

**Environmental factors associated with non-infective acute respiratory illness in athletes:
A systematic review by a subgroup of the IOC consensus group on “acute respiratory
illness in the athlete”**

ONLINE SUPPLEMENTARY FILES

Supplementary File 1. Full search string.

PubMed:

("non-infective acute respiratory illness" OR "air pollution" OR chemical* OR "non-infective acute respiratory disease*" OR "non-infective acute respiratory tract illness" OR "non-infective acute respiratory tract disease" OR weather OR climate OR chlorin* OR allerg* OR (inhal* AND gas*) OR "air quality" OR Rhinoconjunctivitis OR hypox* OR pollinosis OR Hypersensitivity) AND ("athlete"* OR "sport"* OR "athletic population" OR "active population" OR "professional athlete*" OR "amateur athlete*" OR sportsmen OR sportsman OR sportswomen OR sportswoman OR sportsperson OR competitor OR "sports competitor" OR contestant OR "sports contestant" OR player OR "sports player") AND ("management" OR "treatment" OR "medication" OR "medicine" OR "beta-agonists" OR "anticholinergics" OR "corticosteroids"" OR Bronchodilators" OR "inhaled glucocorticosteroids" OR ICS OR "2-adrenoceptor agonists" OR LABAs OR SABAs OR "leukotriene receptor antagonists" OR Leukotrienes OR LTRAs OR Therapy OR prevent* OR "nonpharmacological strategy" OR "mitigation strateg*" OR prophylaxi* OR "warm up" OR warm-up OR dietary OR Omega* OR vitamin* OR prebiotic OR probiotic OR salt OR "fishoil" OR lycopene OR "ascorbic acid" OR mask OR "heat exchanger" OR "device" OR) NOT (COPD OR "chronic obstructive pulmonary disease" OR cancer OR animal* OR HIV OR "human immunodeficiency virus" OR AIDS OR "acquired immunodeficiency syndrome" OR post-operative OR pre-operative OR postoperative OR preoperative OR military OR review OR meta-analysis OR "food allerg*" OR eczema OR Dermatitis OR "cystic fibrosis" OR pneumonia OR "interstitial disease" OR "cardiovascular disease" OR "coeliac disease" OR pneumothorax OR "heart disease" OR "heat stroke" OR "heat illness" OR "sleep apnoea" OR emphysema OR "mountain sickness" OR "sleep disorders" OR anaphylaxis OR Pregnan* OR Gestation OR maternal OR Hyperb* OR hypercapnia OR scuba OR divers OR diving OR Muscle OR musculoskeletal OR concussion OR injury OR doping OR hypertension OR "cardiac arrest" OR diabetes OR urticarial OR drug* OR tobacco OR infant OR "sleep quality" OR osteoarthritis OR "obesity prevalence" OR osteoporosis) Filters: English, from 1990 - 2020

EBSCOhost:

"human AND ("non-infective acute respiratory illness" OR "air pollution" OR chemical* OR "non-infective acute respiratory disease*" OR "non-infective acute respiratory tract illness" OR "non-infective acute respiratory tract disease" OR weather OR climate OR chlorin* OR allerg* OR (inhal* AND gas*) OR "air quality" OR Rhinoconjunctivitis OR hypox* OR pollinosis OR Hypersensitivity) AND ("athlete"* OR "sport"* OR "athletic population" OR "active population" OR "professional athlete*" OR "amateur athlete*" OR sportsmen OR sportsman OR sportswomen OR sportswoman OR sportsperson OR competitor OR "sports competitor" OR contestant OR "sports contestant" OR player OR "sports player") AND ("management" OR "treatment" OR "medication" OR "medicine" OR "beta-agonists" OR "anticholinergics" OR "corticosteroids" OR Bronchodilators" OR "inhaled glucocorticosteroids" OR ICS OR "2-adrenoceptor agonists" OR LABAs OR SABAs OR "leukotriene receptor antagonists" OR Leukotrienes OR LTRAs OR Therapy OR prevent* OR "nonpharmacological strategy" OR "mitigation strateg*" OR prophylaxi* OR "warm up" OR warm-up OR dietary OR Omega* OR vitamin* OR prebiotic OR probiotic OR salt OR "fishoil" OR lycopene OR "ascorbic acid" OR mask OR "heat exchanger" OR "device" OR) NOT (COPD OR "chronic obstructive pulmonary disease" OR cancer OR animal* OR HIV OR "human immunodeficiency virus" OR AIDS OR "acquired immunodeficiency syndrome" OR post-operative OR pre-operative OR postoperative OR preoperative OR military OR review OR meta-analysis OR "food allerg*" OR eczema OR Dermatitis OR "cystic fibrosis" OR pneumonia OR "interstitial disease" OR "cardiovascular disease" OR "coeliac disease" OR pneumothorax OR "heart disease" OR "heat stroke" OR "heat illness" OR "sleep apnoea" OR emphysema OR "mountain sickness" OR "sleep disorders" OR anaphylaxis OR Pregnan* OR Gestation OR maternal OR Hyperb* OR hypercapnia OR scuba OR divers OR diving OR Muscle OR musculoskeletal OR concussion OR injury OR doping OR hypertension OR "cardiac arrest" OR diabetes OR urticarial OR drug* OR tobacco OR infant OR "sleep quality" OR osteoarthritis OR "obesity prevalence" OR osteoporosis) Full Text; Scholarly (Peer Reviewed) Journals; Published Date: 19960101-20201231; Document Type: Article; Language: English"

Web of Science:

Human AND ("non-infective acute respiratory illness" OR "air pollution" OR chemical* OR "non-infective acute respiratory disease*" OR "non-infective acute respiratory tract illness" OR "non-infective acute respiratory tract disease" OR weather OR climate OR chlorin* OR allerg* OR (inhal* AND gas*) OR "air quality" OR Rhinoconjunctivitis OR hypox* OR pollinosis OR Hypersensitivity) AND ("athlete"* OR "sport"* OR "athletic population" OR "active population" OR "professional athlete*" OR "amateur athlete*" OR sportsmen OR sportsman OR sportswomen OR sportswoman OR sportsperson OR competitor OR "sports competitor" OR contestant OR "sports contestant" OR player OR "sports player") AND ("management" OR "treatment" OR "medication" OR "medicine" OR

IOC Consensus statement Subgroup 3a

“beta-agonists” OR “anticholinergics” OR “corticosteroids” OR Bronchodilators” OR “inhaled glucocorticosteroids” OR ICS OR “2-adrenoceptor agonists” OR LABAs OR SABAs OR “leukotriene receptor antagonists” OR Leukotrienes OR LTRAs OR Therapy OR prevent* OR “nonpharmacological strategy” OR “mitigation strateg*” OR prophylaxi* OR “warm up” OR warm-up OR dietary OR Omega* OR vitamin* OR prebiotic OR probiotic OR salt OR “fishoil” OR lycopene OR “ascorbic acid” OR mask OR “heat exchanger” OR “device” OR) **NOT** (COPD OR “chronic obstructive pulmonary disease” OR cancer OR animal* OR HIV OR “human immunodeficiency virus” OR AIDS OR “acquired immunodeficiency syndrome” OR post-operative OR pre-operative OR postoperative OR preoperative OR military OR review OR meta-analysis OR “food allerg*” OR eczema OR Dermatitis OR “cystic fibrosis” OR pneumonia OR “interstitial disease” OR “cardiovascular disease” OR “coeliac disease” OR pneumothorax OR “heart disease” OR “heat stroke” OR “heat illness” OR “sleep apnoea” OR emphysema OR “mountain sickness” OR “sleep disorders” OR anaphylaxis OR Pregnan* OR Gestation OR maternal OR Hyperb* OR hypercapnia OR scuba OR divers OR diving OR Muscle OR musculoskeletal OR concussion OR injury OR doping OR hypertension OR “cardiac arrest” OR diabetes OR urticarial OR drug* OR tobacco OR infant OR “sleep quality” OR osteoarthritis OR “obesity prevalence” OR osteoporosis)

Refined by: DOCUMENT TYPES: (ARTICLE) AND LANGUAGES: (ENGLISH)

Indexes=SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH, ESCI, CCR-EXPANDED, IC Timespan=1990-2020

Supplementary File 2. Modified 13-point Down and Black score

DOWNS and BLACK Quality Assessment Checklist Adapted for non-RCT articles		Cadima ref nr and author/s
	Description	<i>Author</i>
Nr	<u>REPORTING</u>	Answer Yes=1 No=0
1	Is the hypothesis/aim/objective of the study clearly described?	
2	Are the main outcomes to be measured clearly described in the Introduction or Methods section?	
3	Are the characteristics of the patients included in the study clearly described?	
4	Are the main findings of the study clearly described?	
5	Does the study provide estimates of the random variability in the data for the main outcomes?	
6	Have the characteristics of patients lost to follow-up been described?	
7	Have actual probability values been reported (e.g. 0.035 rather than <0.05) for the main outcomes except where the probability value is less than 0.001?	
	<u>EXTERNAL VALIDITY</u>	Yes = 1 No = 0 Unable to determine= 0
8	Were the subjects asked to participate in the study representative of the entire population from which they were recruited?	
9	Were those subjects who were prepared to participate representative of the entire population from which they were recruited?	
	<u>INTERNAL VALIDITY – BIAS</u>	Yes = 1 No = 0 Unable to determine= 0
10	If any of the results of the study were based on "data dredging", was this made clear?	
11	Were the statistical tests used to assess the main outcomes appropriate?	
12	Were the main outcome measures used accurate (valid and reliable)?	
	<u>INTERNAL VALIDITY – CONFOUNDING (SELECTION BIAS)</u>	Yes = 1 No = 0 Unable to determine= 0
13	Were losses of patients to follow-up taken into account?	
	Total score	0

Table S1. Study characteristics (n = 7).

First author (ref)	Study design	Sample size (F;M)	Type of environment	Level of participation (C/R/Ctrl)	Age (years)	Respiratory illness category
Carey ^{15*}	Interventional	12 (F:4;M:8)	Cold air	C	16.5 [14-21]*	Symptoms + EIB
Kennedy ¹⁶	Interventional	17 (F:17;M:0)	Cold air	R	22±3 [18-29]	Symptoms + EIB
Surda ^{19*}	Observational	296 (F:140;M:156)	Chlorinated SP	C/R/Ctrl	18 [10-35]*	Symptoms
Gelardi ^{17*}	Interventional	54 (F:24;M:30)	Chlorinated SP	C	14 [9-21]*	Symptoms +PD
Levesque ^{20*}	Observational	72 (NA)	Chlorinated SP	C	NA [8-22]	Symptoms
Goma ¹⁸	Observational ⁺	373 (F:138;M:245)	Chlorinated SP	C/R	36±6	Symptoms
Salonen ^{21*}	Observational	793 (F:0; M:793)	NO ₂ in arena	C	16.5 [14-21]*	Symptoms

F: Female; M: Male; NA: not available; SP: swimming pool. C: competitive; R: recreational physically active; Ctrl: controls (non-athletes); Symptoms: self-reported symptoms after exercising in specific environment with or without intervention. EIB: number of subjects having a fall in FEV₁ post-exercise ≥10% (EIB) compared with control condition; PD: physician-diagnosed rhinitis to confirm the origin of pathology (including nasal cytology and anterior rhinomanometry) Age is expressed as mean±SD [range]. ⁺ Study was observational and interventional. * Studies including children and adults.

Table S2. Oxford Level of Evidence and modified Downs & Black Quality Assessment.

First author (ref)	Level of evidence	Quality assessment scores	Quality rating
Carey ¹⁵	4b	7	Fair
Kennedy ¹⁶	2c	9	Good
Surda ¹⁹	3b	4	Poor
Gelardi ¹⁷	4	7	Fair
Levesque ²⁰	3b	8	Fair
Goma ¹⁸	2c	9	Good
Salonen ²¹	3b	9	Good

Level of evidence: 1b - individual RCT with narrow confidence limits; individual cohort study with good follow-up or prospective cohort study with good follow-up; 2b - individual RCT with smaller follow-up, exploratory cohort study, retrospective cohort study. **Scoring criteria:** 11-13: Excellent; 9-10: Good; 7-8: Fair; 0-6: Poor.

Table S3. Scores of modified Downs & Black Quality assessment for the articles included in the present analysis.

Article (first author)	Items of the Down & Black Quality score													Total
	1	2	3	4	5	6	7	8	9	10	11	12	13	
	External validity							Internal validity	Internal validity-bias			Internal validity-confounding		
Carey ¹⁵	1	1	1	0	0	1	1	0	0	0	1	1	0	7
Kennedy ¹⁶	1	1	1	1	1	1	1	0	0	0	1	1	0	9
Surda ¹⁹	0	1	0	0	0	0	1	0	0	0	1	1	0	4
Gelardi ¹⁷	1	1	1	1	0	0	0	1	1	0	0	1	0	7
Levesque ²⁰	1	1	0	1	1	0	0	1	1	0	1	1	0	8
Goma ¹⁸	1	1	0	1	1	1	0	1	1	0	1	1	0	9
Salonen ²¹	1	1	1	1	1	0	1	1	1	0	1	0	0	9