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Epidemiology of Pain Among Algerian Aircrew

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Abstract

Pain is a public health problem, with a prevalence of 12-50 % in the general population. Among aircrew, the issue is that they may have a high prevalence of pain relative to other aviation-related risk factors. The main objective of this study is to descriptively and analytically examine the epidemiological and diagnostic data of aviation-related risk factors in aircrew. This is a cross-sectional, retrospective, single-center study conducted over 36 months, considering cases of flight crew who presented with pain (excluding cancer or complicated cases).The average age of our population was 38.96 years. No statistical link was found between the presence of aviation-related risk factors, particularly cumulative flight hours, and the diagnosis of pain in aircrew (p = 0.1146). This finding aligns with the 2018 work of F. Raynaud. Aircrews, considering cumulative flight hours, load factors, and the use of specific equipment, did not produce significant results, a finding consistent with the data from the 2018 study by F. Raynaud, the 2007 study by J. Lecompte, and the 2012 study by A.S. Wagstaff. However, aeronautical risk factors cannot be ruled out as contributing factors to the development of pain in aircrews, particularly if they are associated with specific medical histories.

Keywords: Pain, Air Crew, Aeronautical Risk Factors.

Introduction

Pain is estimated to be the cause of nearly two-thirds of medical consultations worldwide. International studies report a prevalence ranging from 10.1 % to 55.2 % in the general population with the most recent study by A.M. Dydyk (2020) finding a prevalence of 54 % . The Algerian Society for the Evaluation and Treatment of Pain (ASETP) estimates that "pain is a neglected condition in Algeria and specifies that 30-80 % of pain is not adequately relieved" [1-4].

History of Pain

The most recent history of pain actually begins in 1944, with the advances made by the American neurosurgeon John Bonica, who was already discussing the multidisciplinary approach to pain management. In 1960, he inaugurated the first "pain clinics," the "Washington University Multidisciplinary Pain Center". The year 1973 marked a significant and crucial turning point in the history of pain with the creation of the International Association for the Study of Pain (IASP), and in 1979, this latter body for the study of pain recognized the polymorphic nature of pain [5,6].

Definitions

Definition of Pain

The IASP proposes the polymorphic nature of pain and defines it as "an unpleasant sensory and emotional experience associated with, or described in terms of, actual or potential tissue damage." This places sensory and affective dimensions on the same level. This objective is adopted by the WHO to avoid reducing pain to nociception and to preserve its multidimensional aspect. Recently, in 2020, the IASP proposed a new definition for individuals who are non-communicative or whose pain is not described. By adding the phrase "or similar to that associated with," it includes this category of patients in difficult communication situations [7-9].

Air Crew

Aircrew (AC), specifically airline crew, consists of technical crew, which includes pilots, co-pilots responsible for flying the aircraft, as well as flight mechanics and electronics technicians. For passenger service on board aircraft, there is the commercial crew, including flight attendants.

Aeronautical Risk Factors

In the event of exposure to a painful condition in AC, the risk factors (RFs) added to those of the general population, particularly those in the aviation sector, are classified into three categories [10-12].

- **Individual RFs:** These include non-modifiable factors (age, female sex, history of trauma to an area impacted by an injury) and modifiable factors such as poor physical condition, excess weight, and smoking.
- **Occupational RFs:** These can be physical, such as the seat, posture, lack of lumbar support, wearing night-vision goggles, wearing a combat vest, vibrations, and flight hours. They can also be psychological, primarily related to occupational stress and a general feeling of poor health [13].
- **Risk factors for chronicity:** These are determined by personal factors, factors specific to the illness, occupational factors, medico-legal factors, and psychosocial factors (concepts of apprehension-avoidance and beliefs) and environmental factors [14,15].

Study of Pain In Air Crews

Problematic of Pain in Aircrews

Risk factors are known in the general population, but in aircrews, who are also exposed to aeronautical hazards, isn't there a higher prevalence of pain? In this context, a review of the literature reveals little statistical data from national studies, with the exception of one study that focused solely on back pain, specifically in helicopter pilots [16]. Even international publications lack texts that address the topic of pain in all flight crews as a whole.

Objectives to be Achieved

The primary objective of our work is to estimate the prevalence of pain over a 24-month study period among flight attendants nationwide. Secondly, there are two objectives: first, to study the distribution of pain subgroups and their risk factors, particularly those related to aviation; and second, to evaluate the socio-professional consequences and quality of life of flight attendants, as well as the methods of therapeutic management and their impacts.

From a descriptive and analytical perspective, we collected neurological and management data on aviation-related respiratory issues in flight attendants. This is a cross-sectional, retrospective data-driven study spanning 36 months, including cases of flight attendants assessed at the expert center. Our study was conducted using a standardized questionnaire (demographic, clinical, assessment, examination, and surgical data). Data processing was performed using Zotero, EPI Data, and EPI Info's software, as these are free, efficient, and reliable.

Descriptive Results of The Study

Sociodemographic Characteristics of the Study Population

Age of the AC

The mean age of our study population is 38.96 years, with a 95% confidence interval between 38.02 and 39.9 years. The youngest participant was 20 years old and the oldest was 62 years old (Cf. Table 1). Young adults (25 to 49 years old) represent the majority of our study population, at nearly 90%.

Table 1: Mean Age of ACs

Effective	Min	Average	Max	(95% CI	Average)
303	20.00	38.96	62.00	38.02	39.90

Age Groups

Depending on the age group, we found that young adults aged 25 to 49 represent the majority of our study population in nearly 90% of cases (Cf. Figure 1). The lowest rate is that of the 50-54 age group, at 2.9 years. Year olds with 2.9 years.

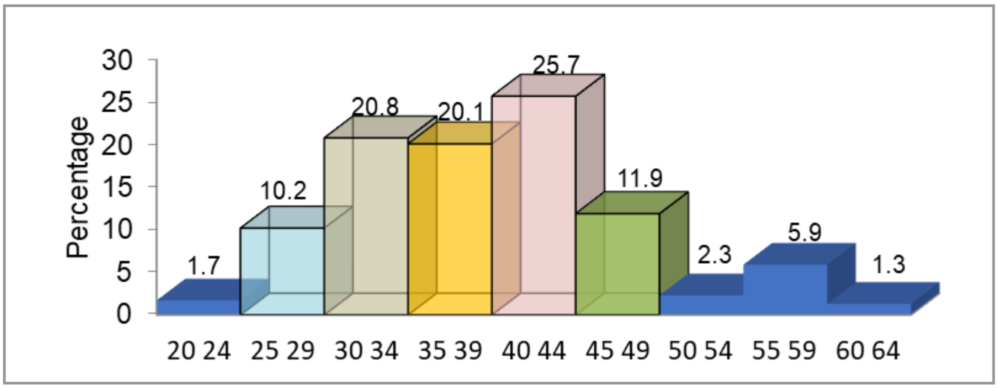


Figure 1: Distribution of AC according to age groups

In our sample, the male population represented 84.2% of the ACs (Cf. Table 2) and we end up with a sex ratio of 5.3 M/W.

Table 2: Distribution of AC According to Sex.

Sex	Effective N	Percentage %
Male	255	84.2
Female	48	15.8
Total	303	100.0

Body mass index (BMI):

The average body mass index (BMI) of the population is 26.57 (95% CI, 26.15-26.99), indicating a high level of overweight and obesity, with extremes ranging from 18.50 to 42.00. (Cf. Table 3).

Table 3: Distribution of Weights According to Average BMI.

Effectives	Min	Average	Max	(95% CI	Average)
303	18.50	26.57	42.00	26.15	26.99

The study of the distribution of AC according to BMI classes shows that the class of 25.01 to 29.99 kg/m² represents the majority, followed by the classes above 30 kg/m², with 49.4% and 15.9% respectively. Normal BMI is present in 34.7%. (Cf. Figure 2).

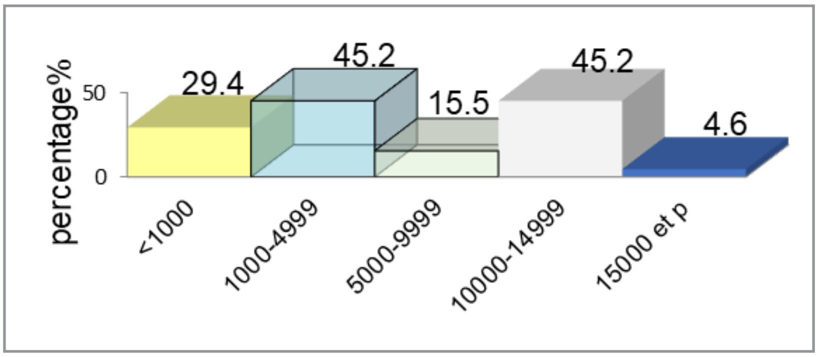


Figure 2: Distribution of AC According to BMI Classes.

Study of Aeronautical Risk Factors

Specific Training for Air Navigation

Of all the flight ACs in our sample, we found that 33.7%, or only one-third, underwent specific training in air navigation (Cf. Table 4).

Table 4: Distribution of AC Members According to Specific Training.

Specific training	Effective N	Percentage %
No	201	66.3
Yes	102	33.7
Total	303	100.0

Aeronautical Specialty

Our results, broken down by aeronautical specialty, showed a majority of 45.9 % pilots and co-pilots, while flight engineers and other specialties, particularly commercial ones, represented 29.4 % and 24.8 % respectively (Cf. Table 5).

Table 5: Distribution of AC Members by Aeronautical Specialty.

Aeronautical Specialty	Effective N	Percentage %
Pilots or Co-Pilotes	139	45.9
Flight Engineers and Associâtes	89	29.4
Others	75	24.8
Total	303	100.0

Type of Aircraft Used

Considering the type of aircraft used, we observed a near-dominance of flight crew members flying heavy aircraft (79.2%), followed by those flying medium aircraft (16.5%), and finally light aircraft (4.3%). (Cf. Table 6).

Table 6: Distribution of AC Members According to Aircraft Type Used.

Aircraft used	Effective N	Percentage %
Light	13	4.3
Medium	50	16.5
Heavy	240	79.2
Total	303	100.0

Flight Hours (FH)

It was found that the 303 AC members included in our study had an average of 3799.22 hours flown during their careers (95% flight hours, 3312.44 - 4286.00). The average range was from 0 to 19870 flight hours. The median was 2020.00 hours (see Table 7). Regarding the distribution of FH by class, those with less than 1000-9999 hours represented more than three-quarters of the FH, and the 5000–9999-hour class alone accounted for almost half of the flight crew, at 45.2%.

Table 7: Distribution of AC by Average Flight Hours.

Effective	Min	Average	Max	Variance	(95% CI	Average)
303	0.0	3799.22	19870.0	18540637.9	3312.44	4286.00

Wearing Specific Equipment
Analysis of the statistical data based on the wearing of specific air navigation equipment reveals that the highest rate is for the combination of wearing a Mae West helmet and a headset, at 81.93% of the sample population, representing 25.1% of flight crew (see Table 8).

Table 8: Distribution of Flight Crew Based on the Wearing of Specific Equipment

Equipment	Effective N	Percentage %
Helmet	1	00.44
Night Vision Goggles and Combat Vest	2	00.88
Helmet and Mae West	186	81.93
Helmet, Night Vision Goggles and Combat Vest	12	05.28
Helmet, Night Vision Goggles and Mae West	12	05.28
Helmet, Combat Vest and Mae West	14	06.67
Helmet, Night Vision Goggles, Combat Vest and Mae West	227	100.0

Clinical Data from the Study
Presence of Medical and Surgical History
Regarding the presence of specific medical and surgical history, it was observed that 84.8% of our neonatal patients already had a history of illness (see Table 9).

Table 9: Distribution of Neonatal Patients According to Medical and Surgical History

Medical and surgical history	Effective N	Percentage %
No	46	15.2
Yes	257	84,8
Total	303	100.0

History of Smoking
In the studied population of ACs (non-psychoactive individuals), a history of smoking was found in 28.4% of ACs, followed by abstinent ACs at 11.9% of all ACs in the sample (Cf. Table 10).

Table 10: Distribution of ACs according to smoking history.

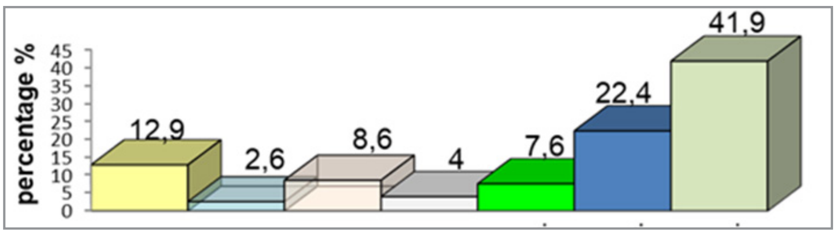
Smoking	Effective N	Percentage %
Yes	86	28.4
No	181	59.7
Absent	36	11.9
Completely	303	100.0

Prévalence of Pain
Over the 24-month study period, the prevalence of pain of all types was 1.61% (Cf. Table 12).

Table 12: Distribution of ACs during the 2-year study

Year	Total workforce	Number of ACs with pain	Percentage %
TOTAL	18737	303	100.00

Study of Pain Subpopulations
Musculoskeletal pain was the most prevalent, accounting for 41.91% of cases, followed by postoperative pain at 22.44%, and then craniofacial pain at 12.71%. Neuralgia, diffuse neuropathy, and otalgia were also present, with respective rates of 8.58%, 7.59%, and 4.5%. The lowest rate was for diffuse myalgia, at 2.64% of cases (Cf. Figure 3).



Craniofacial pain	Myalgia	Neuralgia	Earaches	polyneuropathie	Postoperative pain	Musculoskeletal pain

Figure 3: Frequencies of Pain Subpopulations.

Drug Treatment Used

During our study, it was found that analgesics were used in 94.71 % of cases, followed by anti-inflammatories in 76.56 % and anxiolytics in 69.96 %. Antidepressants were used as a pain reliever in only 7.26 % of cases.

Table 13: Distribution of ACs according to the medication used.

Therapies used	Effective N	Percentage %
Analgesics	287	94,71
Anti-inflammatories	232	76,56
Antiepileptics	34	11,22
Anxiolytics	212	69,96
Antidepressants	22	07,26
Muscle relaxants	118	38,94

Analytical Results of The Study

Study of the Type of Pain and Classes of FH

Analysis of the statistical data according to the age-related disability (ARD) classes and the pain diagnosis revealed that musculoskeletal pain was the most prevalent, with the highest rate in the 10,000–14,999 age group (56.3 %). (Cf. Table 13). Therefore, no correlation was found between these two variables (p = 0.1146).

Table 14: FH classes and the retained pain diagnosis.

FH classes												
Diagnosis	<1000	%	10000-14999	%	1000-4999	%	15000 et p	%	5000-9999	%	Total	%
Craniofacial pain	12	13.5	0	0.0	22	16.1	1	7.1	4	8.5	39	12.9
Diffuse myalgia	0	0.0	1	6.3	3	2.2	2	14.3	2	4.3	8	2.6
Neuralgia	9	10.1	2	12.5	7	5.1	1	7.1	7	14.9	26	8.6
Ear pain	4	4.5	1	6.3	14	10.2	1	7.1	3	6.4	23	7.6
Diffuse polyneuropathy	3	3.4	0	0.0	4	2.9	2	14.3	3	6.4	12	4.0
Postoperative pain	22	24.7	3	18.8	34	24.8	3	21.4	6	12.8	68	22.4
Upper arm pain	39	43.8	9	56.3	53	38.7	4	28.6	22	46.8	127	41.9
Total	89	100	16	100	137	100	14	100	47	100	303	100

Diagnosis and Pain Intensity

In the study of the statistical data according to the variables AVS score and pain diagnosis retained in the AC, there is no objective correlation between these two variables (Chi2= 25.515 df(30) p= 0.6996) (Cf. table 14).

Table 15: Pain intensity (AVS) and the pain diagnosis retained.

Score AVS														
Diagnosis	3	%	4	%	5	%	6	%	7	%	8	%	Total	%
Craniofacial pain	0	0.0	3	16.7	2	10.5	28	14.7	6	8.6	0	0.0	39	12.9
Diffuse myalgia	0	0.0	0	0.0	0	0.0	6	3.2	2	2.9	0	0.0	8	2.6
Neuralgia	0	0.0	1	5.6	3	15.8	16	8.4	6	8.6	0	0.0	26	8.6
Ear pain	0	0.0	1	5.6	5	26.3	14	7.4	3	4.3	0	0.0	23	7.6
Polyneuropathies	0	0.0	1	5.6	1	5.3	6	3.2	4	5.7	0	0.0	12	4.0
Post-operative pain	0	0.0	4	22.2	1	5.3	48	25.3	14	20.0	1	20	68	22.4
Upper arm pain	1	100.0	8	44.4	7	36.8	72	37.9	35	50.0	4	80	127	41.9
Total	1	100	18	100	19	100	190	100	70	100	5	100	303	

Type of Pain and Time of Onset

Analysis of the statistical data based on the time of pain onset and the pain diagnosis revealed that musculoskeletal and postoperative pain were more prevalent during flights, with rates of 24.3 % and 47.3 %, respectively. Similar rates were observed immediately after flights (Cf. Table 15). Therefore, no statistically significant difference was found between these two variables (Chi2 = 22.884, df(12), p = 0.0287).

Table 15: Time of pain onset and pain diagnosis.

Moment of Occurrence								
Diagnosis	During	%	After	%	Out	%	Total	%
Craniofacial pain	9	12.2	16	18.2	14	9.9	39	12.9

Diffuse myalgia	0	0.0	4	4.5	4	2.8	8	2.6
Neuralgia	4	5.4	8	9.1	14	9.9	26	8.6
Ear pain	8	10.8	4	4.5	11	7.8	23	7.6
Polyneuropathies	0	0.0	1	1.1	11	7.8	12	4.0
Post-operative pain	18	24.3	24	27.3	26	18.4	68	22.4
Upper arm pain	35	47.3	31	35.2	61	43.3	127	41.9
Total	74	100	88	100	141	100	303	

(Chi2= 22.884 df(12) p= 0.0287).

Type of Pain and Duration of Pain
This data analysis found that the highest rate was that of musculoskeletal pain associated with a duration of 15 days, at 46.1 % of cases. This was followed by postoperative pain at 21.7 %. (p= 0.0268).

Type of Pain and Functional Rehabilitation
Depending on the pain diagnosis and the functional rehabilitation practice, we observed that 55.1% of patients undergo rehabilitation associated with diffuse polyneuropathy. The correlation between these two variables was not present in this case (Chi2 = 4.538 df (6), p = 0.6042) (Cf. Table 17).

Table 17: Functional Rehabilitation and Retained Pain Diagnosis

	Pain Diagnosis Retained															
Rehabilitation	**1**	**%**	**2**	**%**	**3**	**%**	**4**	**%**	**5**	**%**	**6**	**%**	**7**	**%**	**Total**	**%**
No	14	35.9	3	37.5	7	26.9	9	39.1	6	50.0	24	35.3	57	44.9	120	39.6
Yes	25	64.1	5	62.5	19	73.1	14	60.9	6	50.0	44	64.7	70	55.1	183	60.4
Total	39	100	8	100	26	100	23	100	12	100	68	100	127	100	303	

Chi2= 4.538 df (6) p= 0.6042

1. Craniofacial pain,
2. Diffuse myalgia,
3. Neuralgia,
4. Otalgia,
5. Diffuse polyneuropathy,
6. Post-operative pain,
7. Musculoskeletal pain.

Type De Douleur Et Moyens De Prévention
An analytical study of the type of pain and the preventive measures used revealed a clear correlation between the effectiveness of these measures and the diagnosis of pain. This resulted in a highly significant Pearson correlation coefficient (Chi2 = 51.049 df(36), p = 0.0495) (Cf. Table 18).

Table 18: Prevention methods used and pain diagnosis retained.

	Prevention methods												
Pain diagnosis	**1,2**	**%**	**1, 2, 3**	**%**	**1, 2, 3,4**	**%**	**1,3**	**%**	**1, 3,4**	**%**	**1,4**	**%**	**Total**
Craniofacial pain	1	50.0	0	0.0	2	6.5	0	0.0	0	0.0	24	13.1	27
Diffuse myalgia	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	5	2.7	5
Neuralgia	0	0.0	0	0.0	7	22.6	2	16.7	0	0.0	10	5.5	20
Ear pain	0	0.0	1	100.0	4	12.9	2	16.7	1	50.	11	6.0	19
Diffuse polyneuropathy	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	8	4.4	8
Post-operative pain	1	50.0	0	0.0	7	22.6	2	16.7	0	0.0	43	23.5	53
Upper arm pain	0	0.0	0	0.0	11	35.5	6	50.0	1	50.	82	44.8	100
Total	2	100	1	100	31	100	13	100	2	100	183	100.0	232

(Chi2= 51.049 df(36) p= 0.0495)

- Lifestyle and therapeutic education,
- Postural strengthening,
- Improvement of equipment,
- Better information.

Discussion

In our overall discussion of the results, we found that the prevalence of pain among flight crew was estimated at 1.61 %. This figure is also low compared to the study by F. Raynaud, 2018 , which found a rate of 67.1 % among fighter pilots, although this latter study only examined cervical pain. The same is true in the two studies by A. Dowling, 2020 and AM. Dydyk, 2020 , which found percentages of 70.0% and 54.3%, respectively. Regarding the risk factors associated with pain, we have objectively found a non-significant statistical link between the type of pain diagnosed and the mean BMI, these results are consistent with those of E. Dehez of 2014 and F. Raynaud of 2018where back pain in helicopter pilots and neck pain in fighter pilots were studied [17,18].

The presence of a medical-surgical history (84.8% of cases) correlated with the type of pain diagnosed did not have a clear statistical significance in our study (p = 0.4277). Therefore, when comparing these results with data from the literature, particularly F. Raynaud (2018) and E. Dehez (2014), which demonstrated a highly significant association ($p < 0.05$), these results are interpreted in light of the fact that our study sample included all flight crew categories, including commercial pilots, who do not adhere to the same flight crew expertise criteria as helicopter and fighter pilots, where highly selective standards apply.

Depending on the type of aircraft used and the presence of pain, we observed that the results in the published studies, particularly E. Dehez (2014). were significant compared to our study (not significant). This result may be linked to specific practical training as well as the prevention methods used. The FH (Head Pain Value) correlated with the diagnosed pain was not statistically significant, despite a very high mean FH compared to the F. Raynaud study of 2018, J. Lecompte of 2007, and AS. WAGSTAFF of 2012 [19, 20].

This could be related to the excessive exposure of fighter pilots to aeronautical RFs (Frequency Disruptors) and the direct link with the particular type of neck pain experienced by fighter pilots. However, our results are consistent with those of Van den Oord Mhah of 2010 and Rahman Shiri of 2015 [21, 22], and their results were related to the type of aircraft used and the type of pain considered.

The timing of pain onset was clearly correlated with the type of pain diagnosed, in strong agreement with the studies by F. Raynaud (2018), A. Heraudeau-Fritsch (2006), E. Dehez (2014), Van den Oord Mhah (2010), and Thomae MK (1998) [10, 22–24]. Regarding medication use, we observed high rates of medication use (79.89 %) compared to data from the literature (E. Dehez, 2014, and F. Raynaud, 2018), with less than 50 % of treatments being drug-based [23,24].

These latter studies used non-pharmacological approaches much more frequently. Anxiolytics were used in 69.96% of cases and antidepressants in 7.26 % of our patients. It should be noted that these two types of medication are incompatible with air navigation and are used during periods of temporary incapacity; if used inappropriately, they can jeopardize flight safety.

In our study, only 60 % of flight crew members used functional rehabilitation and physical medicine as an effective alternative, which impacts their availability for air navigation. Our results are low compared to the 2025 A. Acevedo study, which found that 58% to 77 % used these services [25]. Compared to the general population, our results were superior, given the unique status of this population in terms of care and quality of medical expertise.

Conclusion

The results obtained in our study have contributed to updating the epidemiology of pain in AC. Contrary to the initial research question, our flight crew do not experience more pain than the general population. In response to our research question, it is estimated that our flight crew have the advantage of possessing protective factors, and that in some AC, painful pathologies were ruled out during previous assessments and therefore cannot be included in medical evaluations. However, aviation-related risk factors cannot be excluded as contributing factors to the occurrence of pain in AC, and if they are associated with a specific history of pain, the combination may constitute a predictive element for the occurrence of pain in AC.

Certain aeronautical specialties, the type of aircraft, and the pilot's sex constitute a significant risk of developing certain types of pain, particularly back pain and craniofacial pain, which suggest close monitoring in terms of care and medical expertise. Our work did not allow us to establish a "typical" profile of pilots who would be more at risk of experiencing pain, but suggests that particular attention should be paid to pilots with a high number of flights and a significant medical or surgical history, or those working in certain aeronautical specialties. It is time to promote hygiene measures, regular physical activity, and specific training. Similarly, the value of physical medicine and non-pharmacological approaches as therapeutic alternatives should be emphasized.

Recommandations and Perspectives

The results of our work did not allow us to establish a "typical" profile of flight crew members who would be more at risk of experiencing pain, but suggest that particular attention should be paid to the accumulation of hospital stays and to a significant medical and surgical history, or to certain aeronautical specialties. It is important to emphasize medical assessments and preventive pain management measures, as well as lifestyle practices specific to each aeronautical specialty. Special attention should be given to improving overall ergonomics in the design of specific equipment and new aircraft. Ultimately, future epidemiological studies and research can help develop a more standardized approach to pain management in flight crew members.

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