

Factors Associated with Retention Intention of Physicians in Rural Areas of Afghanistan: A Cross-Sectional Study Using Ordinal Logistic Regression

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Abstract

Background: A major challenge in healthcare systems is the limited retention of physicians in underserved areas.

Objectives: This study aimed to identify the factors related to the retention of physicians in rural areas of Afghanistan.

Methods: This analytical cross-sectional study was conducted among physicians working in rural areas across 34 provinces of Afghanistan. A sample of 352 physicians was selected using a multistage sampling method. Data were collected using a standardized questionnaire designed to assess physicians' desire for retention in underserved areas. Retention intention was measured using a single question with a five-point Likert scale ranging from "very low" to "very high," and this ordinal variable served as the dependent variable in the analysis. Mean (standard deviation) and frequency (percentage) were used for data description, and an ordinal logistic regression model was employed for analysis. All statistical analyses were performed using SPSS version 26, with the significance level set at 5%.

Results: Of the total participants, 82.10% (n=289) were male, 84.94% (n=299) were married, and 77.84% (n=274) were native to rural areas. The study found that 46% of physicians had a moderate desire for retention, and 28% had a high to very high desire. Financial incentives received the highest importance scores, followed by regulatory interventions and personal/professional support. Employment status was the strongest negative predictor, with long-term contract physicians having 54% lower odds of retention than permanent employees (OR=0.46, p=0.009). Each unit increase in personal/professional support compliance raised retention odds by 8% (OR=1.08, p<0.001). Native physicians showed significantly higher retention desire than non-natives (p<0.001), particularly at moderate levels. Age and work experience had weak inverse correlations with retention. Non-financial organizational support factors emerged as more critical determinants than financial incentives or educational interventions.

Conclusion: Physician retention is associated with educational interventions, regulatory interventions, financial incentives, and personal and professional support. Policymakers may consider prioritizing and improving these factors when formulating retention strategies.

Keywords: Retention of Physicians, Rural Areas, Afghanistan, Human Resources Planning.

1. Introduction

A well-functioning healthcare system is essential for any society, and its workforce is the key driving force. Without adequate human resources, the healthcare system cannot effectively fulfill its role in promoting health (1). Over the past few decades, the

demand for healthcare services has rapidly increased, driven by population growth and improved health literacy (2). Physicians, nurses, and paramedics are the cornerstone of healthcare systems, and their unavailability can cause irreparable damage and hinder the achievement of Universal

Health Coverage (UHC) (3). Equitable distribution of human resources is as important as their overall availability. Unequal distribution across different areas poses significant challenges to healthcare systems (4). Today, policymakers increasingly emphasize the fair allocation of skilled healthcare professionals to underserved areas to ensure equal access to healthcare and medical services for all populations (5,6).

Urbanization has led to the migration of large populations to cities. Many physicians, nurses, and paramedics prefer to live in urban areas due to convenience and better access to facilities (6,7). In contrast, living conditions in rural areas are often limited, which discourages healthcare professionals from staying. Some physicians commute between rural workplaces and urban residences to meet their essential needs, and in some cases, long distances have even resulted in fatalities. Additionally, many professionals ultimately choose urban life over rural life (6), further reinforcing urbanization and rural-to-urban migration. Consequently, the inaccessibility of health facilities in rural areas has contributed to increased maternal mortality, cardiovascular diseases, and other conditions requiring specialized care. Governments in developed countries have prioritized addressing the shortage of healthcare professionals in rural areas, with equitable resource distribution as a subsequent goal (8).

The World Health Organization (WHO) has included access to resources and healthcare facilities in deprived areas as part of its special monitoring and reporting missions (9). According to the WHO 2010 report, rural areas worldwide experience significant deprivation compared to urban areas, particularly in terms of medical teams and healthcare centers. This report provided concrete evidence based on investigations conducted across 57 countries (10). In developed countries such as the United

States, England, and France, less than 20% of the population lives in rural areas, whereas countries like Niger (82%), Myanmar (69%), Tajikistan (74%), and Afghanistan (74%) have the highest rural population ratios (11). Afghanistan's situation is particularly critical due to decades of warfare. The WHO report indicates that approximately 38% of the Afghan population lack access to healthcare services, with only 0.8 medical doctors and 0.1 obstetricians per 15,000 people. In some areas, there is no access to medical doctors or specialized healthcare professionals (12).

Unequal distribution of physicians, specialists, and paramedics is a universal problem. For instance, in the United States, the rural population constitutes 20% of the total population, but only 11% of medical doctors practice in rural areas (13). This imbalance is largely attributed to the reluctance of healthcare professionals to serve and remain in underserved regions (5,6,10,14).

The retention of physicians in underserved areas is influenced by multiple factors, including financial incentives, professional and personal conditions, living environment, local culture, physicians' age, rural nativity, and gender (15-19). Although several studies have examined retention in various national contexts, the existing evidence is heavily skewed toward stable, high-income, or middle-income countries. There is a significant knowledge gap regarding physician retention in conflict-affected and fragile states, where healthcare infrastructure is weak, security concerns are prevalent, and socio-economic conditions differ markedly from those in other settings. Moreover, most existing studies have used non-standardized or single-item measures, limiting the comparability and depth of their findings.

To address this gap, the present study is the first to use a validated, multidimensional questionnaire based on WHO-recommended

domains (17,20), including educational interventions, regulatory frameworks, financial incentives, and personal and professional support, to quantitatively assess retention intention among physicians in rural Afghanistan. Beyond filling a geographical void, this study offers a novel contribution by examining how these factors operate in a unique post-conflict and low-resource environment. The findings are not only critical for Afghanistan's health system recovery but also provide transferable insights for other developing countries grappling with similar challenges of physician maldistribution and rural workforce shortages.

In Iran, studies reported retention rates between 16% and 33% (21,17); in India, approximately 58% (7); in Pakistan, around 30% (22); and in Argentina, about 21% (23). A study conducted in Saudi Arabia indicated that 58% of dental professionals expressed willingness to remain in rural and underserved areas (24).

To the best of our knowledge, no study has been conducted on physician retention in Afghanistan. Given the unique circumstances in this country, including the aftermath of years of colonialism and civil wars, the healthcare system has been experiencing near collapse in recent years (25). Moreover, due to the significant proportion of the country's population residing in rural areas and the unequal distribution of physicians in these underserved areas, it is vital to conduct a study on physician retention. Therefore, this study aimed to examine the retention intention of physicians in underserved areas of Afghanistan and identify associated factors, with particular attention to the WHO-recommended intervention domains, in order to generate evidence that can guide policymakers in designing context-sensitive retention strategies.

2. Method

2.1. Study design and setting

This analytical cross-sectional study was conducted on physicians working in rural areas of Afghanistan over one year, from April 2021 to April 2022. The STROBE guidelines (see Supplementary 1) for observational studies were applied in designing and reporting the results of the study.

2.2. Study population and sample

A total of 352 physicians were included in the study, selected using a multi-stage sampling method and representing 34 provinces of Afghanistan. In the first stage, each province was considered as a stratum, and the sample size in each province was determined proportionally according to the number of physicians. In the second stage, physicians were selected by random sampling according to the assigned numbers. The inclusion criteria were physicians working in health centers in rural areas and willingness to participate in the study. The exclusion criteria were unwillingness to participate, not answering more than 50% of the questions, or excessive work-related time constraints.

2.3. Data collection

The data collection tool was a questionnaire used in a similar study in Iran, whose validity and reliability were confirmed (17). The original validation study was conducted on a sample of 120 physicians working in rural areas of Mashhad, Iran. In that study, face and content validity were assessed using a qualitative approach with the involvement of 10 experts in health policy and health services management. Internal consistency was confirmed with a Cronbach's alpha value of 0.85, and test-retest reliability was assessed using the intraclass correlation coefficient (ICC = 0.79) over a two-week interval on a subsample of 30 physicians. However, due to slight language differences between Iranian Persian (Farsi) and Afghan Persian (Dari), the questionnaire was revised for better

understanding by two Afghans fluent in both languages. In the current study, we re-evaluated face and content validity using a qualitative approach. For this purpose, the revised questionnaire was reviewed by a panel of 10 Afghan physicians (5 male and 5 female) working in rural areas, who assessed the clarity, relevance, and comprehensiveness of the items. Minor wording adjustments were made based on their feedback to ensure cultural and linguistic appropriateness.

Furthermore, we re-assessed the internal consistency of the questionnaire in the Afghan context by calculating Cronbach's alpha using the data collected from the full sample of 352 participants. The Cronbach's alpha value obtained in the current study was 0.85, indicating excellent internal consistency.

The questionnaire consisted of 58 items based on a five-point Likert scale ranging from "very high" to "very low." It had four sections: the first section contained six questions about the demographic characteristics of physicians; the second section contained 25 questions about the importance of each recommended dimension strategy; the third section contained 25 questions about the extent to which each recommended dimension strategy was followed; and the fourth section contained one question about assessing physicians' willingness to remain in rural areas. The validity and reliability of the questionnaire were examined and confirmed in the Mollaei study (17).

2.4. Data Analysis

Mean (and standard deviation) and median (interquartile range) values were used to describe the variables. The ordinal logistic regression model was used for analysis. The outcome variable, retention intention of physicians in rural areas of Afghanistan, was an ordinal variable with five ordered categories (very against, disagree,

somewhat, agree, and very agree). Therefore, ordinal logistic regression was used to examine the association between the outcome and the explanatory variables.

Initially, a proportional odds (PO) cumulative logit model was fitted. The proportional odds assumption was evaluated using likelihood ratio tests, which compared the proportional odds model with models allowing category-specific effects for each predictor. Because multiple hypothesis tests were performed, p-values were adjusted using the Holm correction to control the inflated error rate. Variables with statistically significant adjusted p-values were considered to violate the proportional odds assumption.

Since the proportional odds assumption was violated for two predictors, a partial proportional odds model (PPOM) was subsequently fitted.

Before model fitting, multicollinearity among the explanatory variables was assessed using variance inflation factors (VIFs). A VIF greater than 5 was considered indicative of potentially problematic multicollinearity.

Model parameters were estimated using maximum likelihood. Regression coefficients were exponentiated and reported as odds ratios (ORs) with corresponding 95% confidence intervals (95% CIs). All statistical analyses were performed using SPSS (version 26) and R (version 4.4.1) with the ordinal, car, broom, and dplyr packages. The significance level for all tests was set at 5%.

3. Results

A total of 352 questionnaires were completed: 196 in person and 156 online. The average age was 35.80 ± 6.99 years, and the average work experience was 6.95 ± 5.50 years. Additionally, 82.10% were male ($n=289$), 84.94% were married ($n=299$), 60.51% were permanently employed ($n=213$), and 77.84% ($n=274$) were native to rural areas. In total, 46.02% ($n=162$) had a

moderate to high desire to remain, while (Table 1).
27.84% (n=98) had a high or very high desire

Table 1. The characteristics of the participants (n=352)

Variables	Levels	N	%
Gender	Male	289	82.10
	Female	63	17.90
Marital status	Single	53	15.06
	Married	299	84.94
Employment Status	permanent	213	60.51
	long term contract	11	3.13
	short term contract	120	34.09
	on duty	8	2.27
Local Resident	Yes	274	77.84
	No	78	22.16
The desire to retention	Very low	135	38.35
	Low	55	15.63
	Moderate	64	18.18
	High	42	11.93
	Very high	56	15.91
Age	Mean (SD)=35.80(6.99), Min=23, Max=60		
Years of Work Experience	Mean (SD)=6.95(5.50), Min=1, Max=35		

The assessment highlighted the importance of financial incentives, regulatory interventions, and personal and professional supports in deciding to stay in rural areas. The mean scores for these dimensions were as follows: financial incentives, 79.79 ± 21.04 ;

regulatory interventions, 78.86 ± 20.71 ; and personal and professional supports, 78.77 ± 6.06 . Among these dimensions, financial incentives received the highest scores (Table 2).

Table 2. Descriptive information about the importance and Compliance to the interventions recommended by the World Health Organization

Factors	Questionnaire dimensions	Mean	SD	Min	Max
The importance of interventions according to physicians	Educational interventions	59.57	19.85	24.00	180.00
	Regulatory interventions	78.86	20.71	20.00	176.00
	Financial incentives	79.79	21.04	20.00	100.00
	Personal and professional support	78.77	21.06	27.27	100.00
The Compliance of health system with interventions	Educational interventions	44.20	18.31	20.00	100.00
	Regulatory interventions	55.47	14.36	28.00	100.00
	Financial incentives	47.86	14.50	20.00	95.00
	Personal and professional supports	45.44	14.23	20.00	93.33

The Mann-Whitney U test showed that the importance of regulatory interventions differed significantly between men and women, with men having a significantly higher median score ($p=0.029$). The level of health system compliance with financial incentives ($p=0.029$) and personal and

professional supports ($p=0.005$) was significantly higher among women.

The Mann-Whitney U test results also showed significant differences between individuals' place of residence and the importance of regulatory interventions,

personal and professional supports, and health system compliance with educational interventions, regulatory interventions, and personal and professional supports from physicians' perspective. The median scores of the importance of regulatory interventions ($p=0.043$) and personal and professional supports ($p=0.047$) were significantly higher among non-locals. The median scores of compliances with educational interventions ($p=0.001$), regulatory interventions ($p<0.001$), and personal and professional supports ($p=0.038$) were significantly higher among locals. The chi-square test results showed that retention desire differed significantly between locals and non-locals ($p<0.001$). At moderate and higher retention levels, physicians raised in rural areas had higher scores.

Post-hoc pairwise comparison of locals and non-locals with Bonferroni correction at each retention level showed a significant difference between them at the very low and moderate levels. Specifically, at the very low level, 59.49% of non-local physicians had a very low retention desire, while this proportion was approximately 32.23% for locals. At the moderate level, 21.61% of locals had a moderate retention desire, while this proportion was 6.33% for non-locals.

The Kruskal-Wallis test showed significant differences ($p<0.05$) between the scores of importance of regulatory interventions, financial incentives, and personal and professional supports, and health system compliance with educational interventions, regulatory interventions, and personal and professional supports by employment type.

Post-hoc pairwise comparison with Bonferroni correction showed that the importance of regulatory interventions, financial incentives, and personal and professional supports differed significantly between long-term contract employees compared to short-term contract and on-duty employees ($p<0.05$). There was also a

significant difference between the mean scores of permanent employment status and long-term contract and on-duty employment types ($p<0.05$). The mean compliance score for educational interventions differed significantly between short-term contract employees compared to permanent and long-term contract employees ($p<0.05$). There was a significant difference between the mean scores of permanent employment status and long-term contract and on-duty employment types ($p<0.05$). The mean compliance score for regulatory interventions differed significantly between on-duty employees compared to long-term contract employees ($p<0.05$). There was also a significant difference between the mean scores of permanent employment status and long-term contract employment type ($p<0.05$). The mean compliance score for personal and professional supports differed significantly between on-duty employees compared to other employment types ($p=0.03$).

Spearman's correlation coefficient showed a weak and inverse significant relationship between retention desire and age ($r=-0.139$, $p=0.009$) and work experience ($r=-0.134$, $p=0.012$).

A partial proportional odds ordinal logistic regression model was fitted because the proportional odds assumption was violated for the importance of regulatory interventions and the importance of personal and professional support, based on likelihood ratio tests with Holm-adjusted p-values. These two predictors were therefore modeled with threshold-specific effects, whereas the remaining predictors were constrained to satisfy the proportional odds assumption.

Among demographic factors, employment status emerged as the strongest negative predictor. long-term contract physicians had 54% lower odds of stronger retention intention compared to permanent employees

(OR = 0.46, 95% CI: 0.26–0.82, $p = 0.009$). No significant effects were observed for sex, marital status, years of service, or native status.

Regarding compliance factors, personal and professional support was the strongest positive predictor of retention intention (OR = 1.08, 95% CI: 1.05–1.10, $p < 0.001$), followed by regulatory interventions (OR = 1.04, 95% CI: 1.02–1.07, $p < 0.001$). Each unit increase in personal and professional support compliance was associated with an 8% increase in the odds of stronger retention intention.

Notably, two variables showed threshold-specific effects that varied across different

levels of retention intention. For each one-point increase in personal and professional support, the odds of reporting a retention intention of "somewhat," "agree," or "very agree" rather than "very against" or "disagree" increased by 4%, holding all other variables constant (OR = 1.04, 95% CI: 1.01–1.06, $p = 0.005$).

No significant associations were found for the importance of educational interventions, financial incentives, or compliance with educational interventions or financial incentives, indicating that non-financial organizational support factors are more critical determinants of physician retention in this context (Table 3).

Table 3. Partial proportional odds logistic regression analysis of factors associated with retention intention of physicians

Predictor	OR (95% CI)	P-value
Non-proportional (threshold-specific) effects ‡		
The importance of regulatory interventions		
Very against vs. Very agree	1.04 (0.99–1.08)	0.117
Disagree vs. Very agree	0.97 (0.95–1.00)	0.061
Somewhat vs. Very agree	0.98 (0.95–1.00)	0.064
Agree vs. Very agree	0.99 (0.95–1.03)	0.584
The importance of personal and professional support		
Disagree, somewhat, agree, very agree vs. Very against	0.99 (0.96–1.03)	0.741
Somewhat, agree, very agree vs. Very against and disagree	1.04 (1.01–1.06)	0.005
Agree or very agree vs. Somewhat, Disagree and very against	1.00 (0.98–1.03)	0.864
Very agree vs. lower levels	1.01 (0.97–1.06)	0.653
Proportional effects (global ORs)		
Sex (Female vs. Male)	1.56 (0.83–2.91)	0.166
Marital status (Married vs. Single)	0.63 (0.33–1.20)	0.160
Years of service (per 1-year increase)	1.01 (0.96–1.06)	0.789
Employment status		
Short term contract vs. Permanent (ref)	0.63 (0.18–2.21)	0.467
Long term contract vs. Permanent (ref)	0.46 (0.26–0.82)	0.009
On duty vs. Permanent (ref)	0.83 (0.20–3.47)	0.802
Native (Yes vs. No)	1.68 (0.96–2.96)	0.072
The importance of educational interventions (per unit increase)	1.00 (0.99–1.01)	0.969
The importance of financial incentives (per unit increase)	1.01 (0.99–1.03)	0.352
The Compliance with educational interventions (per unit increase)	1.01 (0.99–1.03)	0.244
The Compliance with regulatory interventions (per unit increase)	1.04 (1.02–1.07)	< 0.001
The Compliance with financial incentives (per unit increase)	1.00 (0.98–1.03)	0.704
The Compliance with personal and professional supports (per unit increase)	1.08 (1.05–1.10)	< 0.001

4. Discussion

The shortage of physicians in underserved areas is a significant issue in healthcare systems, and Afghanistan is no exception (26). The country has experienced profound deprivation, particularly in rural areas, due to internal conflicts and foreign colonization. Given the present circumstances, identifying factors associated with physician retention in underserved areas of Afghanistan is vital.

The retention rate observed in our study (27.84%) is comparable to findings from neighboring countries such as Iran (17) and Pakistan (22), suggesting that physicians in this region face similar challenges in rural practice, including limited infrastructure, security concerns, and inadequate professional support. However, this rate is notably lower than the 58% reported among dentists in Saudi Arabia, which may reflect the relatively better economic conditions and healthcare investments in that country (24). Conversely, our finding is higher than the 21% reported in Argentina (23), possibly due to differences in cultural attachment to rural areas or the proportion of native physicians in our sample. The extremely low permanent retention rate in China (27) highlights the transient nature of rural service in some contexts, whereas our moderate rate may indicate that Afghan physicians, despite the challenging environment, develop a stronger sense of commitment to their rural communities, particularly when they are native to those areas. These cross-country variations underscore the influence of contextual, economic, and cultural factors on retention, emphasizing the need for context-specific policy interventions rather than one-size-fits-all approaches.

The non-significant relationship between gender and retention intention in our study, consistent with Al-Jardali et al. (15), suggests that gender may not be a universal determinant of rural retention. The conflicting findings across studies, higher

retention among males in Saudi Arabia (24) versus females in Bosnia and Herzegovina (18), highlight that gender effects are highly context-specific and may be influenced by cultural norms, security conditions, and societal roles. In Afghanistan, the lack of a gender effect may be explained by the severe challenges facing both male and female physicians in rural areas, including safety concerns, inadequate infrastructure, and limited professional opportunities, which may override gender-specific differences. Additionally, the small proportion of female physicians in our sample (17.90%) may have limited statistical power to detect a true effect. These findings align with previous research suggesting that place of birth and prior rural living experience are more consistent predictors of retention than gender (6,14). Therefore, policymakers should prioritize these more robust factors rather than focusing primarily on gender-based strategies.

Our study also investigated the effect of marital status on physician retention in multiple models (with controlling for other variables). The results indicated no significant relationship between marital status and retention intention. Other studies showed conflicting results regarding the effect of marriage. Some did not find a statistically significant effect (22,17,16). However, others considered marital status and family ties to be influential factors (24,14). In the study by Mollahaliloglu et al. (2015) in Turkey, single physicians were significantly more inclined to serve in rural areas than married physicians (14). Marriage has an impact on many aspects of life. Several studies found a significant effect of marriage on work (4,13). The reason for the contradiction in findings across studies may be differences in study populations and cultural contexts.

Physician age was another factor considered in many studies investigating retention. Different results have been

reported regarding the effect of age on retention (24,22,15,14,8). Some studies considered younger age as a positive factor, as younger physicians desired to gain experience in different conditions and serve in underserved areas (14,16). For example, in the study by Mollahaliloglu et al. (2015) in Turkey, young physicians were significantly more willing to serve in rural areas (14). Others considered older age to be an influential factor in retention, citing stability of living conditions, less desire for adventure and gaining life experience in different areas, and a desire to live in quiet areas away from urban hustle and bustle (28,23). Our results showed that age did not significantly influence physician retention in rural areas. The reason for the difference between our results and previous studies might be differences in study populations and age groups. Given the inconsistency of results, conducting systematic reviews and meta-analyses in this field would be helpful.

The significant positive association between being native to rural areas and retention intention in our study is consistent with the broader literature (5,14,24) and underscores the importance of local ties in physicians' decisions to remain in underserved regions. This finding can be explained by several factors: native physicians have stronger family and community connections, greater familiarity with local culture and living conditions, and a deeper sense of responsibility toward their home communities. Although Mollaei et al. (17) did not find a significant relationship in Iran, this discrepancy may be attributed to differences in sample characteristics, cultural contexts, or the specific rural areas studied. The inconsistency in findings across studies suggests that while place of birth is generally an important factor, its influence may vary depending on the availability of alternative opportunities, the level of rural deprivation, and the strength of community ties. Importantly, our results, along with previous

studies (5,14,24), support the policy recommendation that recruiting and training locally-born physicians, for example, through rural-origin admission programs, can be an effective strategy for improving physician retention in Afghanistan and similar settings.

We investigated the relationships between dimensions of importance (educational interventions, regulatory interventions, financial incentives, and personal and professional supports) and health system compliance with these dimensions on physician retention. In our study, multiple logistic regression showed that with an increase in the importance score of educational interventions, the chance of retention increased. In line with our study, Mollaei et al. found access to continuing education programs and increasing educational opportunities as factors associated with physician retention in deprived areas (17). The review study by Mohammadiaghdam et al. showed that the lack of ongoing training and information updates for physicians in underserved areas negatively affected retention (16). Due to technological development, health authorities can largely address this concern through online and virtual education.

The partial proportional odds ordinal logistic regression model reveals that physicians' retention intention is shaped primarily by non-financial organizational support—especially personal and professional support—alongside regulatory compliance, while employment insecurity (long-term contract status) substantially undermines retention. These findings align with the WHO's four-domain retention framework (education, regulation, financial incentives, and personal/professional support) but critically refine it by showing that, in this context, non-financial organizational supports exert stronger and more consistent effects than financial incentives or educational interventions (29-

31).

Long-term contract physicians exhibited 54% lower odds of stronger retention intention compared to permanent employees (OR = 0.46, 95% CI: 0.26–0.82, $p = 0.009$), while other demographic factors (sex, marital status, years of service, native status) were non-significant. This accords with social exchange theory and organizational commitment literature, which posit that job security and perceived organizational investment elicit reciprocal loyalty and reduced turnover intentions. Contractual employment status signals precarious employment, weakens psychological contracts, and reduces access to career development pathways, thereby diminishing retention (32,33).

The absence of significant effects for sex, marital status, years of service, and native status contrasts with some international reviews that report gendered retention patterns or rural-native advantages, suggesting that in this setting, structural employment conditions may overshadow individual demographic characteristics. Alternatively, limited statistical power or sample homogeneity could attenuate demographic effects (30,31).

Personal and professional support emerged as the most robust positive predictor of retention intention (global OR = 1.08 per unit increase, 95% CI: 1.05–1.10, $p < 0.001$), followed by compliance with regulatory interventions (OR = 1.04, 95% CI: 1.02–1.07, $p < 0.001$). This finding is consistent with the Job Demands, Resources (JD-R) model, which posits that job resources, such as supportive supervision, mentoring, safe working environments, and professional networks, buffer job demands and enhance work engagement and retention. It also resonates with self-determination theory, whereby autonomy-supportive and relatedness-enhancing environments foster intrinsic motivation and sustained

commitment (30,33,34).

Systematic reviews of retention strategies in low- and middle-income countries similarly emphasize that improving living conditions, ensuring workplace safety, fostering professional networks, and providing mentorship are critical for retaining physicians in underserved areas. The transnational co-creation study further clusters interventions into the same four WHO domains, highlighting professional and personal support measures such as team meetings, leadership training, psychological counselling, and administrative support as pivotal (20,29,31).

4.1. Limitations and strengths

One strength of this study is its examination of an important and pressing issue in Afghanistan. However, several limitations should be acknowledged. First, the cross-sectional design precludes causal inferences, as the associations reported are correlational and temporal precedence cannot be established. Second, the use of self-reported data introduces potential social desirability and recall biases, and stated retention intention may not fully reflect actual behavior. Third, selection and response biases may exist, as data were collected through two modes (in-person: $n=196$, online: $n=156$), and physicians with stronger opinions may have been more willing to participate, potentially overrepresenting extreme views. Fourth, the findings may not be fully generalizable to other conflict-affected or low-income settings due to Afghanistan's unique socio-political context, and the study period (April 2021–April 2022) may limit applicability to other timeframes. Fifth, the absence of qualitative interviews restricted our ability to gain deeper contextual insights. The most important practical limitation was the physical distance between researchers and rural health centers, which hindered direct access to some physicians; we attempted to

mitigate this through email communication. Despite these limitations, this study provides valuable baseline evidence for policymakers and future research.

5. Conclusion

Physician retention in underserved areas is a multifaceted issue associated with various personal, cultural, social, and environmental factors. Our findings showed that, after accounting for confounding variables, physician retention in these areas is primarily associated with educational, regulatory, financial, and personal and professional factors. Rural physicians can benefit from training and empowerment programs that are similarly available to their urban counterparts. New regulatory measures that offer financial incentives can further enhance physician retention in rural areas. Additionally, addressing personal and professional supports and ensuring the safety of physicians residing in rural areas is essential. Healthcare policymakers should prioritize these factors to address physician retention in underserved areas. They need to develop future strategies focused on enhancing physician well-being.

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Ethical considerations: This study was conducted based on the declaration of ethical principles of Helsinki and the good clinical practices at the site were approved by the Mashhad University of Medical Sciences with the code of ethics (IR.MUMS.FHMPM.REC.1401.047) and after receiving a written introduction letter, the studied hospitals were referred to. After explaining the purpose and method of the research, informed consent was obtained from the participants. Confidentiality and privacy were assured for all study participants. All methods were carried out in

accordance with relevant guidelines and regulations under ethics approval and consent to participants.

Availability of data and materials: The datasets generated and/or analyzed during this study are not publicly available confidentiality of information but are available from the corresponding author on reasonable request basis.

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