado en la atención ambulatoria.

Palabras Clave: adherencia a la medicación; escala general de adherencia a la medicación; hipertensión; pacientes ambulatorios; Vietnam.

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Abbreviations: CI: confidence interval; GMAS: General Medication Adherence Scale; LMICs: low-to middle-income countries; OR: odds ratio.

INTRODUCTION

Hypertension remains a major concern, as it is a key contributor to cardiovascular disease, all-cause mortality, and the leading cause of disability-adjusted life years lost (Hamrahian et al., 2022; Kario et al., 2024). A total of 1.4 billion adults aged 30-79 years were estimated to be diagnosed with hypertension (Farrar & Frieden, 2025). The prevalence of hypertension varies by country, with an increasing trend observed in Asia (Kario et al., 2024). In Vietnam, approximately 21.1% of the population was reported to have hypertension (Meiqari et al., 2019). The prevalence in mountainous areas was notably high, at 30.0% (Nam et al., 2020).

Detecting elevated blood pressure is widely recognized as a cornerstone preventive strategy for cardiovascular disease (Volpe et al., 2018). However, 41% of patients were unaware of their condition (Inoue, 2025). Uncontrolled hypertension accounts for 50% of all coronary heart disease-related deaths worldwide (Dhar et al., 2017). Notably, there were significant disparities between high-income countries and low-to middle-income countries (LMICs) regarding blood pressure control rates. Blood pressure control rates remain unsatisfactory, particularly in LMICs (Hamrahian et al., 2022).

Adherence to medication is recognized as a key strategy to control blood pressure and measure hypertension management outcomes (Hossain et al., 2025). However, poor adherence to antihypertensive medication represents a growing global concern given its high prevalence worldwide. Thus, the World Health Organization emphasizes non-adherence as the highest priority public health matter. Non-adherence leads to psychosocial and medical complications, a reduction in quality of life, an increase in drug resistance, and wasted healthcare resources. The prevalence of non-adherence in hypertension globally was reported between 46.6% and 55.5% for pill counting and self-reporting, respectively (Martell Claros, 2023).

Non-adherence is notably more challenging in low- and middle-income countries, with 63.35% due to limited health resources and unequal access to care. Factors such as distance to clinics, education, and income have a greater impact in these settings, often forcing patients to choose between competing priorities (Nielsen et al., 2017). Furthermore, ethnic related factors partially contribute to the observed differences. Racial and ethnic minorities are thought to be vulnerable to medication non-adherence. Worse persistence is more common among young males from minority racial and ethnic backgrounds (Hamrahian et al., 2022). Various

factors drive racial and ethnic disparities in hypertension treatment and control, with social determinants of health playing a significant role. These include limited access to regular healthcare, low health literacy, lower socioeconomic status, neighborhood and environmental stability, and restricted availability of nutritious food (Abrahamowicz et al., 2023).

Although antihypertensive adherence has been investigated in several regions of Vietnam (Huong & Nam, 2023; Tam et al., 2020), evidence from mountainous settings remains limited, despite differences in access to care, education, and the presence of ethnic minority communities (Luu et al., 2024). Therefore, adherence to antihypertensive medication was assessed using the GMAS, and factors associated with adherence were examined among hypertensive outpatients attending Quang Ngai Provincial General Hospital 2 (Quang Ngai province, Vietnam).

MATERIAL AND METHODS

Study design and participants

A cross-sectional study was conducted among hypertensive outpatients attending the Cardiovascular Clinic and Geriatrics Clinic at Quang Ngai Provincial General Hospital 2 between September and November 2023. A proportionally stratified sampling approach was applied by clinic, with a target recruitment ratio of 2:1 (Cardiovascular: Geriatrics). At each department, we randomly selected the first five eligible patients attending the Geriatrics Outpatient Clinic and the first ten eligible patients attending the Cardiology Outpatient Clinic on even-numbered weekdays, continuing this process until the required sample size was reached. Patients were eligible if a prior diagnosis of hypertension had been documented and if participation in an interviewer-administered questionnaire was feasible. Patients who were newly diagnosed with hypertension at this visit were excluded. Written informed consent was obtained. Ethical approval was granted by the Institutional Review Board of the University of Medicine and Pharmacy, Hue University (Approval No. H2023/331; June 2, 2023).

The sample size (n) based on the following formula [1] was calculated.

$$n = \frac{z_{1-\alpha/2}^2 p(1-p)}{d^2} \quad [1]$$

Where n: Minimum sample size of the study; Z: Distribution factor at (1- α /2) confidence level; p: Estimated proportion of the population based on a previous study in Vietnam (p=0.654) (Ha & Phuc, 2024). An additional 10% was added to compensate for incomplete or invalid questionnaires. d: Precision level. In total, 662 patients were included in the study.

Data collection

Information on sociodemographic characteristics was collected using a structured questionnaire administered via direct interviews with trained personnel. The interview was conducted in a private room to ensure comfort and confidentiality. Additionally, patients were required to provide information about the healthcare system, including the health insurance copayment rate and medication counseling from healthcare staff. Furthermore, the General Medication Adherence Scale (GMAS) questionnaire was used to explore all aspects of medication adherence (Nguyen et al., 2021a). We also based our information on medical records to obtain details related to treatment, including years of treatment and complications. Additionally, side effects were determined based on patient self-reports. They were considered present if the patient experienced at least one symptom, such as a persistent dry cough, dry mouth, nausea, muscle pain, insomnia, difficulty sleeping, or bradycardia.

Variable assessment

The GMAS was reported to be an effective tool for assessing patients' medication adherence in chronic disease (Naqvi et al., 2018). The Vietnamese version of the GMAS is a reliable and valid tool for assessing medication adherence in Vietnamese patients (Nguyen et al., 2021a). GMAS comprised 11 questions across three domains: patient behaviors, comorbidity, pill burden, and financial constraints. Each question was answered using a 4-point Likert scale: always, mostly, sometimes, and never, corresponding to 3, 2, 1, and 0 points. Patients scoring 30 points or higher were considered adherent, while those with less than 30 points were classified as non-adherent.

Statistical analyses

Descriptive statistics were summarized as frequencies and percentages. Associations between adherence status (GMAS ≥ 30 vs <30) and candidate variables were examined using chi-square tests or Fisher's exact tests, as appropriate. Variables with $p < 0.2$ in univariate analyses and variables considered clinically relevant were entered into a multivariable logistic regression model to estimate adjusted odds ratios (ORs) with 95% confidence intervals (CIs). Our data contained no missing values, and multicollinearity was assessed using the variance inflation factor (VIF); no independent variable had a VIF greater than 10. The Hosmer-Lemeshow goodness-of-fit test indicated good model fit ($p = 0.980$).

RESULTS

Characteristics of the study participants

The majority of patients was aged 60 or above (72.2%) and lived with their family (95.0%). Importantly, ethnic diversity was found in our patients, including Xê Đăng, Rơ Ngâu, Dê Triêng, Gia Rai, and Banar. Approximately 50.2% of participants had an educational level below high school. Approximately 98.6% of patients reported a moderate or higher household income level. The 20% insurance copayment rate accounted for the largest proportion, and more than half had no occupation (Table 1).

Table 2 shows characteristics related to hypertensive treatment of patients. Patients were more likely to have been diagnosed with hypertension for more than 5 years (62.8%). However, not all had been using blood pressure medication for that long; only 61.9% had been on hypertensive medication for ≥ 5 years. Notably, most patients had regular follow-up (95.5%). Dyslipidemia was the most reported main comorbidity (56.2%), followed by diabetes (32.6%). The complications related to hypertension seemed not to appear in the majority of patients (86.7%). Only 15.1% of patients reported experiencing side effects of hypertensive medications. There was 70.9% of patients receiving counseling on medication use from healthcare staff. Additionally, more than 80% of patients believed the treatment was effective and remembered their treatment schedule on their own.

Adherence to antihypertensive medication in outpatients

The majority of patients had no difficulty remembering to take their medication (72.3%) and never forgot to take it due to busy schedules such as traveling, meetings, parties, weddings, or going to church/temple (72.7%). Only 0.2% of patients always stopped taking their medication when they felt better or experienced unwanted side effects like stomach discomfort. Additionally, 0.3% of patients stopped taking their medication because they had to take other medications for different conditions. The majority of patients did not change their treatment doses or stop taking medication due to cost (Supplementary Table S1).

Table 3 represents the prevalence of hypertensive medication adherence based on GMAS. Most patients were observed to adhere to their medications, with an adherence rate of 90.9%. Among them, 59.1% had a GMAS score of 33, while 30.9% had scores between 30 and 32.

Table 1. Characteristics of the study participants.

Characteristics		Frequency (n)	Percentage (%)
Sex	Male	269	40.6
	Female	393	59.4
Age group		66.1 ± 10.0	
	≤50	37	5.6
	51-60	147	22.2
	61-70	267	40.3
	>70	211	31.9
Ethnic	Kinh	633	95.6
	Xê Đăng	6	0.9
	Rơ Ngâu	5	0.8
	Dê Triêng	2	0.3
	Gia rai	1	0.2
	Banar	13	2.0
	Others	2	0.2
Educational level	Less than high school	332	50.2
	High school	124	18.7
	More than high school	206	31.1
Occupation	Farming	52	7.9
	Worker/Laborer	11	1.7
	Public servant/Official	40	6.0
	Trading/Services	33	5.0
	Retired	176	26.6
	Stay at home/Unemployed	350	52.8
Living situation	Living with family/relatives	629	95.0
	Living alone	33	5.0
Household economic	Poor/near-poor	9	1.4
	Moderate or higher income levels	653	98.6
Insurance copayment rate	20%	311	47.0
	5%	191	28.9
	0%	160	24.1
Total		662	100

Factors associated with adherence to antihypertensive medication in outpatients

Counseling from healthcare staff, independent recall of the treatment schedule, regular follow-up attendance, experiencing side effects, and belief in the treatment's effectiveness were significantly associated with adherence. In detail, patients receiving counseling from healthcare staff tended to exhibit higher adherence than those not receiving counseling (OR = 2.217, 95% CI = 1.206-4.082). Additionally, patients who remembered their treatment schedule

independently seemed to have better adherence than those who did not (OR = 2.918, 95% CI = 1.230-6.923). Furthermore, better adherence was observed among patients who attended regular follow-ups compared with those who did not (OR = 4.052, 95% CI = 1.310-12.527). The patients who did not experience side effects of hypertensive medication and believed in the effectiveness of treatment were more likely to exhibit better adherence than the others (OR = 4.788, (2.614-8.771) and OR = 2.128 (1.019-4.425), respectively (Table 4).

Table 2. Characteristics related to the hypertensive treatment of patients.

Characteristics		Frequency (n)	Percentage (%)
Years of hypertensive diagnosis	≥ 5 years	416	62.8
	< 5 years	246	37.2
Using hypertensive medication	≥ 5 years	410	61.9
	< 5 years	252	38.1
Regular follow-up	Yes	632	95.5
	No	30	4.5
Comorbidity	Stroke	12	1.8
	Dyslipidemia	372	56.2
	Diabetes	216	32.6
	No comorbidity	118	17.8
	Others	210	31.7
Complication related to hypertension	Myocardial infarction	10	1.5
	Stroke	42	6.3
	Eye complications	8	1.2
	Other complications	9	1.4
	No complication	574	86.7
Side effects related to hypertension treatment medication	Yes	100	15.1
	No	562	84.9
Advised by healthcare staff on medication use	Yes	469	70.9
	No	193	29.1
Who reminds to take daily medication	Family member	44	6.6
	Self-reminder	618	93.4
Trust in the effectiveness of hypertension treatment medication	Yes	592	89.4
	No	70	10.6
Total		662	100

Table 3. Adherence to antihypertensive medication of patients.

Adherence	Frequency (n)	Percentage (%)	Total (n, %)
Adherence			
GMAS=33	391	59.1	602 (90.9)
GMAS=30-32	211	31.9	
Non-adherence			
GMAS=27-29	36	5.4	60 (9.1)
GMAS<27	24	3.6	
Total	662	100.0	

Table 4. Factors associated with adherence to antihypertensive medication of patients.

Factor	Adherence		
	OR	95% CI	P
Educational level			
Less than high school	1		
More than high school	1.214	0.605-2.437	0.586
Living situation			
Living with family/relatives	1		
Living alone	2.231	0.783-6.357	0.133
Advised by healthcare staff on medication use			
No	1		
Yes	2.217	1.206-4.082	0.010
Who reminds you to take your daily medication			
Family member	1		
Self-reminder	2.918	1.230-6.923	0.009
Attending regular follow-ups			
No	1		
Yes	4.052	1.310-12.527	0.015
Side effects related to hypertension treatment medication			
Yes	1		
No	4.788	2.614-8.771	<0.001
Complication related to hypertension			
Yes	1		
No	1.453	0.692-3.052	0.324
Comorbidity			
Yes	1		
No	0.670	0.266-1.687	0.395
Belief in the effectiveness of hypertension treatment medication			
No	1		
Yes	2.128	1.019-4.425	0.044

Independent variables with $p < 0.2$ in the univariate analysis were included in the multivariable logistic. Regression model.

DISCUSSION

In the present study, a cross-sectional study with 662 hypertensive outpatients found a high proportion of adherence to medication (90.9%). Some factors were identified as affecting adherence, including counseling from healthcare staff, independent recall of the treatment schedule, regular follow-up attendance, experiencing side effects, and belief in the treatment's effectiveness.

Poor adherence to treatment is considered a key contributor to increased hospitalization and mortality in cardiovascular patients. For patients with

cardiovascular diseases receiving medication, assessing adherence is essential to optimize treatment and reduce the risk of treatment failure. Currently, there are several methods used to assess adherence to treatment, in which pre-designed questionnaires are popular and easy to apply (Nguyen et al., 2021b). Notably, GMAS has been translated into Vietnamese and has been shown to have equivalent reliability to the English version. All questions are clear, easy to understand, and suitable for patients in Vietnam (Nguyen et al., 2021a). Thus, we used this questionnaire for this study.

To date, adherence to antihypertensive medication has received considerable attention due to its importance. In developing countries, non-adherence is expected to be higher due to limited health resources and challenges in accessing healthcare. A meta-analysis of 42 studies across 19 developing countries confirmed this expectation, revealing a high proportion of non-adherence (Dhar et al., 2017). Notably, compared with low- and middle-income countries, the proportion of adherence in our study is higher than that reported in Ethiopia and Nepal (Rashid et al., 2024; Sharma et al., 2024). Notably, although we conducted this study in a mountainous area of Vietnam with ethnic diversity, our study population exhibited a higher prevalence of adherence than other GMAS studies conducted in other areas of Vietnam (Ha & Phuc, 2024; Nguyen et al., 2023). This finding may be associated with effective communication strategies implemented in the province, thereby influencing patients' awareness of the importance of adherence. Notably, the GMAS scale includes two questions on costs, and most patients in our study had health insurance and did not bear the economic burden of purchasing medication.

Notably, self-report is the most commonly used method to assess medication adherence in both research and clinical settings. However, its accuracy remains a matter of debate, as adherence may be overestimated compared with other assessment methods. This limitation can be mitigated by using validated scales, ensuring appropriate construct assessment, and reducing social desirability bias. Despite these concerns, self-report measures can provide actionable information and are often preferred because they are rapid, efficient, and cost-saving (Stirratt et al., 2015). In this study, we used self-reports to assess medication adherence; however, we made concerted efforts to improve measurement precision by conducting interviews in a private setting, employing a validated questionnaire, and using trained personnel to create a comfortable interview environment.

With the nature of the disease requiring lifelong blood pressure monitoring and medication, patient compliance with medication is extremely necessary. The primary reason for non-adherence is that patients often do not notice immediate effects on their health, as hypertension progresses silently. This is truly a challenge for doctors and nurses who directly treat and care for patients (Nhu Phuong & Thi Binh, 2021). Our study revealed that patients who receive advice from medical staff tend to have higher medication adherence than those who do not. This emphasizes the importance of healthcare staff in providing patients with advice on knowledge and practices related to treatment compliance.

Notably, most of the patients in our study were retired and had more time to self-manage their illness, so they remembered to take their medication without needing reminders from relatives. As a result, they exhibit a higher proportion of adherence than patients who need reminders from relatives. This is consistent with a previous study that reported a correlation between higher levels of self-management and better hypertension control (Ding et al., 2018). Additionally, patients with longer durations were more likely to receive regular care and to understand the importance of self-management better (Ding et al., 2018). A similar trend was observed in our study, in which patients with regular follow-ups had higher adherence than those without.

Furthermore, drug side effects were estimated in 20–97% of patients who take anti-hypertensive medications and are considered the main determinant of low adherence to antihypertensive medications (Tedla & Bautista, 2016). A decrease in sexual drive and genitourinary symptoms, specifically excessive urination, were identified as potential markers for screening patients at high risk of non-adherence within the next three months (Tedla & Bautista, 2016). Our study supports this finding and highlights the importance of enhancing patients' understanding of both pharmacotherapy and their disease. A treatment regimen should be designed to address individuals' needs, balancing effectiveness and tolerability (Khan et al., 2014).

Also, the belief in the effectiveness of treatment was observed to influence adherence in our study. This finding was reinforced by a previous meta-analysis of 94 studies, which emphasizes considering patients' necessity beliefs and concerns to improve prescribing quality by helping doctors engage patients in treatment decisions and increase adherence to appropriate prescriptions (Horne et al., 2013).

Our study is one of the few studies conducted to explore all aspects in relation to adherence to antihypertensive medication in mountainous areas, which accounts for diverse ethnic minorities in Vietnam. Data collection was conducted using a well-structured questionnaire, a pilot study, and trained interviewers. However, our study has several limitations related to its cross-sectional design, including recall bias, selection bias, and the inability to establish causal relationships. In addition, the study population may not be representative of the general population in the area. Furthermore, our study did not compare GMAS-assessed adherence with other methods, such as pharmacy refill data (MPR/PDC), pill counts, or follow-up assessments. Barriers contributing to non-adherence were not identified. Therefore, further studies are required to more comprehensively elucidate adherence to antihypertensive medication in this setting.

CONCLUSION

In this study, high self-reported adherence to anti-hypertensive medication was observed among outpatients in this mountainous setting. Adherence was associated with receipt of counseling, regular follow-up attendance, absence of reported side effects, self-management of dosing schedules, and belief in treatment effectiveness. Routine, standardized counseling and structured follow-up reinforcement should be implemented, and proactive assessment and management of side effects should be incorporated to support sustained adherence. Future studies incorporating objective adherence measures and blood pressure control outcomes are warranted.

CONFLICT OF INTEREST

The research was conducted entirely free from any involvement in commercial, financial, or personal matters that might be perceived as a possible conflict of interest or that could have influenced the outcomes or interpretation of the study.

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AVAILABILITY OF DATA AND MATERIALS

The datasets used and analyzed during the current study are available from the corresponding author on reasonable request.

GENERATIVE ARTIFICIAL INTELLIGENCE (AI)

The authors used ChatGPT (OpenAI) to improve the language and readability of the manuscript. The authors reviewed and edited the content and take full responsibility for its accuracy. No images were generated or manipulated using AI tools.

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AUTHOR CONTRIBUTION:

Contribution	Hoang YTB	Bui NTN	Tran TT	Hoang TA
Concepts or ideas	x	x		x
Design	x	x	x	
Definition of intellectual content	x	x		
Literature search	x	x	x	x
Experimental studies	x	x	x	x
Data acquisition	x	x	x	x
Data analysis	x	x	x	x
Statistical analysis	x		x	x
Manuscript preparation	x	x	x	x
Manuscript editing	x		x	
Manuscript review	x	x	x	x

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Supplementary data

Table S1. Specific aspects of GMAS questionnaire.

No.	Question	Always n (%)	Mostly n (%)	Sometimes n (%)	Never n (%)
1	Difficulties in remembering to take your medications	3 (0.5)	25 (3.8)	155 (23.4)	479 (72.3)
2	Forgetting to take your medication due to busy schedule, travelling, meeting, events at home, party, marriage, religious celebrations, etc.	0	8 (1.2)	173 (26.1)	481 (72.7)
3	Discontinuing medication when feel well	1 (0.2)	3 (0.5)	24 (3.6)	634 (95.7)
4	Stopping medications due to adverse effects such as gastric discomfort, etc.	1 (0.2)	7 (1.1)	10 (1.5)	644 (97.2)
5	Stopping medications without consulting doctor	11 (1.7)	6 (0.9)	22 (3.3)	623 (94.1)
6	Discontinuing medication due to other medicines	2 (0.3)	5 (0.8)	10 (1.5)	645 (97.4)
7	It is a hassle to remember medications due to medication regime complexity	6 (0.9)	8 (1.2)	45 (6.8)	603 (91.1)
8	During the last month, missing medicines due to progression of disease and addition of new medicines	2 (0.3)	2 (0.3)	5 (0.8)	653 (98.6)
9	Altering medication regimen, dose and frequency by yourself	8 (1.2)	9 (1.4)	40 (6.0)	605 (91.4)
10	Discontinuing these medications because they are not worth of the spent money	1 (0.2)	1 (0.2)	4 (0.6)	656 (99.0)
11	Difficulties in buying medicines due to expensive	1 (0.2)	1 (0.2)	4 (0.6)	656 (99.0)