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Patient-level and Physician-level Predictors of Discharge Against Medical Advice: A Multilevel Modeling Approach

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Abstract

Background: Discharge Against Medical Advice (DAMA) is a complex and multifaceted issue in healthcare, often challenging the continuity of care and affecting patient outcomes.
Objectives: This study aimed to investigate the predictors of Discharge Against Medical Advice (DAMA) by simultaneously examining patient- and physician-level variables within a unified analytical framework.
Methods: This cross-sectional study was conducted in 2023 at one of the largest private hospitals in northwest Iran. The study included all 16,071 patients admitted in 2022 and 137 attending physicians. A multilevel analysis model was employed to examine the influence of variables related to patients and physicians in predicting DAMA.
Results: The study involved patients with a mean age of 45.28 ± 19.59 years, with 67.7% being women and 14.8% not having health insurance. Among the physicians studied, the mean age was 56.27 ± 12.29 years, with 67.2% being male and 70.1% being hospital shareholders. Patients with DAMA comprised 6.8% (n = 1094). The null model had a log-likelihood value of -3304.90. When patient-level predictors were added, the value increased to -3041.76, a statistically significant improvement ($P < 0.001$) based on the chi-square test. Subsequently, incorporating physician-level predictors further increased the log-likelihood value to -2996.16, and this increase was also statistically significant compared to the model with only patient-level predictors ($P < 0.001$). Physician-level factors, including specialization, sex, and experience, were associated with DAMA. Significant patient-level variables included age, type of insurance, and type of disease ($P < 0.05$).
Conclusions: Utilizing multilevel modeling enables the assessment of the significance of both physician-level and patient-level factors. To avoid conflicting results, it is recommended to evaluate hospital performance based on DAMA by considering both levels.

Keywords: DAMA, Inpatient, Multilevel Analysis, Private Hospital, Iran

1. Background

Discharge Against Medical Advice (DAMA), the voluntary departure of patients from healthcare facilities against medical advice, is a complex phenomenon that presents significant challenges for healthcare providers and institutions (1). It has been observed in various healthcare settings, including general hospitals, and has garnered attention due to its potential implications for patient outcomes, continuity of care, and healthcare resource utilization (1, 2).

Recognizing predictors of DAMA is essential for patient safety, efficient resource allocation, ethical considerations, cost management, and evidence-based healthcare policies. It underscores the importance of

patient-provider interactions and the need for proactive measures to prevent DAMA (3-5).

Studies have shown that DAMA can be influenced by a multitude of factors, encompassing personal, clinical, and contextual dimensions (6). Personal preferences, perceptions of care quality, financial constraints, cultural beliefs, and patient-provider communication are some of the intricate factors that might play a role in patients' choice to leave the hospital prematurely. Moreover, the healthcare environment itself, including the quality of physician-patient relationships, hospital policies, and patient education, can significantly influence the likelihood of DAMA (7, 8).

Meanwhile, physician-level variables remain one of the most significant factors influencing patient discharge with personal satisfaction. Poor communication between physicians and patients, a lack of patient trust in their physician, and incorrect documentation are among the key factors that can significantly influence a patient's decision to self-discharge (3, 6, 9).

While prior research has examined specific aspects of DAMA, such as patient demographics or clinical characteristics, there is a paucity of studies that comprehensively explore both patient-level and physician-level variables within a single analytical framework (10).

This research employs a novel approach to unravel the complex predictors of DAMA by simultaneously considering patient-level and physician-level variables.

2. Objectives

To facilitate this analysis, a multi-level analytical framework is employed, which not only accounts for individual factors but also acknowledges the potential influence of physician-level characteristics on patients' decisions regarding DAMA. By examining these variables within a single model, we aim to provide a more nuanced understanding of the underlying dynamics that lead to DAMA.

3. Methods

The cross-sectional study, conducted in 2023, was carried out at a general hospital in Tabriz, Iran. This hospital is the second-largest private healthcare facility in northwest Iran, encompassing 11 specialized departments, including CCU, General ICU, Medical ICU, Lung ICU, NICU, Pediatrics, Obstetrics and Gynecology, Internal Medicine, Orthopedics, and Cardiac Surgery. The hospital is equipped with 179 active beds and serves an annual patient population exceeding 16,000.

A comprehensive census approach was employed to include all 16,071 patients admitted to the hospital between 21 March 2021 and 20 March 2022. Additionally, the study involved 137 attending physicians in its scope. Vital information was gathered from the electronic records in the hospital Information System (HIS) and compiled into an Excel spreadsheet. This data encompassed both social and clinical details, such as age, sex, definitive disease diagnosis, insurance type, and the attending physician. The diseases were categorized into 22 distinct groups based on the International Classification of Diseases 10th Revision (ICD-10). For streamlined data analysis, these disease categories were further condensed into six groups, a classification arrived at through consensus among five physicians, each with expertise in different medical specialties. These six groups were identified as follows:

(1) Blood and cancer-related diseases; (2) internal diseases; (3) psychiatric and neurological disorders; (4) ear, nose, throat, and eye conditions; (5) gynecological issues, obstetrics, fetal, and neonatal abnormalities; (6) other diseases.

Patients were categorized into six distinct groups based on their insurance coverage. This classification involved three primary insurance entities prevalent in Iran: Social security insurance (Tamin Ejtemaei), health insurance (Salamat), and armed forces insurance (Niroohaye Mosallah) (11). Additionally, two more groups were established, one for individuals with rural insurance (Roostayi) and another for patients covered by alternative insurance funds. Lastly, a separate group was designated for individuals lacking any form of insurance coverage.

The data collected from the physicians encompassed details such as age, sex, their area of expertise (surgeon or non-surgeon), their level of specialization (whether they were specialists or subspecialists), their professional experience, and the type of contractual arrangement they had (either as guests or shareholders).

To ensure the privacy and confidentiality of both patients and physicians, sensitive identity information

like first names, last names, and national identification codes was redacted from the records. Instead, each patient and physician was assigned a unique code for the purpose of data analysis, thereby safeguarding their personal information.

To investigate the predictors of DAMA, a multilevel modeling approach was applied to simultaneously examine patient- and physician-level variables. Multilevel modeling offers several benefits, including the ability to account for nested data structures, such as patients within physician groups, thereby capturing the hierarchical nature of healthcare data. Additionally, it allows for the simultaneous examination of both patient-level and physician-level variables within a unified analytical framework, providing a more comprehensive understanding of the factors influencing discharge against medical advice (DAMA).

3.1. Statistical Analysis

The data were presented using descriptive statistics, including mean ± standard deviation for quantitative data and median (Q1 - Q3) for qualitative data. A multilevel analysis approach was employed to examine the influence of patient- and physician-related variables on the likelihood of DAMA. Multilevel models are particularly suitable for handling complex data structures with nested levels. Unlike single-level models, such as simple regression, which assume independence of observations, multilevel models account for dependencies in nested data structures, such as when patients are nested within physician groups (12).

A generalized multilevel model akin to traditional linear regression was utilized. The primary distinction lies in the acknowledgment that observations are not assumed to be independent in linear multilevel modeling (12). Consequently, the multilevel analysis model was instrumental in partitioning the variance at the patient level due to the effects attributed to physician-level factors.

To explore the association between individual factors (variables at the patient level) and physician factors (variables at the physician level) with DAMA, a two-level random-intercept Poisson model was employed. Data analysis was conducted using Stata software version 16, and statistical significance was determined with a p-value threshold of less than 0.05.

Two-level logistic regression model:

The two-level logistic regression model with a random intercept is defined as follows for modeling the response variable (denoted as Y) with p predictors at level 1 and q predictors at level 2 (13, 14):

$$logit\left(\frac{P(Y_{ij}=1)}{1-P(Y_{ij}=1)}\right)=\beta_{00}+\Sigma_1^p\beta_{ij}x_{ij}+\Sigma_1^q\beta_{0j}Z_j+u_{0j}$$

Here, $P(Y_{ij}=1)$ is the probability of patient i being discharged against medical advice when treated by physician j. The model includes fixed effects (β00, βi0, β0j) related to level one and level two predictors, and a random effect (u_{0j}) with a normal distribution having mean zero and variance σ_u^2. In this model, $e^{\beta_{ij}}$ is interpreted as the odds of DAMA.

Three models were examined: First, a null model (no predictors included), then a model with patient-level variables, and finally a Full model incorporating all level one and level two variables for the data. The addition of variables in the three models was assessed using -2log likelihood and the Likelihood Ratio Test (LRT).

4. Results

This study focused on a group of 16,071 individuals who were admitted to the hospital and received care from 137 physicians. The average age of the medical practitioners was 56.27±12.29 years. Of the physicians, 92 individuals (67.2 percent) were male. Furthermore, 41 physicians (29.9 percent) held guest positions, while 96 (70.1 percent) were shareholders within the hospital. Supplementary demographic attributes of the physicians are detailed in Table 1.

The mean age of the patients was 45.28 ± 19.58 years. Among these patients, 5,181 individuals (32.2 percent) were male. Variation in health insurance coverage was observed, with 13,698 patients (85.2 percent) possessing insurance, while 2,373 patients (14.8 percent) lacked such coverage. Further demographic particulars about the patients are furnished in Table 1.

In Table 2, the results of regression modeling for the studied models are presented. The log-likelihood value for the null model was -3304.90, which increased to -3041.76 with the addition of patient-level predictors. This increase of 263.14 units was statistically significant based on the chi-square test ($P < 0.001$). Subsequently, incorporating physician-level predictors into the model

Table 1. Descriptive Statistics of some Demographic Characteristics at the Level of Patient and Physician

Variables	No. (%)
Sex	
Male	5181 (32.24)
Female	10890 (67.76)
Insurance type	
No Insurance	2373 (14.77)
Tamin Ejtemaei	8749 (54.44)
Salamat	1963 (12.21)
Niroohaye Mosallah	560 (3.48)
Roostayi	1037 (6.45)
Other	1389 (8.64)
Type of disease	
Group I	1854 (11.54)
Group II	8478 (52.75)
Group III	751 (4.67)
Group IV	108 (0.67)
Group V	4154 (25.85)
Group VI	7069 (43.99)
Age [a]	45.28 ± 19.59
Physician-level variables	
Sex	
Male	92 (67.15)
Female	45 (32.85)
Shareholder	
Guest	41 (29.93)
Shareholder	96 (70.07)
Field	
Non-Surgeon	39 (28.47)
Surgeon	98 (71.53)
Level	
Specialist	124 (90.51)
Sub-Specialist	13 (9.49)
Number of patients [b]	57 (17-154)
Experience (y) [b]	9 (3-19.5)
Age (y) [a]	56.27 ± 12.29

[a] Numbers are reported as Mean ± SD.

[b] Numbers are reported as Median (Q1 - Q3).

resulted in a log-likelihood value of -2996.16. This increase, compared to the previous model (model with patient-level predictors), was also statistically significant ($P < 0.001$).

Patients with DAMA comprised 6.8 percent (n = 1094). In Table 2, the outcomes of a two-level logistic regression model with a random intercept are presented. Based on the results in Table 2, at the patient level, there was a relationship between age, type of disease (Group II, Group V), and the type of insurance with the odds of DAMA. With an increase in patient age, the chance of DAMA also increased ($P < 0.05$). The presence of Group V disease increased the chance of DAMA by a factor of 10, while Group II decreased this chance by a factor of 2 ($P < 0.001$). The odds of DAMA in patients with rural insurance were 64 percent lower compared to those without rural insurance ($P < 0.001$).

At the physician level, there was an association between specialized field, sex, medical history, and the request for DAMA. Patients with physicians specializing

Table 2. Results of two-level Random Intercept Logistic Regression Model

Patient-Level Variables	Model with Patient -and Physician-Level Predictors (Full Model)			Model with Patient-Level Predictors		
	OR (std)	95% CI	P - value	OR (std)	95% CI	P - Value
Age	1.01 (0)	(1 - 1.02)	0.01	1.01 (0.003)	(1.003;1.01)	0.02
Group I						
No	Ref					
Yes	0.72 (0.13)	(0.5 - 1.03)	0.07	0.72 (0.13)	(0.5;1.03)	0.07
Group II						
No	Ref					
Yes	0.53 (0.07)	(0.41 - 0.68)	<0.001	0.57 (0.07)	(0.44;0.73)	<0.001
Group III						
No	Ref					
Yes	0.84 (0.21)	(0.51 - 1.37)	0.48	0.96 (0.25)	(0.58;1.58)	0.87
Group IV						
No	Ref					
Yes	0.47 (0.35)	(0.11 - 1.99)	0.30	0.5 (0.37)	(0.12;2.14)	0.35
Group V						
No	Ref					
Yes	10.86 (2.17)	(7.34 - 16.07)	<0.001	12.64 (2.43)	(8.67;18.44)	<0.001
Group VI						
No	Ref					
Yes	0.67	(0.46 - 0.98)	<0.001	0.98	(0.83 - 1.20)	0.02
Sex						
Male	Ref					
Female	0.82 (0.11)	(0.63 - 1.07)	0.14	0.8 (0.11)	(0.62;1.04)	0.09
Insurance						
No Insurance	Ref					
Tamin Ejtemaei	0.97 (0.09)	(0.81 - 1.16)	0.73	0.98 (0.09)	(0.81;1.17)	0.79
Salamat	0.69 (0.12)	(0.49 - 0.98)	0.03	0.7 (0.12)	(0.5;0.99)	0.05
Niroohaye Mosallah	0.51 (0.13)	(0.3 - 0.85)	0.01	0.51 (0.13)	(0.3;0.85)	0.01
Roostayi	0.36 (0.09)	(0.23 - 0.58)	<0.001	0.38 (0.09)	(0.24;0.6)	<0.001
Other	0.67 (0.13)	(0.46 - 0.97)	0.036	0.67 (0.13)	(0.46;0.97)	0.04
Physician-level variables						
Field						
non - surgeon	Ref					
Surgeon	0.25 (0.08)	(0.13 - 0.48)	<0.001			
sex						
Male	Ref					
Female	2.04 (0.59)	(1.16 - 3.58)	0.013			
Shareholder						
Guest	Ref					
Shareholder	1.35 (0.51)	(0.64;2.84)	0.42			
Level						
Specialist	Ref					
Sub - Specialist	0.41 (0.2)	(0.16 - 1.06)	0.06			
Experience	1.05 (0.02)	(1 - 1.1)	0.03			
Age	0.97 (0.02)	(0.93 - 1.01)	0.12			
Random effect						
Intercept	2.06 (3.16)	(0.10;41.83)	0.63	0.013 (0.003)	(0.008;0.23)	<0.001
Var (Intercept)	0.77 (0.21)	(0.45 - 1.33)		1.18 (0.28)	(0.73;1.89)	
log likelihood	- 2996.16			- 3041.76		

in surgery had a 75 percent lower chance of DAMA compared to those with non-surgeon specialties ($P < 0.001$). The chance of DAMA was twice as high with female physicians compared to male physicians ($P < 0.05$). An increase in experience increased the odds of DAMA.

5. Discussion

DAMA is a complex phenomenon that can have significant repercussions for both patients and healthcare systems. This study aimed to explore the predictors of DAMA by considering both patient-level and physician-level variables within a single analytical framework. The findings shed light on several important aspects of DAMA and provide insights that can inform healthcare practices and policies.

5.1. Patient-Level Predictors

- Age: The study revealed that older patients are more likely to choose DAMA. This finding aligns with previous research suggesting that older individuals may assert their autonomy more in healthcare decisions. As age increases, patients may have stronger preferences regarding their treatment choices, including the decision to leave the hospital prematurely (3).

- Type of Disease: The nature of the disease played a significant role in DAMA decisions. Patients with

gynecological issues, obstetrics, fetal, and neonatal abnormalities were more likely to opt for DAMA, whereas those with internal diseases were less likely to do so. This distinction emphasizes the importance of considering the severity and type of illness when predicting DAMA. Patients with less severe conditions might perceive fewer risks in leaving against medical advice (10).

- Insurance Coverage: The study highlights that insurance status exerts an influence on DAMA decisions. Patients with rural insurance exhibited a lower probability of self-discharge compared to those without insurance. This suggests that financial factors can be a driving force behind DAMA, with uninsured individuals facing greater economic barriers to continuing treatment (3, 15).

5.2. Physician-Level Predictors

- Expertise: Patients attended by physicians with surgical expertise were less likely to seek self-discharge compared to those cared for by physicians with internal expertise. This highlights the potential impact of physician specialization on patient choices. Patients may have greater trust in the treatment plans provided by specialists, leading to a lower likelihood of DAMA (9, 16).

Sex of Physician: The study found that patients attended by female physicians were more likely to choose self-discharge based on personal preference. This result suggests sex disparities in patient preferences and physician-patient communication styles. Female physicians may exhibit more patient-centered communication, which could influence patients' decisions (16-18).

Physician Experience: An increase in physician experience was associated with a higher likelihood of patients opting for self-discharge. While this result is intriguing, it may be indicative of patients' perceptions of more experienced physicians and their trust in their judgment (19). Further research is needed to delve into the underlying factors contributing to this association.

The study's findings have important implications for healthcare providers and institutions. To reduce DAMA rates, healthcare providers should prioritize effective physician-patient communication, especially when dealing with older patients or those with certain types of diseases. Additionally, interventions and support for uninsured patients may help mitigate DAMA associated with financial concerns.

Future research should delve deeper into the complex interactions between these predictors and explore qualitative aspects of patient-physician interactions. Understanding the nuances of these dynamics will contribute to more effective strategies for preventing DAMA, ultimately improving patient outcomes and healthcare system efficiency.

5.3. Conclusions

This study provides a thorough investigation into Discharge Against Medical Advice (DAMA), examining predictive factors at both patient and physician levels through multilevel modeling. This approach offers a nuanced understanding of DAMA dynamics, emphasizing the significance of proactive measures to improve patient safety and satisfaction while optimizing healthcare resource utilization. Based on the study's insights, actionable recommendations for healthcare managers include:

- Establish Support Systems for Vulnerable Patients: Develop programs or financial assistance initiatives to support uninsured or underinsured patients, mitigating economic barriers to healthcare and reducing DAMA risk.

- Customize Care Plans Based on Patient Characteristics: Tailor treatment and discharge strategies according to patient demographics and clinical profiles, ensuring personalized care and minimizing the likelihood of DAMA.

- Monitor and Evaluate Physician Performance: Implement systems for assessing physician performance and patient outcomes, including DAMA rates, providing feedback and support to optimize care delivery.

- Foster Interdisciplinary Collaboration: Promote teamwork and communication among healthcare professionals to develop comprehensive patient care plans, addressing factors contributing to DAMA and improving outcomes.

By implementing these recommendations, healthcare managers can effectively reduce DAMA rates, enhance patient satisfaction, and facilitate better continuity of care within healthcare institutions.

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Footnotes

Authors' Contribution: A. T. collected the clinical data, interpreted them and conceived and designed the evaluation and drafted the manuscript. A.J. Studied concept and design. H. H. evaluated the clinical data, revised the manuscript and performed the statistical analysis. M. GH. supervised study and revised the manuscript. H. S. B. re-analyzed the clinical and statistical data and revised the manuscript. All authors read and approved the final manuscript.

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