Work Context and Screening Process in Brazilian Civil Aviation

Contexto de Trabalho e Processo de Inspeção na Aviação Civil Brasileira

Contexto de Trabajo y Proceso de Inspección en la Aviación Civil Brasileña

Empirical Research Reports

Michelle Salgado Ferreira Arcúrio[1]
https://orcid.org/0000-0003-4858-3180
E-mail: michelle.arcurio@gmail.com

Mário César Ferreira[1]
https://orcid.org/0000-0002-4962-5154
E-mail: ferreiramariocesar@gmail.com

[1] University of Brasilia, Brasilia, DF, Brazil

Editor in charge:
João Viseu

Como citar:
Arcúrio, M. S. F., & Ferreira, M. C. (2025). Work Context and Screening Process in Brazilian Civil Aviation. *Revista Psicologia: Organizações e Trabalho, 25*, e25489. https://doi.org/10.5935/rpot/2025.25489

Abstract: The work of Brazilian civil aviation protection agents (APACs) involves complex technical requirements that are crucial to airport security and have an impact on well-being. This study assessed the work context of APACs at screening checkpoints in Brazilian airports using the Work Context Assessment Scale (WCAES) from the Inventory of Work and Risk of Illness (IWRI). The sample included 475 APACs from eleven airports, covering 71% of Brazil's scheduled aviation passenger traffic. Analyses showed that 59.4% of participants are female, 64.4% completed high school, and 71.2% work 6 to 8 hours daily. APACs rated work organization negatively/seriously, while other WCAES dimensions were moderate/critical. Analysis of variance revealed differences in perception based on sociodemographic variables. The use of EACT introduces theoretical contributions from activity ergonomics and work psychodynamics to the work context in airport screening processes.
Keywords: airports, ergonomics, task performance and analysis.

Resumo: O trabalho dos Agentes de Proteção da Aviação Civil (APACs) envolve requisitos técnicos complexos, cruciais para a segurança aeroportuária, impactando o bem-estar. Este estudo avaliou o Contexto de Trabalho dos APACs em canais de inspeção de aeroportos, utilizando a Escala de Avaliação do Contexto de Trabalho (EACT) do Inventário de Trabalho e Risco de Doença (ITRD). A amostra incluiu 475 APACs de onze aeroportos, cobrindo 71% do tráfego de passageiros da aviação regular do Brasil. As análises mostraram que 59,4% dos participantes são mulheres, 64,4% completaram o ensino médio, e 71,2% trabalham de 6 a 8 horas diárias. Os APACs avaliaram a organização do trabalho de forma negativa/séria, enquanto outras dimensões da EACT foram moderadas/críticas. A ANOVA revelou diferenças de percepção com base em variáveis sociodemográficas. O uso da EACT introduz contribuições teóricas da Ergonomia da Atividade e da Psicodinâmica do Trabalho ao contexto de trabalho em inspeção aeroportuária.
Palavras-chave: aeroportos, ergonomia, análise e desempenho de tarefas.

Resumen: El trabajo de los Agentes de Protección de la Aviación Civil (APAC) implica complejos requisitos técnicos cruciales para la seguridad aeroportuaria impactando el bienestar. Este estudio evaluó el Contexto de Trabajo de los APACs en los puestos de control de los aeropuertos brasileños, utilizando la Escala de Evaluación del Contexto de Trabajo (EECT) del Inventario de Trabajo y Riesgo de Enfermedad (ITRE). La muestra incluyó 475 APACs de once aeropuertos, que cubren el 71% del tráfico regular de pasajeros de aviación de Brasil. Los análisis mostraron que el 59,4% de los participantes son mujeres, el 64,4% terminaron la enseñanza secundaria y el 71,2% trabajan entre 6 y 8 horas diarias. Los APAC evaluaron la organización del trabajo de forma negativa/seria, mientras que otras dimensiones del EECT eran moderadas/críticas. El ANOVA reveló diferencias de percepción en función de las variables sociodemográficas. El uso del EECT introduce contribuciones teóricas de la Ergonomía de la Actividad y de la Psicodinámica al contexto laboral en la inspección aeroportuaria.
Palabras clave: aeropuertos, ergonomía, análisis y desempeño de tareas.

Introduction

The effectiveness of each State's security systems is crucial for maintaining a safe and unified environment. Despite continuous improvements, civil aviation remains vulnerable to sabotage, posing risks of significant loss of life, social and economic upheaval, and disruption of global connectivity.

Preventive and responsive measures aim to protect against intentional acts and create barriers against potential threats. The smooth operation of air transport relies on the seamless flow of passengers, where punctuality is paramount (Tuchen et al., 2020). This process heavily depends on the diligent work of Civil Aviation Protection Agents (APACs) at screening checkpoints, making effective operation challenging.

Real work situation of AVSEC professionals and the critical nature of daily screening checkpoint operations were described by Arcúrio et al. (2016). This aligns with literature highlighting the complexity (Lee et al., 2009; Mclay et al., 2006; Mclay et al., 2007; Mery et al., 2013; Riffo et al., 2017) and strategic importance of screening in preventing attacks against civil aviation (Song & Zhuang, 2017).

Airports, as socio-technical environments, are marked by regulatory rigidity and work overload, affecting all users, not just passengers (Tuchen et al., 2020). Incorrect security planning and non-ergonomic terminal designs can impact the performance of Brazilian APACs. Ergonomics is a scientific discipline that can significantly enhance the reliability of security systems by focusing on efficiency, effectiveness, and the well-being of workers and users of civil aviation services. Aircraft accident records revealed that factors beyond pilot error contribute to accidents, Martins (2006).

Ergonomics has provided valuable input for reconceptualizing training and communication design, improving fire protection systems, and reviewing error classification and homologation criteria for basic training aircraft.

Campos (2011) emphasizes issues such as inadequate task planning, flawed administrative management, incomplete training of mechanics, and ineffective maintenance operations. Ergonomics and safety in aircraft maintenance environments directly influence flight safety (Lima et al., 2015). Unfavorable working conditions reduce the reliability of aircraft systems, and participatory diagnostic methods can quickly identify ergonomic risks and guide actions to mitigate them.

Scientific literature has primarily focused on pilots and flight safety, leaving a gap in research on security operations at civil aviation airports, particularly concerning APACs in Brazil. Additionally, studies using the theoretical-methodological framework of Activity Ergonomics are notably lacking (Ferreira, 2017; Montmollin, 1990).

The limited studies available underscore the necessity for additional research to develop rigorous scientific insights (Arcúrio et al., 2018; Arcúrio et al., 2020; Arcúrio & Arruda, 2022). This is crucial for advancing security measures and improving the efficiency, effectiveness, and well-being of APACs. The research framework employed in this article is based on the Ergonomics of Activity Applied to Quality of Life at Work (EAA-QLW) approach, which is used in Brazil (Camargo et al., 2021; Ferreira, 2017; Vilarinho et al., 2021).

Three interrelated concepts are used to interpret and analyze empirical data on the work of APACs (Ferreira, 2017):Working Conditions and Organizational Support: these encompass physical, material, and symbolic elements in the work environment that facilitate operators' activities. This includes architectural features (floor, walls, ceiling), physical environment (workspace, lighting, temperature), tools and equipment (machines, instruments), information resources (raw materials), and organizational resources (supplies, technologies). Work Organization: This concept outlines management principles that shape the work environment and guide activities. It incorporates elements such as division of labor (hierarchical, technical), organizational mission and objectives (quality, quantity), prescribed work (tasks, procedures), working time (shifts, breaks), work processes (cycles, stages), and work management (controls). Socio-professional Relationships: these encompass interpersonal and communicational interactions in the work environment. Elements include hierarchical relationships (supervisors, senior managers), relationships with peers (co-workers, team members), and external relationships (citizens, users of services, clients). Methodologically, this research employed the Work Context Assessment Scale (WCAES) to operationalize key concepts and understand protection agents' perceptions of their work environment (Ferreira et al., 2013). The work environment, being socio-technical, encompasses material, organizational, and social aspects where work activity occurs, alongside individual and collective mediation strategies (ICMEs) used by workers to interact with their work reality (Ferreira & Mendes, 2003).

This context shapes social, technical, and instrumental relationships necessary within a corporate setting, imposing physical, cognitive, and emotional demands on workers that can impact health and safety or promote quality of life at work. Applying ergonomic principles in Aviation Security (AVSEC), particularly at screening checkpoints, is critical for enhancing the quality of life for AVSEC professionals. The study aimed to investigate the perceptions of APACs (airport security workers) at Brazilian airport screening checkpoints regarding their work context. The goal was to identify critical variables that jeopardize both organizational objectives and the health and safety of the workers, as

well the well-being of service users.

Method

Participants

The study population comprised 974 APACs working at screening checkpoints in eleven airports across Brazil These airports represent 71% of the total passenger traffic in Brazilian scheduled aviation between January and September 2022 (Agência Nacional de Aviação Civil [ANAC], 2022). The specific airport names are restricted to comply with the need-to-know principle (International Civil Aviation Organization [ICAO], 2022) and to protect aviation security information and ethical principles of academic research in the human sciences. To ensure reliability, a stratified proportional sampling technique was employed due to the limited number of airports involved. APACs from eleven airports were selected proportionally based on each airport's total number of APACs. The sample consisted of 475 APAC, which ensures a 96% confidence level, with a 4% margin of error, and assumed a maximum proportion of 0.5 due to the lack of previous benchmarks for this research topic.

Instruments

The studies employed a socio-professional questionnaire including demographic variables (gender, age, education) and occupational details (primary position at the screening checkpoint, total daily workload including other paid activities, years of service in AVSEC, years of service at the screening checkpoint, and daily work schedule at the screening checkpoint). The Work Context Assessment Scale (WCAES), developed by Ferreira & Mendes (2003), was utilized. Responses were recorded on a five-point Likert scale ranging from "1" (never occurs) to "5" (always occurs), with negative items reverse-scored. Factor scores were derived by averaging the items within each factor.

The WCAES consists of 31 items divided into three factors: Working Conditions (WC, 10 items) which assesses variables related to the workstation; the organizational infrastructure, the physical environment, the equipment available to carry out the work, the technological apparatus, among other structural aspects; Work Organization (WO, 11 items), which assesses the division of labor, institutional rules, time structure, working hours, forms of control, discipline and productivity; Socio-professional Relationships (SR, 10 items), which express intra- and inter-group interactional characteristics between different hierarchical levels and with users and; (Ferreira & Mendes, 2003). In the original psychometric validation study, the factors of this scale showed good internal consistency with Cronbach's alphas above 0.75 (Ferreira & Mendes, 2003).

The following parameters were used to analyze the results obtained when applying the WCAES: above 3.70, the evaluation was considered negative/serious (it increases the risk of accidents at work and the professional becoming ill); between 2.30 and 3.69, a moderate/critical evaluation (it moderately explains the risk of accidents at work and the professional becoming ill) and; an evaluation with a score equal to or below 2.29, positive/satisfactory (it shows indicators of the professional's health/well-being) (Ferreira & Mendes, 2008). The research respected the ethical aspects established in Resolution nº. 510/2016 on Ethics in Research in the Humanities and Social Sciences.

Data Collection Procedures and Ethical Considerations

The socio-professional questionnaire and the Work Context Assessment Scale (WCAES) were hosted on the LimeySurvey digital platform to guarantee the adherence of the target audience and the reliability, confidentiality and security of the data resulting from the survey. From an ethical standpoint, the research was carried out respecting all the aspects contained in Items V and VII of Article 1, Sole Paragraph, of Resolution No. 510/2016 (Brasil, 2016)., which exempts submission to the Research Ethics Committees of the National Research Ethics Committee [CEP-Conep], applicable when the research: does not identify the participants; establishes databases with aggregated information; is aimed at studying situations that emerge from real and authentic scenarios in professional practice. Measures were taken to ensure the confidentiality of the information provided to respondents, including the use of a consent and assent register, in which participants' free and informed consent was explained, in accordance with Article 17 of Resolution No. 510/2016 (Brasil, 2016). The authors are fully responsible for the data generated in this research.

The database containing aggregated information is based on airports selected in proportion to the total number of APACs at each airport, according to ANAC's database. The data, collected through the socio-professional questionnaire and the Work Context Assessment Scale (WCAES), hosted on LimeSurvey, was provided by APACs working at the selected airports. Local AVSEC managers at each airport distributed a survey link to APACs working at screening checkpoints from September to December 2022. The survey included explanations about the research nature and ethical principles (voluntary participation, anonymity, confidentiality, and the option to withdraw without consequences). Respondents then accessed the Work Context Assessment Scale (WCAES) questions.

Data Analysis Procedures

The study utilized STATA (version 15.1) for Windows to analyze data in two stages. Initially, descriptive statistics were applied to socio-professional data and scales. T-tests and ANOVA were conducted to examine relationships between scale items, factors, and socio-professional variables. The Tukey test was employed for post-hoc analysis of variance (ANOVA) to identify statistically significant differences between group means (Gurvich & Naumova, 2021).

In the second stage, Factor Analysis was used to analyze scale results, revealing that two items did not load onto a single factor but onto at least two factors, prompting their removal from further analysis. Work Context Assessment Scale: The pace of work is fast: 39.5% always. There is a division between those who plan and those who execute: 31.9% always. Despite their removal, these items were depicted to maintain informational integrity, offering a comprehensive perspective. They likely span multiple factors due to their frequent use in workers' activities. In the analytical dimension of the work context, the feasibility of analysis was ensured by excluding these two mentioned items. The tests to verify the assumptions were as follows: Cronbach's alpha: high reliability of the research instrument with 0.9485 for "Evaluation in the Work Context"; Bartlett's test of sphericity: the variables are correlated with each other, with $p<0.01$; Kaiser-Meyer-Olkin (KMO) statistic: 0.960 for "Evaluation in the Work Context"; Communality: most of the variables scored less than 0.5.

Results

Based on the treatment outlined, the following results were obtained.

Socio-professional profile

The socio-professional results of the participants are shown in Table 1.

Table 1. *Socio-professional Characteristics of the Participants (*n *= 475)*

Gender	F	%	Total daily workload. including other paid activities (hours)	**F**	**%**
Male	192	40.4%	6 to 8	337	71.2%
Female	282	59.4%	8 to 11	108	22.8%
Other	1	0.2%	More than 11	28	5.9%
Age (years old)			Length of service at AVSEC		
Less than 20	3	0.6%	No experience	1	0.2%
20 to 24	55	11.6%	Less than 1 month	12	2.5%
25 to 29	69	14.5%	1 to less than 6 months	36	7.6%
30 to 39	145	30.5%	6 to less than 12 months	47	9.9%
40 to 49	143	30.1%	1 to less than 3 years	73	15.4%
50 to 59	52	10.9%	3 to less than 5 years	77	16.2%
more than 60	8	1.7%	5 to less than 7 years	42	8.8%
			7 to less than 10 years	64	13.5%
			10 years or more	123	25.9%
Education level			Length of Service at the Screening Checkpoint		
High School	306	64.4%	No experience	1	0.2%
Incomplete University Graduation	95	20.0%	Less than 1 month	11	2.3%
Graduated	71	14.9%	1 to less than 6 months	39	8.2%
Postgraduate (*lato sensu*)	3	0.6%	6 to less than 12 months	52	10.9%
Master's, Doctorate degree (*stricto sensu*)	0	0.0%	1 to less than 3 years	84	17.7%
			3 to less than 5 years	74	15.6%
			5 to less than 7 years	53	11.2%
			7 to less than 10 years	59	12.4%
			10 years or more	102	21.5%
Predominant Position Held			Daily Work Schedule in the Screening Checkpoint (hour shifts)		
X-ray equipment.	64	13.5%	4	35	7.4%
Passenger flow control.	36	7.6%	6	223	46.9%

Screening with a manual metal detector.	4	0.8%	8	206	43.4%
Equally distributed in the previous functions.	304	64.3%	Others	11	2.3%
AVSEC supervisor - screening checkpoint.	65	13.7%			

In general, the socio-professional characteristics of the participants are not homogeneous. Of the respondents, 59.4% said they were female; 64.4% had completed high school, the minimum requirement for taking part in AVSEC courses. In terms of age distribution, 30.5% were aged between 30 and 39.

The survey revealed that the majority (71.2%) of professionals working at Brazilian airport screening checkpoints have daily working hours ranging from 6 to 8 hours. Specifically, 46.9% of respondents work a 6-hour daily schedule, while 43.4% work an 8-hour daily schedule. This data highlights a significant organizational characteristic of work in Brazilian airport screening checkpoints, where the predominant daily work hours fall within the 6 to 8-hour range.

The results also help to dispel the notion that most APACs work other jobs to supplement their income, since only 5.9% of the participants said they worked more than 11 hours a day. Among all respondents, 64.3% perform AVSEC functions equally. The role of supervisor is predominantly held by 13.7% of respondents. Specifically operating x-ray equipment are only 13.5% of the APACs.

Work Context Assessment

Table 2 shows the analyses resulting from the descriptive statistics of the scale and its respective factors.

Table 2. *Averages, Coefficient of Variation and WCAES Standard Deviations and its Factors*

Scales and Factors	Average	Standard Deviation	Coefficient of variation	Situation Judgment
Work Context (EACT)				
Work Organization	3,72	0,68	0,18	Negative/Severe
Work conditions	2,72	1,00	0,37	Moderate/Critical
Socio-professional Relationships	2,88	1,01	0,35	Moderate/Critical

According to the survey responses from APACs, the factor of work organization (*M* = 3.72; *SD* = 0.68) was perceived as negative or serious in the work context (WCAES). The coefficient of variation (CV = 0.18, indicating an average level) supports this perception. The operational pace, management style at airports, and professional interactions impose a notable cognitive and emotional burden on APACs during their duties. Working conditions (WC) (*M* = 2.72; *SD* = 1.00) and socio-professional relations (SR) (*M* = 2.88; *SD* = 1.01) were in the moderate/critical assessment range. In TC, the most critical item was noise in the work environment. Of the items that make up the SRs, those with the most representative negative evaluation were "Employees are excluded from decisions and there are professional disputes in the workplace".

Table 3. *Average, Standard Deviation of Evaluation Factors by Gender*

	Female		Male	
Scales and Factors	Average	Standard Deviation	Average	Standard Deviation
Work Context (EACT)				
Work Organization	3.73	0.72	3.71	0.62
Work conditions	2.71	1.02	2.74	0.99
Socio-professional Labor Relations	2.91	1.03	2.82	1.00
Scales and Factors	*t*-Test	Degree of Freedom		*p*-Value
Work Context (EACT)				
Work Organization	0.24	472		0.81
Work conditions	-0.43	472		0.67
Socio-professional Relationships	0.94	472		0.35

When evaluating the mean for work organization, for both females (*M* = 3.73; *SD* = 0.72) and males (*M* = 3.71; *SD* = 0.62), the results point to evaluations tending towards negative/serious in both groups. No significant differences were found between the means for gender in the other factors, as shown in Table 3.

In terms of age, it was possible to identify significant differences when comparing the under-40 and 40+ age groups in all the WCAES factors, except for Socio-professional Relationships

(*t*(Student) = -1.91; *gl* = 472; *p* = 0.06). As Table 4 shows, the WCAES factors relating to work organization and working conditions proved to be more costly in the under-40 age group and were rated as negative/serious.

Table 4. *Differences in Assessment Factors by Age*

Age	40 years or more		Less than 40 years	
Scales and Factors	Average	Standard Deviation	Average	Standard Deviation
Work Context (EACT)				
Work Organization	3,62	0,49	3,80	0,40
Work conditions	2,60	0,67	2,82	0,62
Socio-professional Relationships	2,77	0,72	2,95	0,61
Scales and Factors	*t*-Test	Degree of Freedom	*p*-Value	
Work Context (EACT)				
Work Organization	-2,68	472	0,00	
Work conditions	-2,34	472	0,02	
Socio-professional Relationships	-1,91	472	0,06	

When analyzing the work organization (WO) factor by age, findings indicate a notable difference in perception. Participants aged 40 or older rated this factor moderately/critically (M=3.62; SD=0.49), contrasting with those under 40 who rated it negatively/seriously (M=3.80; SD=0.40). This suggests that older workers emphasize task division, content, standards, controls, and work pace more than their younger counterparts in response to task demands. A possible explanation for the negative or critical assessment of work organization is the overlapping of tasks combined with the frequent modifications in work instructions required to comply with regulatory updates.

In the comparison between the groups (Tukey), Table 5, there was no significant difference in relation to the socio-professional relationships factor - WCAES, so age is not a determining factor in this regard.

Table 5. *Differences in Assessment Factors by Age*

Scales and Factors	*F* (ANOVA)	*p*-Value	Difference between Categories? (Tukey test, 0.05)
Work Context (EACT)			
Work Organization	2.85	0.0233	From 30 to 39 years old showed a significant difference in relation to 40 to 49 years old
Work conditions	2.42	0.0477	From 30 to 39 years old showed a significant difference in relation to 40 to 49 years old
Socio-professional Relationships	1.13	0.3437	(*There was no significant difference)

With regard to length of service in AVSEC, the analytical dimension of the WCAES shows significant differences in the up to 1 year category (*M* = 3.59) compared to the age group of 1 to less than 5 years (*M* = 3.83) for the work organization factor (ANOVA: *F* = 3.13; *p* = 0.0255), so it is necessary to highlight the negative/serious judgment for this factor in the time series of 1 to less than 5 years and 5 to less than 10 years, as shown in Table 6.

Table 6. *Differences in Assessment Factors by Length of Service in AVSEC*

Scales and Factors	*F* (ANOVA)	*p*-Value
Work Context (EACT)		
Work Organization	3.13	0.0255
Work conditions	3.49	0.0157
Socio-professional Relationships	3.98	0.0080

In terms of socio-professional relations (ANOVA: *F* = 3.98; *p* = 0.008), time in service of up to 1 year (*M* = 2.63) has the lowest average age categories. This result may indicate that adaptation to the profession in terms of the subject matter in its early stages requires less of the APACs. Over time, as experience and social relationships develop, the significance of this condition increases. Key items in this factor, such as "The information needed for my tasks is always accessible" and "Tasks are clearly defined," made notable contributions. Air transport's standardized approach to operational issues aligns with these findings, highlighting that security protocol information is accessible and clear to APACs is inherent to the airport screening process.

In terms of working conditions, results show significant differences when comparing groups: those with less than 1 year of experience exhibit less critical representativeness compared to those with 1 to less than 5 years and 5 to less than 10 years of experience.

This indication stems from the judgment of the effects on work due to the precariousness of equipment, material conditions or work tools assessed as insufficient to perform the tasks and which increase with work experience (up to 1 year, *M* = 2.43; from 1 year to less than 5 years, *M* = 2.79

and from 5 years to less than 10 years, *M* = 2.85). The items that most influenced this factor are: *There is noise in the work environment, The equipment needed to carry out the tasks is precarious and The physical space to carry out the work is inadequate.*

The comparative analysis of averages indicates that professionals with longer tenure hold a more critical perspective on this factor. The limitations on staff perceptions are closely associated with the prevailing security culture within the organization. (Skorupski & Uchroński, 2018). This suggests they possess a stronger AVSEC culture and heightened situational awareness regarding screening process risks, potentially due to greater experience and awareness of job insecurities, compared to less experienced peers.

Table 7 shows that, in terms of work organization (ANOVA: *F* = 2.77; *p* = 0.0412; *M*= 3.83), items such as The demand for results is present; The rules for carrying out tasks are strict and There is monitoring of performance negatively influenced the evaluation of APACs who declared that they had between 1 and less than 5 years' service in the screening checkpoint.

Table 7. *Differences in Evaluation Factors by Length of Service in the Screening Checkpoint*

Scales and Factors	*F* (ANOVA)	*p*-Value
Work Context (EACT)		
Work Organization	2.77	0.0412
Work conditions	3.62	0.0131
Socio-professional Relationships	2.79	0.0404

APACs are crucial for ensuring the operational security and efficiency of the airline industry. However, within the highly regulated system of civil aviation, there is a strong emphasis on standardization and performance monitoring. This raises questions about how these requirements are implemented and managed. In the working conditions factor (ANOVA: *F* = 3.62; *p* = 0.0131; *M* =2 .44) there is less impact for APACs with up to 1 years' service, which shows that APACs with less time in service judge the organization positively in this factor. In terms of socio-professional relations, the items "Employees are excluded from decisions" and "Communication between employees is unsatisfactory" were rated moderately/critically for the length of service from 1 year to less than 5 years (ANOVA: *F* = 2.79; *p* = 0.0404; *M* = 3.02), which may be indicative of damage to the collective aspect of work.

The Tukey test comparison revealed that participants with over 1 year of service in the screening checkpoint showed fewer positive assessments across all three WCAES factors. This analysis suggests that longer service in the screening checkpoint correlates with a heightened critical perception of the work context.

According to the results in Table 8, the level of education is not a determining variable between the groups (i) complete higher education and postgraduate studies, (ii) incomplete higher education and (iii) secondary education in terms of the WCAES factors.

Table 8. *Differences in Assessment Factors by Level of Education*

Scales and Factors	*F* (ANOVA)	*p*-Value
Work Context (EACT)		
Work Organization	1,6	0,2034
Work conditions	2,5	0,0794
Socio-professional Relationships	2,3	0,1016

Discussion

AVSEC professionals operate in high-pressure environments that require technical precision and rapid execution during the screening of passengers' belongings. The demand for expedited processing may compromise the effective detection of prohibited items (Skorupski & Uchroński, 2018). Arcúrio et al. (2018) highlight how time constraints increase the risk of human error during security screening procedures. It also underscores the complexity and demands of the roles performed by APACs at Brazilian airport screening checkpoints.

Two factors of the WCAES scale were rated between moderate and critical, with work organization being evaluated as negative to serious, highlighting the need for ergonomic improvements. Arcúrio et al. (2018) stressed fostering a non-punitive culture to encourage reporting and identify how human capacity can enhance technology design and information processing (Wickens et al., 2013).

Responses to the WCAES scale highlight concerns related to high performance demands, constant monitoring, and rigid work rules. While such standards are intended to ensure procedural safety, they often reduce operational flexibility and may increase human costs, including the risk of illness and workplace accident risks. In aviation security, strict adherence to rules is commonly assumed to mitigate risks, fostering an environment similar to mass production, where human behavior is tightly regulated. However, this assumption has been challenged by Kirschenbaum (2015)

challenges this assumption who argues that rules are only effective when they accurately reflect the problem at hand and have a proven track record of success.

According to Reason (2009), such rules gain credibility and are more likely to be followed-even in varying contexts-when they demonstrate consistent efficacy.

Accidents may occur when a rules are applied in situations where it only partially suitable. Professionals often rely on well-established rules, even when contextual conditions do not fully correspond. Several factors influence decision-making in these environments, including technical competencies, the characteristics of passenger luggage, and the pressures imposed by work schedules. Although performance monitoring is essential for ensuring compliance and security, certain managerial practices may lead to more critical perceptions among employees. Moreover, the work process is shaped by a range of intense variables, including socio-environmental stressors such as temperature, noise, lighting, and constant surveillance (Dismukes, 2009; Kirschenbaum, 2015).

Abrahão et al. (2009) state that real work results from a compromise between production objectives, its characteristics, and social recognition, affecting both productivity and health outcomes. Over time, due to the cumulative effects of daily operations, demanding environments and real-world working conditions, a gradual deviation in performance from the prescribed standards and reference procedures may occur. This phenomenon, known as *practice drift*, reflects the divergence between prescribed work and actual work as it unfolds in practice (International Civil Aviation Organization [ICAO], 2018).

In aviation, the concept of "real-world working" refers to the real tasks performed by professionals, often diverging from prescribed procedures. This notion helps explain deviations from expected system performance, particularly in response to unforeseen operational situations. Professionals' situational awareness may overlook the potential for serious consequences from occasional failures, leading to non-compliance with rules and safety risks in daily operations (Zhao et al., 2016). To mitigate these issues, Kirschenbaum (2015) proposes designing technology to minimize human intervention in air transport operations and simplify decision-making complexity. This approach aims to reduce cognitive effort, streamline equipment usage, and alleviate time pressure and stress associated with human judgment in decision-making.

Workplace stress arises from the disparity between professional demands and a worker's coping abilities, potentially leading to burnout and negatively impacting mental health (Izdebski et al, 2023). The performance of the activity is also subject to continuous monitoring, given the central role that APACs play in the screening checkpoint, as they make decisions in favor of safety (Blok et al., 2018) and represent one of the layers of pre-shipment safety (Stewart & Mueller, 2018).

In Brazil, the airport screening process adheres to national and international standards established by the ICAO, reflecting the mandatory normative rigidity enforced by the state. According to Reason (2009),human cognition creates mental models of tasks by associating rules with specific work situations. An analysis of the work organization (WO) factor revealed that participants under the age of 40 rated this aspect as significantly more severe compared to those over 40. This age-related difference is noteworthy, as the WO factor influences both the standards and expected outcomes in the work of AVSEC professionals (APACs), potentially impacting career continuity in the field and the efficiency of screening procedures (Arcúrio et al., 2017).

On the (WO) factor, Dismukes (2009) states that learning leads to the automation of behavior. Schemas and mental models are developed because of training and experience in a given environment. A novice may only have a vague idea of the important components of the system or have assimilated incomplete rules for determining the behavior they should employ in a situation.

The ANOVA analysis (and later the Tukey test) of the work organization (WO) factor and length of service in AVSEC revealed that this factor falls short of what it should be or the expectations of the APACs, where the longer the length of service, the greater the perception of severity in this factor. This corroborates research results (Arcúrio et al., 2017) showing that the experience acquired over time in the workplace reveals well-structured representations that are fundamental to the way workers think and act.

The moderate to critical evaluation of Organizational Task (OT) by APACs new to AVSEC (up to 1 year) suggests that despite the importance of early career expectations, the work situation may not align with their initial expectations. This finding corroborates studies carried out by Arcúrio et al. (2017), where a higher percentage of older APAC age groups disagreed with the statement "the work you do is temporary for me": 60.7% for ages 50-59 and 65% for ages 40-49. This situation could potentially exacerbate long-term suffering for APACs if strategies to mitigate risks of illness and workplace accidents are not implemented. The analysis revealed that the work organization factor negatively impacted APACs with 1 to less than 5 years of experience in the screening checkpoint, showing a lower critical perception among those with less experience. There was no significant difference observed in the Organizational Task (OT) factor based on experience in AVSEC or the screening checkpoint, indicating its criticality across all cases.

Key factors influencing job tenure and performance, such as skill development opportunities, constructive feedback, recognition, and career advancement, Harris (2002). ANOVA results indicate that older AVSEC professionals tend to be more critical in their evaluations than younger

counterparts, suggesting that an effective AVSEC culture may develop with experience over time (Arcúrio et al., 2020). Older professionals may analyze new work environments and relationships more critically. In high-pressure or critical situations, this can trigger to what Doerner (1987, as cited in Reason, 2009) describes as an "intellectual emergency reaction" - a cognitive response characterized by reduced intellectual engagement and an increase in reflexive, automatic behaviors. Such reactions can impairself-reflection and strategic planning ultimately resulting in the repetition of routineactions over time.

In this model, the absence of deliberate action planning can give rise to what Reason (2009) refers to as "new pathologies." Under pressure, professionals may assume greater risks, oversimplifying complex situations, and attribute issues to a single cause -an approach that creates the illusion of thorough analysisConsidering the critical role of civil aviation security and the discretionary nature of the decisions made by APACs, it is essential to implement workplace quality-of-life policies aimed at mitigating the risks associated with decision-making in high-stakes environments.

Studies have shown that top performers, when faced with failure, look for ways to disprove their initially established hypotheses, as mentioned by Reason (2009). On the other hand, underperformers continue to search incessantly for justification and evidence to justify their actions. Experienced AVSEC professionals showed greater criticality in the analysis of the working conditions factor, suggesting they possess more expert resources to solve problems compared to novices. This heightened experience contributes to their more critical perception of this factor.

Each time an AVSEC professional leaves the organization, the process of cultivating a robust security culture is disrupted, regardless of whether their replacement is a novice or experienced professional. This turnover initiates a new cycle of reflection and decision-making within the team. The primary distinction between experienced and novice professionals lies is their depth of knowledge and familiarity with situations (Reason, 2009). Comparative data on length of service suggest that APACs with less than one year of experience, report lower cumulative stress levels, which may lead to a lesser perceived impact on working conditions.

Workload can be analyzed from cognitive, physical, and affective perspectives, encompassing aspects such as information processing, decision-making, posture, pace regulation, and emotional resilience (Abrahão et al., 2009). A detailed assessment of tasks, supported by structured and methodical approaches, is crucial to preventing failures and ensuring quality. Although an increased workload may initially accelerate work pace, it can subsequently lead to performance degradation and deviations from established procedures as professionals adapt to sustained demands. Experienced APACs tend to evaluate working conditions as inadequate or critical, with high noise levels identified as a major contributing factor that negatively influences their overall perception of the work environment.

The 4N model categorizes levels of risk maturity (novice, naive, natural, normalized), accent that without sufficient organizational effort, regression from a natural to a naive state can occur relatively easily (Hopkin, 2012). Achieving natural risk maturity involves automating competent behaviors and ensuring their consistency.

The International Civil Aviation Organization [ICAO] (1998) defines noise as any unwanted sound unrelated to the task being performed, which may impair communication, reduce work performance, and pose risks to health. Physiological and perceptual factors, such as lighting quality, ambient noise, and temperature, significantly influence occupational safety, comfort, and professional performance (Abrahão et al., 2009).Workplace noise impacts AVSEC professionals by impairing auditory perception and increasing stress levels, primarily due to to difficulties in verbal communication. Assessing noise levels is essential to understanding its effects on performance and well-being., At the same time, certain auditory signals-such as alerts from metal detector are crucial for reinforcing security and expediting passenger screening. The screening checkpoint environment must ensure the audibility of security alerts, minimize excessive noise, maintain clear communication, and protect workers' hearing health. Given the high-stakes nature of aviation security, the screening process is subject to intense supervision and control, employing technologies such as closed-circuit television and metal detector gantries to enhance security measures.

Final considerations

The study reveals a challenging work context, with no factor receiving a positive or satisfactory rating. The Work Context Assessment Scale (WCAES) shows moderate to critical ratings for all factors, except work organization, which was assessed as negative/serious. Addressing this issue should be a priority for emergencies and preventive action. Participants under 40 also rated work organization as negative/serious, highlighting the demanding nature of their work, characterized by the effort required to comply with regulations, time pressures, and rigorous screening processes. Both men and women similarly perceive the organization of work as negative/serious. However, the negative/serious evaluation of these factors in the work context warrants further investigation and discussion regarding the profound implications of such perceptions. Empirical studies and in-depth analysis of the workplace itself are necessary to fully understand these issues.

It is worth noting that it is not advisable to soften, naturalize or ignore the evaluative condition of the work context in the screening checkpoint. That is why it is imperative to propose practical, assertive, and focused interventions for each factor that makes up the WCAES, with emphasis on: *The demand for results is present; The rules for carrying out tasks are rigid; There is performance monitoring; Tasks are carried out with time pressure.*

The weakening of the work collective because of overload and overlapping tasks can have repercussions in the form of feelings of helplessness, difficulty in seeking help from peers, weakening of trust and bonds, individualism, isolation, and lack of recognition from the management team and, above all, from coworkers. However, based on a well-articulated working group, it is possible to build new ways of managing the organization and producing concrete changes.

The complete observation of the findings of this study serves as a preamble and provides a reference base for the implementation of an organizational culture that welcomes the design and implementation of a Quality of Life at Work Policy and Program - Política e Programa de Qualidade de Vida no Trabalho (PPQLW) that promotes experiences of well-being at work and, as a result, facilitates the achievement of organizational objectives and goals (Ferreira, 2017; Ferreira et al., 2022; Martel & Dupuis, 2006).

Implementing the PPQLW enables crucial aspects of civil aviation protection agents' work processes to be supported by practical and economic perspectives aimed at enhancing worker well-being. This involves coordinated efforts among professionals such as doctors, AVSEC organizations, technology developers, human resources managers, and professional associations.

Conducting on-site investigations rooted in ergonomics offers a potential strategy to explore how APACs can address the productivity-focused logic inherent in their daily tasks at screening checkpoints. Future studies should consider these findings as a starting point, prompting further exploration into the origins and dynamics underlying workers' evaluations. Utilizing additional methodological approaches such as activity observation, interviews, and focus groups could provide a more comprehensive and detailed understanding than what the WCAES has revealed. The WCAES scale, initially applied in the Brazilian airport context, should be validated academically if adopted by other countries to ensure its cultural relevance and effectiveness. This validation process is crucial to maintain the integrity and reliability of the instrument across different cultural contexts.

Furthermore, the GFH-AVSEC (Arcúrio & Arruda, 2022), which assesses operational risks at airports, could benefit from integrating evaluations of the factors identified in scales like WCAES. This approach would help prioritize and address critical issues identified through comprehensive assessment methods.

The WCAES scale's introduction has ushered in a new phase of exploratory AVSEC studies with its robust methodological design, establishing a foundation for future research. Despite limitations in discussing AVSEC work contexts and the sparse existing literature, the research findings make significant contributions to improving service quality and enhancing positive work experiences for AVSEC professionals. Future studies should prioritize assessing the physical, cognitive, and emotional demands of AVSEC work.

References

Abrahão, J. I., Sznelwar, L., Silvino, A., Sarmet, M., & Pinho, D. (2009). Introdução à ergonomia: da prática à teoria (1st ed.). Editora Blücher.

Agência Nacional de Aviação Civil. (2022). *Dados Abertos*. https://datasearch.anac.gov.br/DataSearch/OpenData/Search

Arcúrio, M. S. F., & Arruda, F. S. de. (2022). Risk management of human factors in airports screening process. *Journal of Risk Research, 26*(2), 147–162. https://doi.org/10.1080/13669877.2022.2108119

Arcúrio, M. S. F., Fortes, J. A. A. S., & Armborst, T. (2016). Fatores e erros humanos na inspeção de segurança da aviação civil brasileira. *Revista Psicologia Organizações e Trabalho, 16*(3), 259-273. https://doi.org/10.17652/rpot/2016.3.11647

Arcúrio, M. S. F., Nakamura, E. S., Pereira, R. R. D., Armborst, T., & Fortes, J. A. A. S. (2017). Security screening process of passengers in Brazilian airports: Bivariate analysis of human errors and factors. *Journal of Airport Management, Henry Stewart Publications, 11*(3), 271-293. https://doi.org/10.69554/XMZA6478

Arcúrio, M. S. F., Nakamura, E. S., & Armborst, T. (2018). Human Factors and Errors in Security Aviation: An Ergonomic Perspective. *Journal of Advanced Transportation*, 2018, 1-9. https://doi.org/10.1155/2018/5173253

Arcúrio, M. S. F., Pereira, R. R. D., & Arruda, F. S. (2020). Security culture in the screening checkpoint of Brazilian airports. *Journal of Air Transport Management, 89*. https://doi.org/10.1016/j.jairtraman.2020.101902

Blok, A., Sharpanskykh, A., & Vert, M. (2018). Formal and computational modeling of anticipation mechanisms of resilience in the complex sociotechnical air transport system. *Complex Adaptative Systems Modeling, 6*(7), 1-30. https://link.springer.com/article/10.1186/s40294-018-0058-2

Brasil. (2016). Resolução nº 510, de 7 de abril de 2016: Dispõe sobre a pesquisa em Ciências Humanas e Sociais. Conselho Nacional de Saúde. http://www.conselho.saude.gov.br

Camargo, S. F., Almino, R. H. S. C., Diógenes, M. P., Oliveira Neto, J. P. de ., Silva, I. D. S. da ., Medeiros, L. C. de ., Dantas, K. G. R., & Camargo, J. D. de A. S.. (2021). Qualidade de vida no trabalho em diferentes áreas de atuação profissional em um hospital. *Ciência & Saúde Coletiva*, *26*(4), 1467–1476. https://doi.org/10.1590/1413-81232021264.02122019

Campos, R. M. (2011). *Ergonomia na aviação: um estudo crítico da responsabilidade dos mecânicos de aeronaves na causalidade dos acidentes* (Dissertação de Mestrado). Programa de Pós-Graduação em Design, Universidade Federal de Pernambuco. https://repositorio.ufpe.br/handle/123456789/3541

Dismukes, R. K. (2009). *Human Error in Aviation. Critical Essays on Human Factors in Aviation*. Ashgate.

Ferreira, M. C., & Mendes, A. M. B. (2003). *Trabalho e Riscos de Adoecimento: O caso dos Auditores-Fiscais da Previdência Social Brasileira*. Ler, Pensar, Agir (LPA).

Ferreira, M. C., & Mendes, A. M. B. (2008). Contexto de trabalho. In M. M. M. Siqueira (Org.), *Medidas do comportamento organizacional: ferramentas de diagnóstico e de gestão* (pp. 111-123). Artmed.

Ferreira, M. C., Paschoal, T., & Ferreira, R.R. (2013). *Qualidade de vida no trabalho: Política e programa para uma empresa de tecnologia da informação* (Relatório Técnico). Universidade de Brasília. ECoS/ErgoPublic,, 2013. https://deposita.ibict.br/bitstream/deposita/94/2/Ebook-MP.pdf

Ferreira, M. C. (2017). Qualidade de vida no trabalho: Uma abordagem centrada no olhar dos trabalhadores (3rd ed.). *Paralelo 15*, *1,* 1-344. https://doi.org/10.1590/1982-7849rac20141629

Ferreira, Mário César, Santos, Letícia A., & Paschoal, Tatiane. (2022). Well-being, malaise, and quality of working life management. *Psicologia: teoria e prática*, *24*(3), ePTPSS15511. Epub 10 de março de 2025. https://doi.org/10.5935/1980-6906/eptpss15511.en.

Gurvich, V., & Naumova, M. (2021). Logical Contradictions in the One-Way ANOVA and Tukey–Kramer Multiple Comparisons Tests with More Than Two Groups of Observations. *Symmetry, 13*(8), 1387. https://doi.org/10.3390/sym13081387

Harris, D. H. (2002). How to really improve airport security. *Ergonomics in Design: The Quarterly of Human Factors Applications, 10*(1), 17-22. https://doi.org/10.1177/106480460201000104

Hopkin, P. (2012). Fundamentals of risk management: understanding evaluating and implementing effective risk management (2nd ed.). Kogan Page Limited.

International Civil Aviation Organization. (1998). *Human Factors Training Manual* (Doc 9683, 1st Edition). ICAO.

International Civil Aviation Organization. (2018). *Safety Management Manual (SMM): Doc. 9859 AN/474*, 4th Edition). ICAO.

International Civil Aviation Organization. (2022). *Annex 17. Safeguarding International Civil Aviation Against Acts of Unlawful Interference* (12nd Edition). ICAO.

Izdebski, Z., Kozakiewicz, A., Białorudzki, M., Dec-Pietrowska, J., & Mazur, J. (2023). Occupational Burnout in Healthcare Workers, Stress and Other Symptoms of Work Overload during the COVID-19 Pandemic in Poland. *International journal of environmental research and public health*, *20*(3), 2428. https://doi.org/10.3390/ijerph20032428

Kirschenbaum, A. (2015). The social foundations of airport security. *Journal of Air Transport Management, 48*, 34–41. https://doi.org/10.1016/j.jairtraman.2015.06.010

Lee, A. J., Mclay, L. A., & Jacobson, S. H. (2009). Designing Aviation Security Passenger Screening Systems Using Nonlinear Control. *SIAM Journal on Control and Optimization, 48*(4), 2085–2105. https://doi.org/10.1137/070707014

Lima, P. N., Vieira, D. C., Tegner, M. G., Heck, I., & Luz, F. R. (2015). Ergonomia e segurança no setor aeronáutico: a contribuição do diagnóstico participativo de riscos em um ambiente de manutenção de aeronaves. In *Anais do Encontro nacional de engenharia de produção: Perspectivas Globais para a Engenharia de Produção*. Fortaleza, Brasil.

Martel, J.-P., & Dupuis, G. (2006). Quality of Work Life: Theoretical and Methodological Problems, and Presentation of a New Model and Measuring Instrument. *Social Indicators Research, 77*, 333-368. https://doi.org/10.1007/s11205-004-5368-4

Martins, E. T. (2006). *Ergonomia na aviação: um estudo crítico da responsabilidade dos pilotos na causalidade dos acidentes* (Dissertação de Mestrado). Programa de Pós-Graduação em Design, Universidade Federal de Pernambuco. https://repositorio.ufpe.br/handle/123456789/3419

Mclay, L. A., Jacobson, S. H., & Kobza, J. E. (2006). A multilevel passenger screening problem for aviation security. *Naval Research Logistics, 53*(3), 183–197. https://doi.org/10.1002/nav.20131

Mclay, L. A., Jacobson, S. H., & Kobza, J. E. (2007). Integer programming models and analysis for a multilevel passenger screening problem. *IIE Transactions, 39*(1), 73–81. https://doi.org/10.1080/07408170600729200

Mery, D., Mondragon, G., Riffo, V., & Zuccar, I. (2013). Detection of regular objects in baggage using multiple X-ray views. *Insight, 55*(1). Insight - Non-Destructive Testing and Condition Monitoring. 55. 16-20. 10.1784/insi.2012.55.1.16. https://doi.org/10.1784/insi.2012.55.1.16

Montmollin, M. (1990). L'ergonomie. Editions La Découverte.

Nowacki, G. & Paszukow, B. (2018). Security Requirements for New Threats at International Airports. *TransNav, The International Journal on Marine Navigation and Safety of Sea Transportation, 12*(1), 187-192. https://doi.org/10.12716/1001.12.01.22

Reason, J. (2009). *El Error Humano* (1st Ed.). Modus Laborandi.

Riffo, V., Flores, S., & Mery, D. (2017). Threat Objects Detection in X-ray Images Using an Active Vision Approach. *Journal of Nondestructive Evaluation, 36*(3). https://doi.org/10.1007/s10921-017-0419-3

Skorupski, J., & Uchroński, P. (2018). Evaluation of the effectiveness of an airport passenger and baggage security screening system. *Journal of Air Transport Management, 66*, 53–64. https://doi.org/10.1016/j.jairtraman.2017.10.006

Stewart, M. G., & Mueller, J. (2018). Risk and economic assessment of U.S. aviation security for passenger-borne bomb attacks. *Journal of Transportation Security.* https://doi.org/10.1007/s12198-018-0196-y

Song, C., & Zhuang, J. (2017). Modeling Precheck Parallel Screening Process in the Face of Strategic Applicants with Incomplete Information and Screening Errors. *Risk Analysis, 38*(1), 118–133. https://doi.org/10.1111/risa.12822

Tuchen, S., Arora, M., & Blessing, L. (2020). Airport user experience unpacked: Conceptualizing its potential in the face of COVID-19. *Journal of Air Transport Management, 89*, 101919. https://doi.org/10.1016/j.jairtraman.2020.101919

Vilarinho, K., Paschoal, T., & Demo, G. (2021). Teletrabalho na atualidade: quais são os impactos no desempenho profissional, bem-estar e contexto de trabalho? *Revista do Serviço Público, 72,* 133-162. https://doi.org/10.21874/rsp.v72.i1.4938

Wickens, C. D., Hollands, J.G., Banbury, S., & Parasuraman, R. (2013). Engineering Psychology and Human Performance (4th ed.). *Psychology Press*. https://doi.org/10.4324/9781315665177

Zhao, J., Shi, L., & Zhang, L. (2016). Application of improved unascertained mathematical model in security evaluation of civil airport. *International Journal of System Assurance Engineering and Management, 8*(S3), 1989–2000. https://doi.org/10.1007/s13198-016-0417-3

Contribution:

Michelle Salgado Ferreira Arcúrio: conceptualization, data curation, formal analysis, investigation, methodology, visualization, writing – original draft, writing – review & editing.

Mário César Ferreira: conceptualization, data curation, formal analysis, investigation, methodology, visualization, writing – original draft, writing – review & editing.

Data availability:

Research data are available upon request to the authors.

Conflicts of interest:

The authors declare that there are no conflicts of interest in carrying out and communicating this research.

Submitted in: July 13th, 2024
Reviewed in: October 18th, 2024
Accepted in: November 26th, 2024
Published in: May 1st, 2025