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

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Abstract: The work of screening 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. The 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. ANOVA 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 the airport screening process.
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 situations 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) emphasize 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., 2016; Arcúrio et al., 2018; Arcúrio, Pereira, & Arruda, 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, commonly utilized in Brazil (Ferreira, 2017; Camargo et al, 2021; Vilarinho et al., 2021).

Three interdependent concepts interpret and analyze empirical data on APACs' work (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, in

addition to the well-being of service users.

Method

Participants

The research population consisted of 974 APACS working at screening checkpoints in eleven Brazilian airports. These airports represent 71% of the total passenger traffic in Brazilian scheduled aviation during the period of January to 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 was 475 APACs that guarantee a confidence level of 96%, 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; and Socio-professional Relationships (SR, 10 items), which express intra- and inter-group interactional characteristics between different hierarchical levels and with users (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 point of view, the research was carried out respecting all the aspects contained in Items V and VII of the Sole Paragraph of Article 1 of Resolution nº 510/2016, 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; and 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, where participants' free and informed consent was explained, in accordance with Article 17 of Resolution No. 510/2016. The authors are fully responsible for the data generated in this research.

The database with aggregated information is based on airports selected in proportion to each airport's total number of APACs, as per 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 nature of the research 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 (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 $p < 0.01$; the Kaiser-Meyer-Olkin (KMO) statistic: 0.960 for "Evaluation in the Work Context"; Communality: most of the variables scored less than 0.5.

Results

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 in 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%
Position held most of the time			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%

Gender	F	%	Total daily workload. including other paid activities (hours)	**F**	**%**
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. Those specifically operating x-ray equipment only constitute 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 the 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".

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, with the exception of 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.

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. One hypothesis for the negative/serious evaluation of work organization is the overlapping of tasks and the frequent changes in work instructions to comply with regulatory changes.

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

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	

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)

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.

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 of the 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 of staff perception are related to security culture (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.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.

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According to the results in Table 8, 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 work in high-pressure environments that demand technical accuracy and speed while screening passengers' belongings. The need for quick processing can lead to conflicts in effectively detecting prohibited items (Skorupski & Uchroński, 2018). Arcúrio et al. (2018) highlight that time constraints increase the risk of human error in security screening tasks. The study underscores the complexity of APACs' roles at Brazilian airport screening checkpoints.

Two WCAES scale factors were rated as moderate to critical, with work organization assessed as negative to serious, which stresses 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).

Participants in the WCAES scale draw attention to demanding results, performance monitoring, and rigid work rules. While these standards ensure procedural safety, they reduce flexibility, which can increase human costs, such as illness and accident risks. Aviation security assumes that strict rule compliance mitigates risks, creating an environment similar to mass production where human behavior is tightly controlled. However, Kirschenbaum (2015) challenges this assumption. Rules guide professionals effectively when they accurately describe a problem and have a history of success, becoming more influential and likely to be applied in the future, even in varied situations (Reason, 2009).

Accidents can occur when a rule is applied in situations where it only partially fits. Professionals tend to rely on stronger rules, even if conditions don't fully align. Factors such as technical skills, luggage characteristics, and work schedule pressures are key considerations. While performance monitoring is essential, management practices may lead to more critical evaluations from workers. The work process involves intense variables, including socio-environmental stressors like temperature, noise, lighting, and monitoring (Kirschenbaum, 2015; Dismukes, 2009).

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, as a result of day-to-day operations, the demanding environment and the current operating conditions, there is a gradual deviation in performance from the reference performance, the prescribed work and the actual work, now known as practice drift (International Civil Aviation Organization [ICAO], 2018).

In aviation, prescribed work is known as "actual work," a concept explaining deviations from expected system performance due 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, Shi, & Zhang, 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, Sharpanskykh, & Vert, 2018) and represent one of the layers of pre-shipment safety (Stewart & Mueller, 2018).

In Brazil, the airport screening process aligns with national regulations and international standards from the ICAO, reflecting mandatory normative rigidity enforced by the state. Reason (2009) notes that human cognition creates mental models of tasks by linking rules to work situations. Analysis of the work organization (WO) factor shows that participants under 40 rated it significantly higher in severity than those over 40. This difference is important as the WO factor impacts standards and expected outcomes in APAC work, which may affect career continuity in AVSEC and streamline screening procedures (Arcúrio et al., 2017).

On the (WO) factor, Dismukes (2009) states that learning leads to the automation of behavior. Schemes 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 influence job tenure and performance, such as skill development opportunities, feedback, recognition, and career advancement, Harris (2002). ANOVA results show that older AVSEC professionals are more critical than younger ones, suggesting that an effective AVSEC culture strengthens with time, as noted by Arcúrio et al. (2020). Older professionals may analyze new work environments and relationships more critically. In critical situations, this can trigger an "intellectual emergency reaction" (Doerner, 1987, cited by Reason, 2009), leading to reduced intellectual engagement and reflexive behaviors, which diminish self-reflection and planning abilities, resulting in repetitive actions over time.

In this model, lack of action planning leads to "new pathologies," as described by Reason (2009). Professionals may take greater risks due to urgency, oversimplifying issues and attributing problems to a single cause, which falsely suggests comprehensive consideration. Given the critical nature of civil aviation security and the discretionary decisions made by APACs, there is a need to implement workplace quality of life policies to address the risks in decision-making.

Studies have shown that top performers, when faced with failure, look for ways to disprove their initially established hypotheses (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, it resets the formation of the security culture, whether the replacement is a novice or experienced professional. This initiates a cycle of reflection and decision-making. The difference between experienced and novice professionals is their knowledge and familiarity with situations (Reason, 2009). A comparison of service length indicates that APACs with less than one year of service experience lower cumulative stress, resulting in less impact on working conditions.

Workload can be viewed through cognitive, physical, and affective lenses, encompassing analysis, decision-making, posture, pace management, and resilience (Abrahão et al., 2009). Detailed task assessment and organized methods are essential to prevent failures and maintain quality, as increased workload can initially boost pace but later lead to performance changes and non-compliance with procedures due to adaptation. Experienced APACs perceive working conditions as inadequate and critical, particularly due to high noise levels, which are seen as a significant factor affecting their overall perception.

The 4N model to categorize levels of risk maturity (novice, naive, natural, normalized), deems 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, which can hinder communication, affect work performance, and pose health risks. Physiological and perceptual factors, such as lighting quality, noise, and temperature, influence safety, comfort, and professional performance (Abrahão et al., 2009).

Noise in the workplace affects AVSEC professionals by impairing hearing and increasing stress due to communication challenges. Evaluating noise is essential for understanding its impact, while sound cues like metal detector alerts enhance security and expedite passenger processing. The checkpoint environment must ensure security alerts are audible, excessive noise is reduced, communication is clear, and hearing health is protected. Given the serious consequences of security screening failures, the work process is heavily supervised and controlled, utilizing technologies like closed-circuit television and metal detector gantries to enhance security measures.

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 emergency 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 relationships 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 , Santos, & Paschoal, 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 activity 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.

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