Ministero dell'Interno
Dipartimento dei Vigili del Fuoco, del Soccorso pubblico e della Difesa civile

CORPO NAZIONALE DEI VIGILI DEL FUOCO

"Monitoraggio cardiovascolare e innovazioni tecnologiche: applicazioni per il VF»

VDS Dott.ssa Eleonora Ruscio

Inquadramento dell'attività del vigile del fuoco come 'disciplina sportiva'

Task Force 8: Classification of Sports

Jere H. Mitchell, MD, FACC, *Chair*
William Haskell, PHD, Peter Snell, PHD, Steven P. Van Camp, MD, FACC

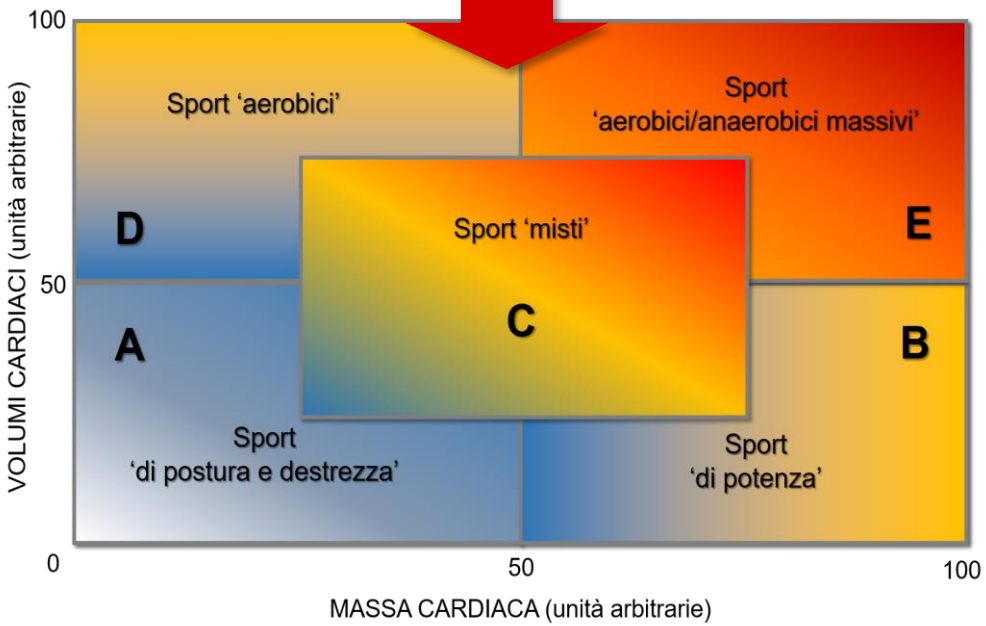
+

STRESS AND THE GENERAL ADAPTATION SYNDROME*

BY

HANS SELYE, M.D., Ph.D., D.Sc., F.R.S.C.

Professor and Director of the Institute of Experimental Medicine and Surgery, Université de Montréal, Montreal, Canada



Modicato da: Comitato organizzativo Cardiologico per l'idoneità allo Sport ANCE - ANMCO- FMSI- SIC - SIC Sport 'Protocolli cardiologici per il giudizio di idoneità allo sport agonistico' 2017, pagina 5

Article

Fitness Fights Fires: Exploring the Relationship between Physical Fitness and Firefighter Ability

Annmarie Chizewski [1,*], Allyson Box [2], Richard Kesler [2,3] and Steven J. Petruzzello [2,3]

1. Introduction

Firefighting involves various aspects of physical fitness, including cardiovascular endurance, muscular strength and endurance, power, agility, and flexibility. Despite the

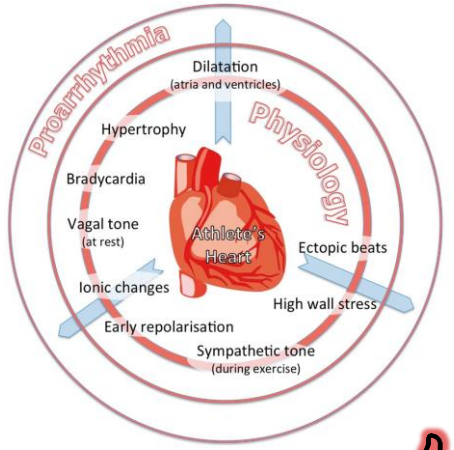
? **RISCHIO INTRINSECO**

Immagine da: https://www.giornaledibrescia.it/brescia-e-hinterland/sogni-di-diventare-vigile-del-fuoco-un-corso-dai-neopompieri-1.3689420

COMITATO ORGANIZZATIVO CARDIOLOGICO
PER L'IDONEITÀ ALLO SPORT AGONISTICO
FMSI - SIC SPORT - ANCE - ANMCO - SIC

Protocolli cardiologici per il giudizio di idoneità allo sport agonistico (COCIS) 2023

Casa Editrice Scientifica Internazionale



GRUPPO 1 (comuni, >80%)

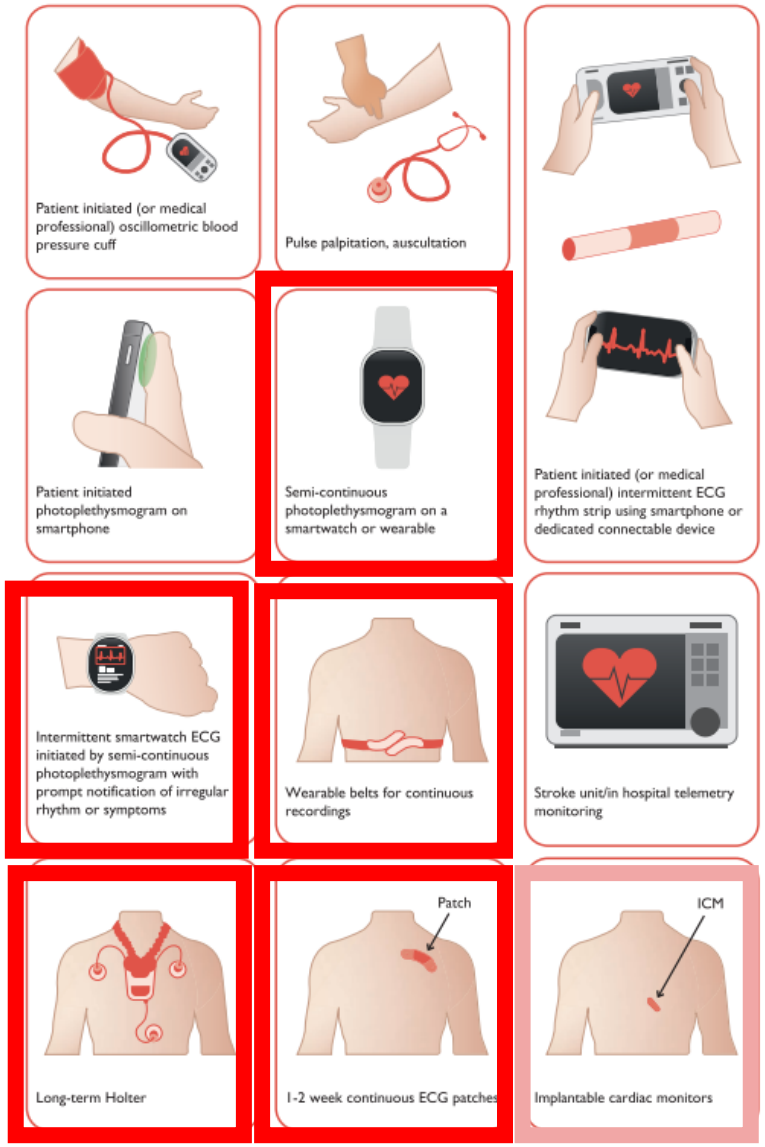
- bradicardia/aritmia sinusale
- ritmo atriale ectopico "basso"
- BAV I grado
- BBD incompleto (o QRS "notched" in V1)
- ripolarizzazione precoce
- ipertrofia ventricolare sinistra o destra per isolati criteri di voltaggio

GRUPPO 2 (non comuni, <5%)

- ingrandimento atriale sinistro
- ingrandimento atriale destro
- deviazione assiale sinistra
- deviazione assiale destra
- inversione delle onde T
- sottoslivellamento del tratto ST
- onde Q patologiche
- BBD o BBS completo
- ipertrofia ventricolare destra per criteri non di solo voltaggio
- pre-eccitazione ventricolare
- QT lungo o corto
- alterazioni tipo Brugada 1 in V1-V2

"The athlete's heart is a proarrhythmic heart, and what that means for clinical decision making" Heidbuchel H, Europace. Volume 20, Issue 9, Sett. 2018, pagine 1402.

Monitoraggio della salute cardiovascolare: dispositivi



Smartwatch Algorithm for Automated Detection of Atrial Fibrillation

Joseph M. Bumgarner, MD,[a] Cameron T. Lambert, MD,[a] Ayman A. Hussein, MD,[a] Daniel J. Cantillon, MD,[a] Bryan Baranowski, MD,[a] Kathy Wolski, MPH,[b] Bruce D. Lindsay, MD,[a] Oussama M. Wazni, MD, MBA,[a] Khaldoun G. Tarakji, MD, MPH[a]

Rationale and design of a large-scale, app-based study to identify cardiac arrhythmias using a smartwatch: The Apple Heart Study

Mintu P. Turakhia, MD, MAS,[a,b] Manisha Desai, PhD,[c] Haley Hedlin, PhD,[c] Amol Rajmane, MD, MBA,[d] Nisha Talati, MBA,[d] Todd Ferris, MD, MS,[e] Sumbul Desai, MD,[f] Divya Nag,[f] Mithun Patel, MD,[f] Peter Kowey, MD,[g] John S. Rumsfeld, MD, PhD,[h] Andrea M. Russo, MD,[i] Mellanie True Hills, BS,[j] Christopher B. Granger, MD,[k] Kenneth W. Mahaffey, MD,[d] and Marco V. Perez, MD[l] *Stanford, Palo Alto, Cupertino, CA; Philadelphia PA; Denver Colorado; Camden NJ; Decatur TX; Durham NC*

THE LANCET

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ARTICLES · Volume 394, Issue 10201, P861-867, September 07, 2019 · Download Full Issue

An artificial intelligence-enabled ECG algorithm for the identification of patients with atrial fibrillation during sinus rhythm: a retrospective analysis of outcome prediction

Zachi I Attia, MS[a,†] · Peter A Noseworthy, MD[a,†] · Prof Francisco Lopez-Jimenez, MD[a] · Prof Samuel J Asirvatham, MD[a] · Abhishek J Deshmukh, MBBS[a] · Prof Bernard J Gersh, MB ChB[a] · et al. Show more

*"2020 ESC Guidelines for the diagnosis and management of atrial fibrillation developed in collaboration with the European Association of Cardio-Thoracic Surgery (EACTS)". Hindricks G. et al. *European Heart Journal (2020) 00, 1125*

	Sensitivity	Specificity
Pulse taking	87-97%	70-81%
Automated BP monitoring	93-100%	86-92%
Single lead ECG	94-98%	76-95%
Smartphone apps	91.5-98.5%	91.4-100%
Watches	97-99%	83-94%

Tipo di device: esterno (*wereable*: wrist band, ring, chest band, patch; *non-wereable*, single time point DHT), *(interno: ICM)*

Tipo di monitoraggio: 'patient-activated', ore, giorni, anni

Acquisizione: ECG, Holter, multiparametrica

Data reporting: continua, semi-continuo, intermittente

Tecnologia: fotopletismografica, 'ECG-based'

The Current State of Mobile Phone Apps for Monitoring Heart Rate, Heart Rate Variability, and Atrial Fibrillation: Narrative Review

Ka Hou Christien Li[#1,2,3], Francesca Anne White[#3], Timothy Tipoe[1,2], Tong Liu[4], Martin Cs Wong[5], Aaron Jesuthasan[3], Adrian Baranchuk[6], Gary Tse[#2,7], Bryan P Yan[7,8,9]

Mobile health technologies are rapidly developing for AF detection and other purposes (>100 000 mHealth apps and ≥400 wearable activity monitors are currently available).[197] Caution is needed in

Monitoraggio della salute cardiovascolare: letteratura scientifica

Walk Free

Registratore patch Holter ECG indossabile a 3 canali senza cavi.

Clickholter ECG

Piccolo, durevole e preciso: lo standard della cardiologia clinica.

Walk400h

Clickholter con capacità di registrazione fino a 7 giorni.

WebApp Global Repository

On premises
ECG WebApp Holter

ECGWebApp Holter

Gestisce l'intero flusso di lavoro Holter: referta, archivia e visualizza gli esami ECG Holter.

ECGWebApp Reporting

Report statistici in un click.

The NEW ENGLAND JOURNAL of MEDICINE

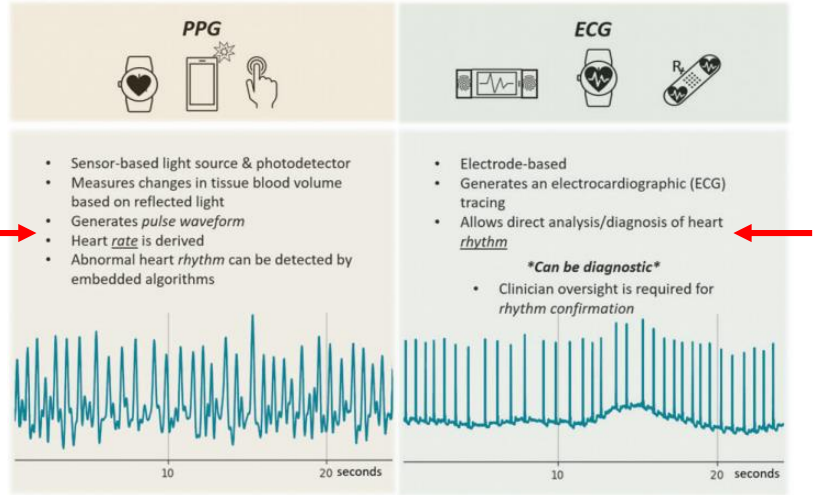
REVIEW ARTICLE

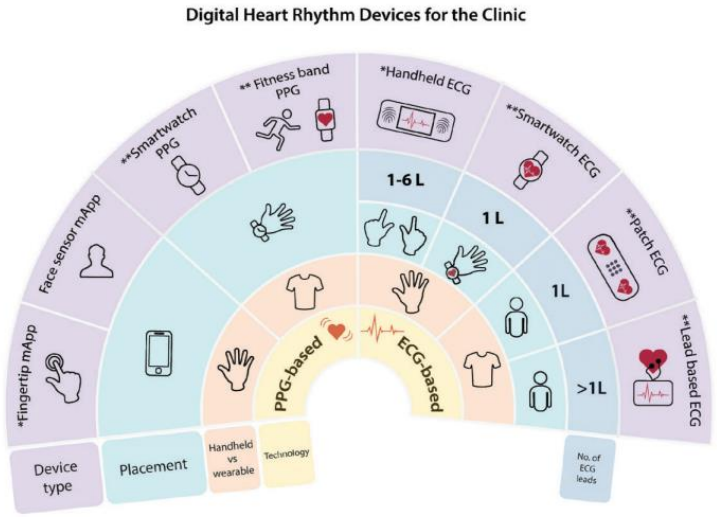
WEARABLE DIGITAL HEALTH TECHNOLOGIES IN MEDICINE

Stephen H. Friend, M.D., Ph.D., Geoffrey S. Ginsburg, M.D., Ph.D., Rosalind W. Picard, Sc.D., *Guest Editors*, and Jeffrey M. Drazen, M.D., *Editor*

Wearable Digital Health Technologies for Monitoring in Cardiovascular Medicine

Erica S. Spatz, M.D., M.H.S., Geoffrey S. Ginsburg, M.D., Ph.D., John S. Rumsfeld, M.D., Ph.D., and Mintu P. Turakhia, M.D., M.A.S.





*Some are CE marked with validated algorithms
** Majority are CE marked with validated algorithms

ESC European Society of Cardiology
Europace (2022) **24**, 979–1005
https://doi.org/10.1093/europace/euac038

POSITION PAPER
EHRA practical guide

How to use digital devices to detect and manage arrhythmias: an EHRA practical guide

Emma Svennberg[1], Fleur Tjong[2], Andreas Goette[3,4], Nazem Akoum[5], Luigi Di Biase[6], Pierre Bordachar[7], Giuseppe Boriani[8], Haran Burri[9], Giulio Conte[10], Jean-Claude Deharo[11,12], Thomas Deneke[13], Inga Drossart[14,15], David Duncker[16], Janet K. Han[17], Hein Heidbuchel[18,19], Pierre Jais[20], Marcio Jansen de Oliveira Figueiredo[21], Dominik Linz[22], Gregory Y.H. Lip[23,24], Katarzyna Malaczynska-Rajpold[25], Manlio F. Márquez[26,27], Corrette Ploem[28], Kyoko Soejima[29], Martin K. Stiles[30], Eric Wierda[31], Kevin Vernooy[32], Christophe Leclercq[33]

Courtesy of Cardioline. Via Linz 151 -38121 Trento, Italia.

Monitoraggio della salute cardiovascolare e innovazioni tecnologiche: applicazioni al vigile del fuoco. Letteratura scientifica.

Sensors (Basel). 2024 Apr 2;24(7):2273. doi: 10.3390/s24072273.

Integrated Portable and Stationary Health Impact-Monitoring System for Firefighters

Panagiotis Lioliopoulos [1], Panagiotis Oikonomou [1], Georgios Boulougaris [1], Kostas Kolomvatsos [1]

Smart Garments for Emergency Operators: the ProeTEX Project

D. Curone, E. L. Secco, A. Tognetti, G. Loriga, G. Dudnik, M. Risatti, R. Whyte, A. Bonfiglio, G. Magenes, *Member, IEEE*

Annu Int Conf IEEE Eng Med Biol Soc. 2010:2010:3594-7. doi: 10.1109/IEMBS.2010.5627452.

Fire fighters and rescuers monitoring through wearable sensors: The ProeTEX project

Giovanni Magenes [1], Davide Curone, Laura Caldani, Emanuele Lindo Secco

- *to monitor the health state of emergency operators during their activities in harsh environments*

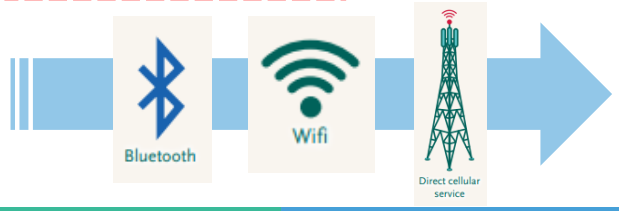
Med Pr. 2018 Jan 1;69(1):1-11. doi: 10.13075/mp.5893.00591. Epub 2017 Nov 24.

Verification of electronic device technology for measurement and evaluation of thermal exposure of fire fighters and members of rescue teams

Šárka Bernatíková [1], Hana Tomášková [2], Marek Bužga [3], Zdeněk Jirák [3], Petr Novák [4], Ján Babjak [4], Tomáš Kot [4], Václav Krys [4], Ladislav Jánošík [5]

Fig 1. Left panel: Civil Protection IG; right panel Fire-Fighters IG.

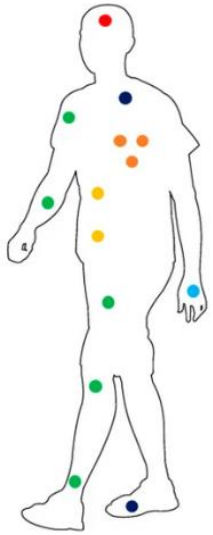
Fig 2. Details of the Fire-Fighters Inner Garment worn by an operator.



Abstract—Financed by the European Commission, a consortium of 23 European partners, consisting of universities, research institutions, industries and organizations operating in the field of emergency management, is developing a new generation of "smart" garments for emergency-disaster personnel. Garments integrate newly developed wearable and textile solutions as like as commercial portable sensors and devices, in order to continuously monitor risks endangering rescuers' lives. The system enables detection of health state parameters of the users (heart rate, breathing rate, body temperature, blood oxygen saturation, position, activity and posture) and environmental variables (external temperature, presence of toxic gases and heat flux passing through the garments), to process data and remotely transmit useful information to the operation manager.

The European Integrated Project, called ProeTEX (Protection e-Textiles: Micro-Nano-Structured fiber systems for Emergency-Disaster Wear) started on February, 2006 and will end on July, 2010. During this 4.5 years period, three subsequent generations of sensorized garments are being released. This article proposes an overview of the project and gives a description of the second generation prototypes, delivered at the end of 2008.

Monitoraggio della salute cardiovascolare e innovazioni tecnologiche: applicazioni al vigile del fuoco. Focus su parametri.



- EEG sensors
- ECG sensors
- Respiratory sensors
- Inertial Measurments Units (IMUs)
- Pulse Oximeter
- Other sensors (Temperature, Sweat)

- HR and HRV;
- QRS complexes comparison;
- P, T waves and related segments.

ARTICLE

Heart Rate Variability

Standards of Measurement, Physiological Interpretation, and Clinical Use

Task Force of the European Society of Cardiology the North American Society of Pacing Electrophysiology

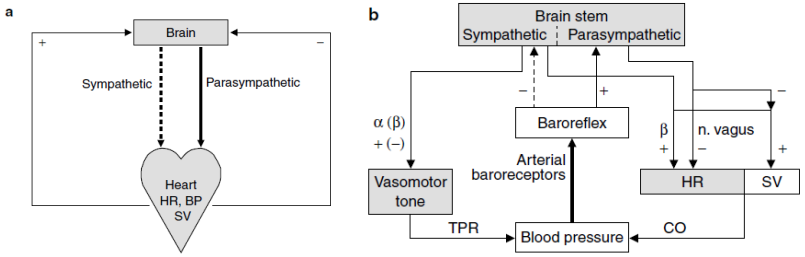
Decreased Heart Rate Variability and Its Association with Increased Mortality After Acute Myocardial Infarction

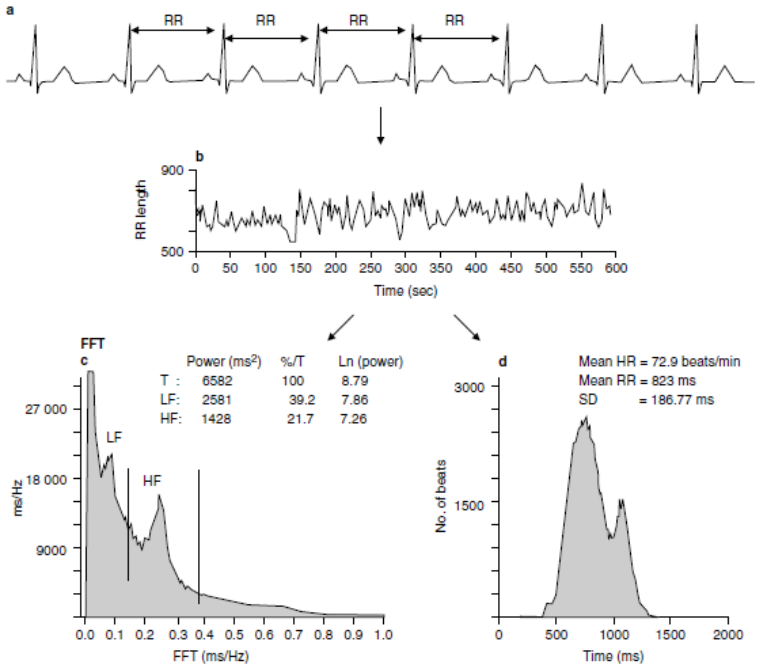
ROBERT E. KLEIGER, MD, J. PHILIP MILLER, AB, J. THOMAS BIGGER, Jr., MD, ARTHUR J. MOSS, MD, and the MULTICENTER POST-INFARCTION RESEARCH GROUP*

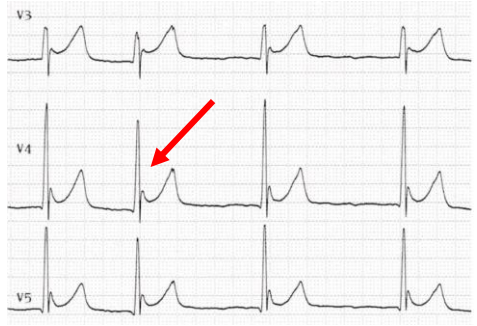
Heart Rate Variability in Athletes

André E. Aubert, Bert Seps and *Frank Beckers*

Laboratory of Experimental Cardiology, School of Medicine, K.U. Leuven, Leuven, Belgium







ECG Changes in Hypothermia

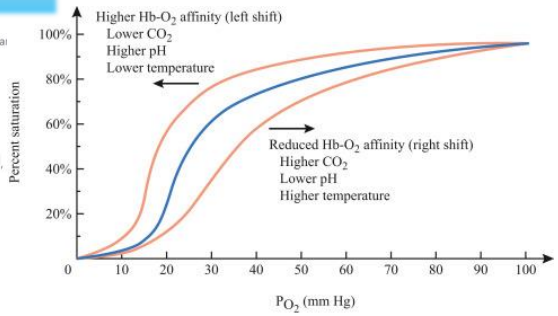
- Bradyarrhythmias
- Osborne Waves (= J waves)
- Prolonged PR, QRS and QT intervals
- Shivering artefact
- Ventricular ectopics
- Cardiac arrest due to VT, VF or asystole

- oxygen saturation;
- minute ventilation.

> Am J Emerg Med. 2018 Sep;36(9):1561-1564. doi: 10.1016/j.ajem.2018.01.029. Epub 2018 Jai

Cardiorespiratory dynamics of rescuers during cardiopulmonary resuscitation in a hypoxic environment

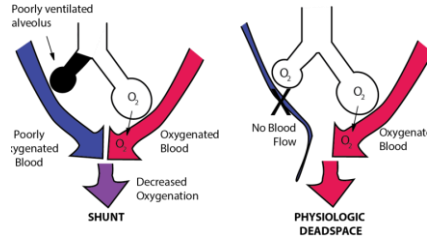
Tomonobu Sato [1], Tomonori Takazawa [2], Masahiro Inoue [1], Yasunori Tada [1], Takashi Suto [1], Masaru Tobe [1], Shigeru Saito [1]

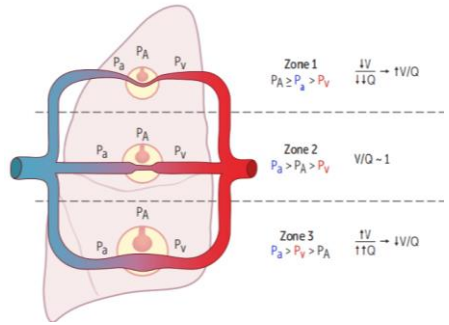


> Am Rev Respir Dis. 1977 Nov;116(5):919-43. doi: 10.1164/arrd.1977.116.5.919.

State of the art: ventilation-perfusion relationships

J B West





"Smart Textiles and Sensorized Garments for Physiological Monitoring: A Review of Available Solutions and Techniques". Angelucci A. et al. Sensors. 2021, 21(3), 814

Monitoraggio della salute cardiovascolare e innovazioni tecnologiche: applicazioni al vigile del fuoco. Cenni di sorveglianza sanitaria.

Concerning the surveillance of civil emergency operators, some interesting applications are represented by the sensorized jackets for fire-fighters developed by the Danish companies Viking Life-Saving Equipment A/S [10] and Systematic Software Engineering A/S [11]: the former allows to detect potentially critical heat levels for the wearer by means of temperature sensors integrated in its internal and external textile layers, the latter integrates sensors for physiological state monitoring (heart rate, body temperature and activity detection sensors) as like as for equipment monitoring (oxygen level in tanks) and rescuer location. In the last decade, the European Commission identified this emerging research branch as a major topic in the ICT field, funding projects under the Fifth

Journal of the American Heart Association
Volume 11, Issue 7, 5 April 2022
https://doi.org/10.1161/JAHA.121.022543

ORIGINAL RESEARCH

Association Between Atrial Fibrillation and Occupational Exposure in Firefighters Based on Self-Reported Survey Data

CLINICAL PERSPECTIVE

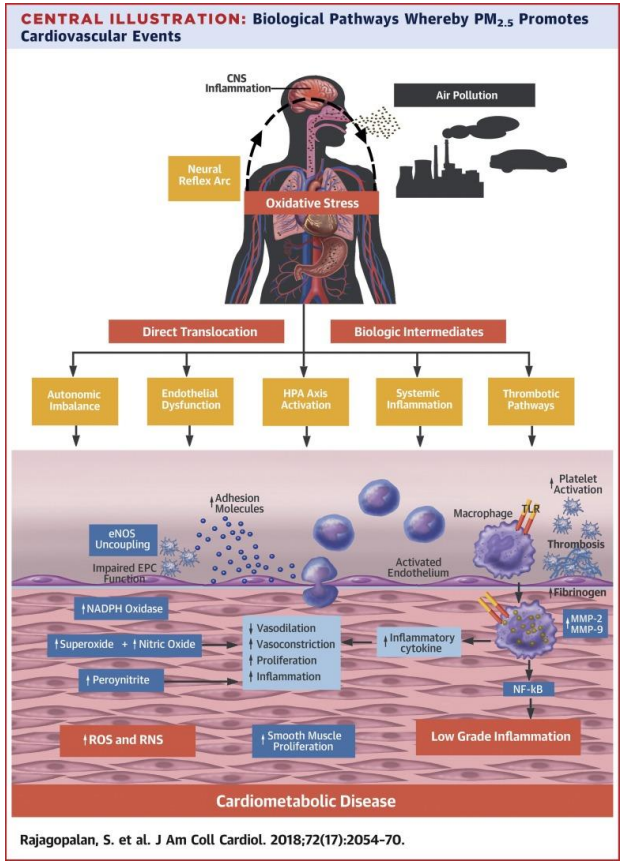
What Is New?

- In this survey-based study of 10 860 firefighters, an increased prevalence of atrial fibrillation was observed among firefighters with increased fire exposure as measured by fires fought per year (0–5 fires per year 2%, 6–10 fires per year 2.3%, 11–20 fires per year 2.7%, 21–30 fires per year 3%, 31 or more fires per year 4.5%; $P<0.001$).
- In a multivariable analysis, fires fought per year was a risk factor for atrial fibrillation (odds ratio 1.14 [95% CI, 1.04–1.25]; $P= 0.006$).

What Are the Clinical Implications?

- The association between atrial fibrillation and fire exposure is cause for concern.
- Further studies to elucidate the mechanisms are essential.

AF-related outcomes



Rajagopalan, S. et al. J Am Coll Cardiol. 2018;72(17):2054-70.

Courtesy of VIKING LIFE-SAVING EQUIPMENT A/S, Saedding Ringvej 13, 6710 Esbjerg, Denmark.
Courtesy of Systematic, Søren Frichs Vej 39, 8000 Aarhus C, Denmark.

Conclusioni

- L’assimilazione dell’attività del vigile del fuoco a “disciplina sportiva” (COCIS 2023) ha una finalità operativa fondamentale, costituendo un presupposto strumentale utile alla distinzione fra aspetti fisiologici e patologici.
- Le tecnologie di monitoraggio cardiovascolare hanno subito un’espansione negli ultimi decenni, in particolare nel settore medicale. D’altra parte, la letteratura scientifica riguardo il monitoraggio cardiovascolare nel settore della sicurezza (end-users: vigili del fuoco) è esigua.
- Alcuni prototipi, primariamente equipaggiati con sensori di monitoraggio cardiovascolare, sono stati validati in laboratorio. L’affinamento della sensoristica, basato sulla più ampia esperienza nel settore medicale e su considerazioni mediche fisiopatologiche, è auspicabile.
- Il monitoraggio ai fini della sicurezza sul lavoro offre spunti interessanti per analisi di sorveglianza sanitaria, sebbene l’affidabilità dei risultati richieda una metodologia pre-specificata.