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The role of cognitive functions in assessing aptitudes for carrying firearms by police officers

O papel de funções cognitivas na avaliação da aptidão ao porte de arma de fogo em policiais

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Abstract

Objective
To analyze the association between cognitive functions and the clinical and demographic profiles of police officers undergoing psychological evaluations for firearm possession in southern Brazil.

Method
A total of 250 psychological assessment records from 2015 to 2021 were reviewed. Cognitive functions were evaluated through tests measuring attention, memory, and logical reasoning. Statistical analyses included descriptive and inferential procedures to test the study hypotheses.

Results
The study found a significant cognitive decline associated with increasing age among police officers, indicating a higher risk for older adults carrying firearms. Mental disorders were shown to affect cognitive abilities; however, factors such as age and education mitigated this impact.

Conclusion
These findings highlight the importance of regular cognitive assessments for police officers, especially older individuals, to enhance preventive strategies and improve psychological evaluations related to firearm possession in Brazil.

Keywords: Attention; Memory; Mental disorders. Psychologic technics; Psychological safety.

Resumo

Objetivo
Identificar a associação entre as funções cognitivas e os perfis clínico e demográfico de policiais submetidos a avaliações psicológicas para porte de arma de fogo no sul do Brasil.

Método
Foram analisados 250 registros de avaliações psicológicas realizadas entre 2015 e 2021. As funções cognitivas foram avaliadas por meio de testes de atenção, memória e raciocínio lógico. A análise estatística envolveu procedimentos descritivos e inferenciais para testar as hipóteses do estudo.

Resultados
Foi identificado um declínio cognitivo significativo relacionado à idade dos policiais, o que aumenta o risco no uso de armas de fogo por profissionais mais velhos. Transtornos mentais influenciam as capacidades cognitivas, entretanto, fatores como idade e escolaridade podem mitigar esse impacto.

Conclusão
Os achados ressaltam a necessidade de avaliações cognitivas regulares para policiais, especialmente os mais velhos, contribuindo para o desenvolvimento de estratégias preventivas e aprimoramento das avaliações psicológicas relacionadas ao porte de arma de fogo no Brasil.

Palavras-chave: *Atenção; Memória; Transtornos Mentais; Técnicas psicológicas; Segurança psicológica.*

Permission to carry or possess a firearm in Brazil is granted upon delivery of psychological aptitude proof, which must be certified by a psychologist. The Federal Council of Psychology (Resolution No. 1) and the Federal Police (Normative Instruction No. 78) regulate the psychological evaluation for handling and carrying firearms in Brazil (Conselho Federal de Psicologia, 2022; Departamento da Polícia Federal, 2014). These regulations define the relevant psychological characteristics and outline the procedures psychologists must follow during evaluations. Among the key psychological characteristics, executive functions stand out, including attention, mnemonic, intellectual processes, inhibitory control and planning, as well as personality traits, behavior and assessment of critical judgment.

Public security professionals are the main carriers of weapons in Brazil. For this workers' segment, firearms are essential tools for performing their police duties. psychological evaluations are typically part of the selection process for police institutions, ensuring candidates possess psychological capacities compatible with the demands of high-risk activities (Faiad et al., 2021). Public security professionals are expected to exhibit psychological profiles suited to armed security tasks and to adhere to safety standards and legal principles.

During their careers in the police, professionals often face a range of occupational stressors that affect their psychological conditions, leading to physical and psychological exhaustion. The high prevalence of mental disorders among these professionals is a good example (Lima et al., 2015; Queirós et al., 2020). Police activity stress, aspects of organizational culture and climate, shift work, exposure to occupational risks, in addition to psychosocial factors, are powerful precipitators of mental illness over time (Castro & Cruz, 2015; Pereira et al., 2020; Souza & Minayo, 2005).

The presence of clinical conditions, such as burnout syndrome and post-traumatic stress, influence the intensity of the application of force and more violent behavior during adverse events in police operations (Kop & Euwema, 2001; Queirós et al., 2013; Queirós et al., 2020; Swick et al., 2012). Police officers with high scores on burnout dimensions were more likely to use force against civilians (Kop & Euwema, 2001). Police officers diagnosed with post-traumatic stress showed a significant deficit in motor response inhibition with increased impulsivity and a greater chance of errors in task execution (Swick et al., 2012).

Thus, even if the police officer presents a psychological profile that meets the requirements necessary to integrate the police institution, the ability to handle firearms safely can deteriorate throughout their career, causing adverse impacts on their health and safety, as well as increasing risks to the community (Molas et al., 2014). Involvement in incidents with firearms, the occurrence of crimes resulting from the abusive use of force and cases of firearm suicide represent the main negative consequences associated with the handling of firearms, often precipitated by altered psychological conditions such as mental disorders.

Mental health and cognitive aspects such as attention span, working memory and reasoning should be examined in the psychological evaluation for handling firearms, especially in the case of professionals in the police area. Cognitive functions play an essential role in the analysis and correct interpretation of stressful situations during police activity, enabling a better perception of risks in the environment (Andersen et al., 2018; Laborde et al., 2014). On the other hand, deficits in working memory and reduced attention capacity are associated with impairments in information processing and, consequently, with a greater likelihood of errors in decision-making during risky police operations (Kleider-Offutt et al., 2016).

In a dynamic environment, the ability to perceive and interpret the emotions and intentions of others is crucial, especially in situations that require negotiation and conflict mediation. In general, police officers need to make decisions in high-pressure and unpredictable situations, making the use of cognitive skills essential to perform their police duties. However, there is a significant association between age and cognitive performance in the general population, indicating that memory and attention deteriorate as age advances (Balzarotti et al., 2022; Borda et al., 2019; Nascimento et al., 2015; Rodrigues et al., 2008). No studies were found that elucidate this correlation in the police field; however, evidence like this is particularly important for public safety, since aging can impact the performance of risky police activities and the ability to safely use firearms.

This study aimed to identify the association between cognitive functions – memory, attention and reasoning – and the clinical and demographic profiles of police officers undergoing psychological evaluations for carrying and handling firearms. The following hypotheses were tested: 1) There is a significant difference in performance on cognitive tests according to age; 2) Police officers diagnosed with a mental disorder perform worse on cognitive tests than those without such a diagnosis.

Method

Participants

This investigation consisted of an observational study, in which data from 250 records of psychological evaluations for carrying firearms performed with police officers from a police organization in the southern region of Brazil were examined. These evaluations were carried out from 2015 to 2021. The sample included both active and retired police officers. The police officers underwent psychological evaluation with the aim of restoring the right to carry firearms, which had been suspended due to internal regulations of the organization. All police officers were evaluated by police psychologists belonging to the organization's permanent staff. The dataset used for this research was provided by the Police Organization after approval by the Human Research Ethics Committee of the Federal University of Santa Catarina, through opinion number 5,397,946.

Within the scope of the internal policies of the institution where the study was conducted, it is stipulated that, in the event of absence from work upon a medical recommendation reported on a health certificate indicating a diagnosis of mental disorder, the right to carry a firearm is compulsorily suspended. In order to reactivate the right to carry a firearm, a psychological evaluation indicating psychological aptitude for the use of firearms is required. Likewise, upon retirement, police officers lose the right to carry a firearm due to the change in employment relationship and, in order to regain that right, police officers are required to undergo a psychological evaluation conducted by psychologists belonging to the institution. It is important to highlight that the psychological

evaluations of the police officers followed the guidelines of the Federal Council of Psychology and the Normative Instruction No. 78 of the Federal Police, with regard to the technical, ethical and methodological procedures of the psychological evaluation.

Study Variables

The data source provided by the organization contained demographic, occupational, and clinical information, as well as data on psychological instrument scores. *Demographic variables* included gender, age, and education. *Occupational variables* included data on position held, type of employment relationship with the organization, and length of police service. *Clinical* variables were characterized by the presence or absence of mental disorder and classification according to the International Statistical Classification of Diseases and Related Health Problems – ICD-10 (World Health Organization, 2003), i.e., the medical diagnosis reported on the health certificate. Psychological variables referred to the scores on cognitive screening instruments related to memory, logical reasoning, and general attention (mean of the scores for concentrated, divided, and alternating attention); and quantitative personality indicators from the Palographic test.

Measures

The psychological variables were measured using tests with established psychometric validity and reliability, all approved by the Brazilian Psychological Test Assessment System at the time of their application. The tests were applied individually, in the presence of the psychologist, following the application standards contained in the test manual. To assess attention, the following tests were used: Psychological Battery for Attention Assessment (Rueda, 2010), Concentrated Attention Test – TEACO – FF (Rueda, 2009), Alternating Attention Test – TEALT (Rueda, 2010), Divided Attention Test – TEADI (Rueda, 2010. To assess memory, the following tests were used: Recognition Memory Test – TEM-R (Rueda et al., 2016), Pictorial Memory Test – TEPIC-M (Rueda & Sisto, 2007). The nonverbal intelligence test – R-1 (Alves, 2012) was used to assess intelligence. The following tests were used to assess personality characteristics: Palographic Test in personality assessment (Alves & Esteves, 2019), and the Pfister test. The results obtained in the Pfister test were not reviewed in the present study.

Data Processing and Analysis

The data were analyzed using statistical procedures. Initially, descriptive statistics were performed to characterize the sample. Subsequently, inferential statistics were performed to examine the validity of the study hypotheses. The normality of all continuous variables in the study was tested using the Kolmogorov-Smirnov and Shapiro-Wilk tests. Among the continuous variables, only general attention presented a normal distribution. Thus, statistical comparisons between general attention and the categorical variables were performed using parametric tests: Student's *t*-test, analysis of variance (One-way ANOVA) and Tukey's post hoc test. Memory and reasoning were assessed using nonparametric tests: Mann-Whitney *U* test and Kruskal-Wallis test, since they did not meet the assumption of normality. Spearman's correlation coefficient was used to assess associations between quantitative variables, with effect sizes interpreted according to Cohen's criteria. Data organization, processing, and review were carried out using Excel and IBM®SPSS® (version 21). A significance level of $p < 0.05$ was adopted for all analyses.

Results

Demographic and Clinical Characteristics

Demographic, occupational and clinical characteristics are presented in Table 1.

Table 1
Participants' demographic, occupational and clinical characteristics (N = 250)

Profile variables/Categories	*n*	%
Gender	46	18.4
Female	204	81.6
Male		
Age range		
24–37	55	22.0
38–51	60	24.0
52–65	105	42.0
66–79	30	12.0
Education		
High school	63	25.0
Higher education	187	75.0
Position		
Civil police officer	198	79.0
Civil police chief	29	12.0
Civil police clerk	21	8.0
Civil police psychologist	2	1.0
Link		
Active	128	51.0
Retired	122	49.0
Length of service (years)		
1–12	83	33.0
13–24	44	18.0
25–36	99	40.0
37–48	24	10.0
Mental disorder		
No	161	64.4
Yes	89	35.6

Among the 250 psychological assessment records reviewed, the predominant demographic profile was as follows: male participants (81.6%), with an average 50 years of age (*SD* = 12.7), and higher education (75.0%). The age range spanned from 24 to 78 years, with the most frequent age group being 52–65 years (42.0%). Most participants (75.0%) had higher education, and the sample was nearly equally divided between active and retired police officers (51.0% and 49.0%, respectively). The majority of participants (40.0%) had between 25 and 36 years of police service, that is, they were close to retirement. The second most frequent age range was situated in the first years of the career, between 1 and 12 years of service (33.0%). The attestation of mental disorder was classified as yes (35.6%) and no (64.4%), considering the clinical condition documentary record.

Table 2 shows the distribution of mental disorders according to length of service, age group and sex.

Table 2
Distribution of mental disorder diagnoses, according to length of service, age group and sex

Variables	Diagnosis of mental disorder				Total (n = 250)	Total (%)
	No		Yes			
	n (161)	%	n (89)	%		
Length of service (years)						
1–12	35	21.7	48	53.9	83	33.2
13–24	21	13.0	23	25.8	44	17.6
25–36	82	50.9	17	19.1	99	39.6
37–48	23	14.2	1	1.1	24	9.6
Age group						
24–37	31	19.2	24	26.9	55	22.0
38–51	10	6.2	50	56.1	60	24.0
52–65	92	57.1	13	14.6	105	42.0
66–79	28	17.3	2	2.2	30	12.0
Gender						
Female	13	8.0	33	37.0	46	18.4
Male	148	91.9	56	62.9	204	81.6

Mental disorders were more frequent among police officers who were at the beginning of their careers, i.e., between 1 and 12 years of service (53.9%). The age group with the highest frequency of mental disorders was 38 to 51 years (56.1%), followed by the age group 24 to 37 (26.9%), with the average age being 43 years. (Table 2)

Cognitive Functions and Age

To test hypothesis 1, correlations between age and the scores obtained on the cognitive function screening instruments were examined (see Table 3). Significant negative correlations were found between age and all cognitive variables tested. Effect sizes were moderate for all of them: age and memory (r = -0.546; p < 0.01), age and reasoning (r = -0.523; p < 0.01), and age and general attention (r = -0.423; p < 0.01).

Additional assessments revealed significant differences in cognitive scores between younger officers (24–51 years old) and older officers (52–79 years old), with younger officers performing better on memory and general attention scores. Within the age subgroups, significant differences

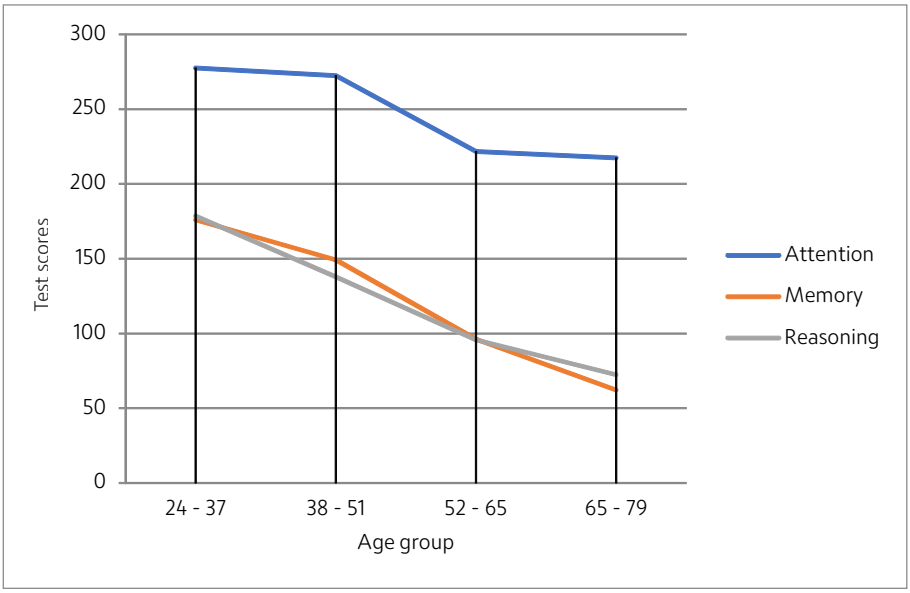
Table 3
Spearman correlation between scores of cognitive screening instruments and age

Variables	Age	Memory	Reasoning	General attention
Age				
r	1.000			
N	250			
Memory				
r	-0.546**	1.000		
N	244	244		
Reasoning				
r	-0.523	0.357**	1.000	
N	243	241	243	
General attention				
r	-0.423**	0.457**	0.362**	1.000
N	249	244	243	246

Note: ** The correlation is significant at the 0.01 level (2 tails).

were found only for reasoning between the 24–37 and 38–51 year groups. The results suggest that cognitive decline varies by age group, which can be seen in detail in Figure 1.

Figure 1
Correlation between age and the results of cognitive measures



These findings confirmed hypothesis 1 of the study: *There is a significant difference in the performance of cognitive tests according to age*. Cognitive functions declined as the age of the police officers increased. This age-related decline in cognitive performance, commonly observed in other populations (Borda et al., 2019; Nascimento et al., 2015; Rodrigues et al., 2008), has significant implications for firearm-related work, emphasizing the need for targeted preventive measures for older officers.

Table 4
Cognitive tracking instruments' score comparison according to levels of education

Variables	High school	Higher education	Statistics
Memory			
Median	79.41	137.18	Z = 5.57**
N	62	182	
Reasoning			
Median	88.46	133.00	Z = 4.26**
N	60	183	
General attention			
Median (*SD*)	214.31 (58.69)	256.78 (60.39)	*t* = -4.8**
N	62	184	

Note: ** Significant at 0.01. Mann-Whitney *U* test compared the memory and reasoning variables. *t*-test for assumed equal variances.

Cognitive test scores were compared based on two education levels: high school and higher education. Due to career policy changes requiring higher education for entry into the police force after 2009, participants with only high school education were older and had longer service or were retired.

As shown in Table 5, significant differences between the two groups for the three cognitive variables. As expected, police officers with high school education obtained lower results in memory, reasoning and general attention, compared to the group of police officers with higher education. These results converge with those found in relation to age, since the police officers belonging to the high school education group are also the oldest.

Table 5
Comparison of cognitive tracking instruments' score, according to the link

Variables	Active	Retired	Statistics
Memory			
Median	156.81	85.86	Z = -7.85**
N	126	182	
Reasoning			
Median	152.23	88.36	
N	60	115	Z = -7.08**
General attention			
Median (*SD*)	270.30 (59.58)	219.80 (54.99)	*t* = -6.9**
N	128	118	

Note: ** Significant at 0.01. Mann-Whitney *U* test compared the memory and reasoning variables. *t*-test for assumed equal variances.

Table 6 compared the scores of the cognitive screening instruments between the types of employment: active and retired.

Table 6
Comparison of cognitive tracking instruments' scores and mental disorders

Variables	Mental disorder		Statistics
	Yes	No	
Memory			
Median	149.14	107.74	Z = -4.39**
N	87	157	
Reasoning			
Median	138.83	112.27	Z = -2.84**
N	89	154	
General attention			
Median (*SD*)	263.53 (61.32)	236.18 (61.38)	*t* = -3.3**
N	89	157	

Note: ** Significant at 0.01. Mann-Whitney U test compared the memory and reasoning variables. *T*-test for assumed equal variances.

Significant differences were found for memory, reasoning, and general attention, with active officers demonstrating superior cognitive performance compared to retired officers.

Cognitive Functions and Mental Disorders

Comparisons between groups with and without mental disorders according to the scores of the cognitive screening instruments are presented in Table 7. Contrary to expectations, officers with a mental disorder diagnosis scored higher in memory, reasoning, and general attention.

Table 7
Comparação dos escores dos instrumentos de rastreio cognitivo e transtorno mental

Variables	Mental Disorders		Statistics
	Yes	Not	
Memory			
Median	149.14	107.74	Z = -4.39**
N	87	157	
Reasoning			
Median	138.83	112.27	Z = -2.84**
N	89	154	
General attention			
Average (*SD*)	263.53 (61.32)	236.18 (61.38)	t = -3.3**
N	89	157	

Note: **Significant at 0.01. Mann-Whitney U test compared the variables memory and reasoning. *T*-test assuming equal variances.

A possible explanation for this result may be associated with the fact that most police officers diagnosed with mental disorders (83.15%) belong to the youngest group in the sample, specifically in the age groups of 24 to 37 years and 38 to 51 years, who are also the most educated. As illustrated in Figure 1, police officers between 24 and 51 years demonstrated significantly better cognitive performance compared to those in the age groups of 52 to 65 years and 66 to 79 years.

The statistical analyses refuted hypothesis 2: *Police officers diagnosed with mental disorder have lower performance in cognitive tests than those who do not present such a diagnosis*. Instead, the findings suggest that in this sample, a mental disorder diagnosis did not negatively impact cognitive functions, diverging from trends reported in the literature.

The results highlight the importance of age, education, and employment status in understanding cognitive performance among police officers. The findings underscore the need for regular cognitive evaluations, particularly for older and retired officers, to address potential implications for firearm-related work.

Discussion

The aim of this study was to identify the association between cognitive functions and the demographic and clinical profiles of police officers undergoing psychological evaluation allowing them to carry and handle firearms. Negative and moderate associations were observed between cognitive functions and age, indicating that cognitive abilities tend to decrease significantly as professionals age. These findings are in line with those of Kaufman and Horn (1996), who, in a study involving 1,500 adults aged 17 to 94, identified that cognitive abilities associated with fluid intelligence decline progressively throughout adulthood, with a more pronounced decrease after age 55. Although several studies corroborate these results, none of them focused specifically on the public safety professionals (Borda et al., 2019; Nascimento et al., 2015; Rodrigues et al., 2008).

Research on police officers' cognitive variables is crucial due to the emerging evidence that links firearm use to cognitive abilities. Studies indicate that decreased cognitive functions are associated with an increased risk of target recognition errors, directly affecting police shooting accuracy in high-risk situations (Biggs et al., 2015; Kleider-Offutt, et al., 2016; Kleider et al., 2010). Reduced working memory negatively affects gun handling performance, with officers with low working memory likely to misfire at unarmed targets and to hesitate when faced with armed targets (Kleider et al., 2010). Conversely, well-developed working memory has been shown to improve

making shooting decisions. Furthermore, impaired cognitive functions can lead to changes in situational awareness, risk perception, and the ability to analyze and interpret stressful situations, leading to adverse consequences in the context of policing and firearm use (Andersen et al., 2018; Laborde et al., 2014).

As police officers age, the need for periodic reassessment of cognitive abilities becomes critical, especially given the risk inherent in carrying and handling firearms in high-stress situations. Balzarotti et al. (2022) reported similar findings in a study on cognitive abilities in elderly drivers, noting declines in selective attention and deductive reasoning during periodic driver's license renewal exams.

This study also revealed superior cognitive performance among police officers with higher levels of education, compared to those with lower levels (higher education vs high school). The positive correlation between education and cognitive performance is well-documented (Brucki et al., 2003; Rodrigues et al., 2008; Opdebeec et al., 2016; Ostrosky-Solis et al., 1998; Wilson et al., 2009). However, it is crucial to consider the age a key factor in this relationship, as older police officers tended to have lower levels of education, while younger officers had higher levels.

Education is often cited as a protective factor against cognitive decline. Studies have found a positive association between higher education levels and a lower incidence of dementia and cognitive impairment (Pettigrew et al., 2020; Stern, 2012; Xu et al., 2016; Zhang et al., 1990). A Brazilian study reinforces this perspective, demonstrating that illiterate elderly individuals were more likely to experience cognitive decline compared to literate ones, suggesting that education may protect against cognitive losses (Nascimento et al., 2015). However, a systematic review and meta-analysis covering 92 studies found no significant link between education and the rate of cognitive decline in elderly individuals from the general population, indicating that changes in cognitive abilities may occur with aging, regardless of educational level (Seblova et al., 2020).

This study revealed unexpected regarding the association between cognitive functions and mental disorders. Contrary to prevailing literature, police officers diagnosed with mental disorders demonstrated higher scores on cognitive screening tests. Previous studies have consistently linked mental disorders to reduced cognitive performance (Dehn & Beblo, 2019; Knight & Baune, 2018; Langarita-Llorente & Gracia-Garcia, 2019; Lima et al., 2018). People with depression generally exhibit poor executive functions, memory, attention and cognitive processing speed, when compared to healthy individuals (Bora et al., 2013; Rock et al., 2014).

However, these findings revealed that police officers with mental disorders achieved higher scores on cognitive screening tests. This finding is supported by research such as that of Bomfim et al. (2021) who found no significant differences in cognitive performance between elderly Brazilians with and without major depression. Furthermore, Leonard and Abramovitch (2019) observed that college students with generalized anxiety disorder showed no impairments in seven cognitive domains, suggesting that compensatory mechanisms may be triggered in cases of clinical anxiety.

In this study, the lack of association between cognitive performance and mental disorders be explained by factors such as age and education, which have been shown to have a significant correlation with cognitive performance. The higher incidence of mental disorders among younger and more educated police officers suggests that these variables may have a more substantial impact on cognitive functions than the presence of mental disorders. In addition, the methodological limitations of this study may have influenced the results. It is possible that younger police officers, despite being diagnosed with mental disorders, have developed compensatory strategies that mitigate the impact of these disorders on cognitive performance. Higher education, in turn, may

provide a more solid foundation for the development of cognitive skills, which could explain the better performance in this group. These hypotheses highlight the complexity of the relationships between mental health, age, education, and cognitive functions, and point to the need for more in-depth studies that take into account these variables in an integrated manner.

Limitations: This study has limitations that should be considered when interpreting the study outcome. Psychological assessments were performed after the period of absence for treatment, which may have coincided with the remission of psychological symptoms and the recovery of social and occupational functioning. This implies that the police officers could have been in a more stable mental state at the end of the absence period than at the beginning, which potentially influences the results related to mental disorder, both in relation to the cognitive functions and the personality indicators.

Furthermore, Additionally, mental disorder diagnoses were based on records from police officers actively employed, excluding retired officers without organizational ties, which limits the generalizability of findings.

Implications: This study has important implications for public safety professionals and security organizations, whether public or private. The findings highlight the need for periodic psychological assessments of cognitive abilities and mental health. Continuous monitoring by psychologists and medical professionals is essential to promote mental health and prevent risks throughout a police career. Institutional strategies, such as limiting high-risk activities for older officers and suspending firearm use during periods of mental illness, could reduce accidents and adverse outcomes.

Finally, this study underscores the need for specific retirement criteria for public safety professionals. Aging and accumulated stress may impair the ability of security forces to meet the demands of their roles, suggesting a need for retirement policies tailored to the unique challenges of the profession. Furthermore, the scarcity of Brazilian research on the psychological aspects of firearm use highlights a critical gap, emphasizing the need for studies examining these variables within the country's social and political context.

Conclusion

This study revealed significant cognitive decline associated with aging in police officers, underscoring the increased risk posed by older individuals handling firearms. It also highlighted the importance of frequent reassessment of cognitive abilities. While mental disorders can impact cognitive performance, this effect may not be universal, as factors such as age and education may mitigate these impairments. These findings are critical and can enhance clinical reasoning in psychological assessments related to firearm authorization.

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