



apresentam

REABILITAÇÃO PÓS-COVID-19: ASPECTOS CONCEITUAIS

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Professor Titular Aposentado do Centro de Ciências da Saúde e Esporte
(UDESC).**

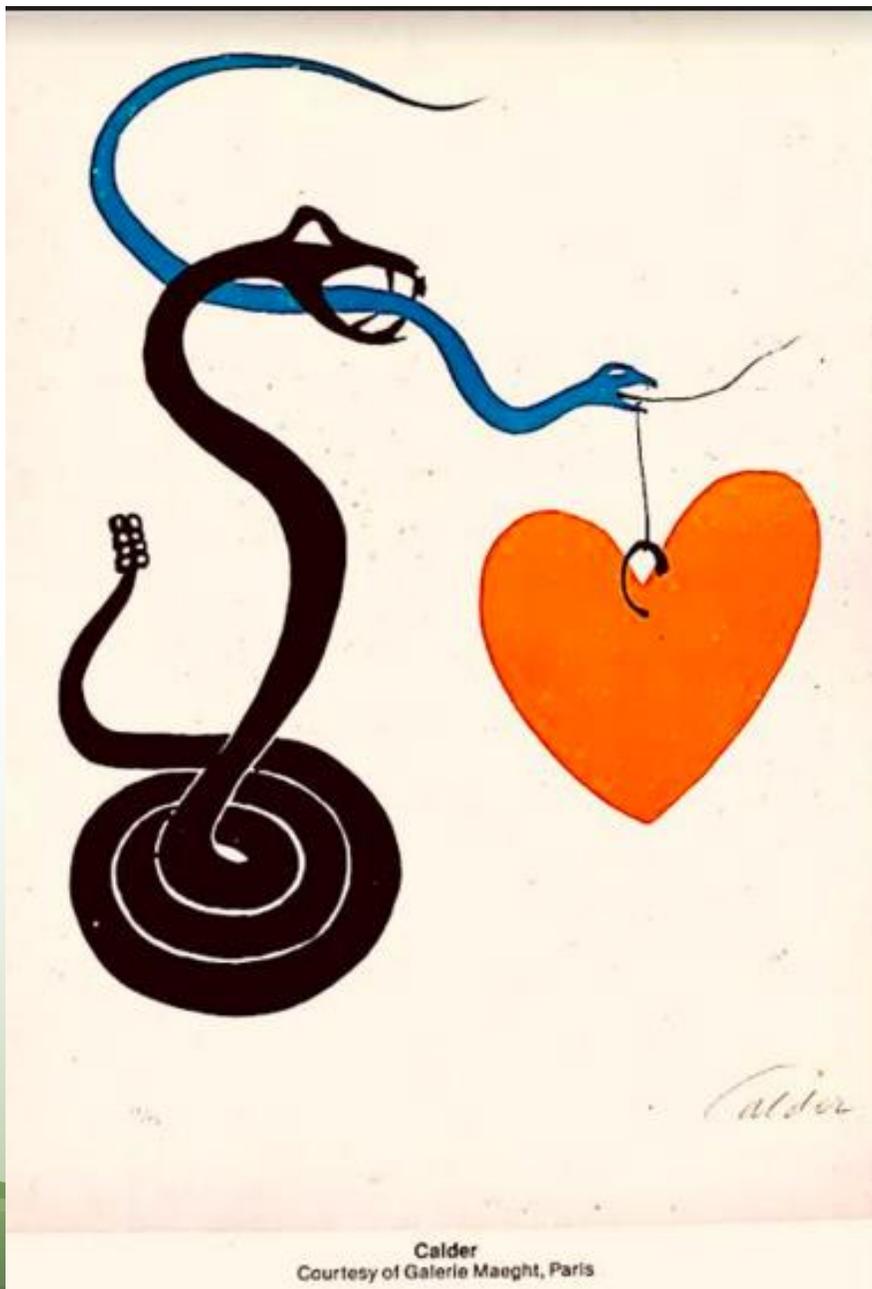
**Doutorado em Medicina pela Faculdade de Medicina da USP (Área de
Patologia).**

**Ex-Presidente da SBMEE e SBC/DERC.
Editor Chefe da Revista do DERC.**

INTRODUÇÃO

REABILITAÇÃO NA COVID-19

- ✓ Convencional ou baseada no exercício?
- ✓ Presencial ou domiciliar (remota)?
- ✓ Exercício moderado contínuo, intervalado moderado, intervalado intenso ou resistido?
- ✓ Quando considerar treinamento ventilatório, prática esportiva e a dança?
- ✓ Quando considerar a influência do meio ambiente?



Physical inactivity is associated with a higher risk for severe COVID-19 outcomes: a study in 48 440 adult patients

Sallis R, et al. Br J Sports Med 2021.

Hermann M et al. Feasibility and Efficacy of Cardiopulmonary Rehabilitation following COVID-19. Am J Phys Med Rehabil. 2020

Sobreviventes de COVID-19 grave costumam apresentar:

Grande limitação para as atividades da vida diária, necessitando de reabilitação multimodal com aplicação de conhecimentos específicos da área cardiovascular e pulmonar.

Grave comprometimento da função pulmonar, crítica polineuropatia, crítica miopatia e descondicionamento cardiorrespiratório.

Elevada prevalência de ansiedade e depressão.

Sarah De Biase et al. The COVID-19 rehabilitation pandemic. Age and Ageing; 2020.

PONTOS CHAVES:

A reabilitação pós-COVID-19 é complexa e requer abordagem interdisciplinar.

Mesmo na ausência da COVID-19, o descondicionamento físico e a fragilidade resultantes do auto-isolamento, medidas de proteção e distanciamento social também exigirão providências para a reabilitação física e emocional.

Para o atendimento do conjunto de suas necessidades e objetivos pessoais, os idosos precisam de acesso aos serviços de reabilitação em tempo hábil.

Os serviços de reabilitação precisam se preparar para uma grande onda pós-pandêmica de idosos necessitados, consequência da demanda reprimida.

Sarah De Biase et al. The COVID-19 rehabilitation pandemic. Age and Ageing; 2020.

Key points:

Há necessidade de que sejam consideradas as eventuais necessidades de reabilitação, particularmente de **idosos com e sem COVID-19**, por meio de estratégias que permitam oferecer em **larga escala** um atendimento eficaz no mundo com a COVID-19.



Diretrizes

Diretriz Brasileira de Reabilitação Cardiovascular – 2020

Carvalho T, Milani M et al. Arq Bras Cardiol. 2020;114(5):943-87.

REABILITAÇÃO CARDIOPULMONAR E METABÓLICA

Principais condições clínicas TRATADAS com a prática regular de exercícios físicos
(reabilitação*)

* Sinônimo de tratamento

Doença aterosclerótica coronariana

Hipertensão arterial sistêmica

Insuficiência cardíaca

Doença vascular periférica arterial e venosa

Diabetes mellitus tipo II

Síndrome metabólica

Obesidade

Ansiedade e depressão

Doença pulmonar crônica

Disfunção sexual

REABILITAÇÃO CARDIOPULMONAR E METABÓLICA

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Disfunção sexual

COVID-19



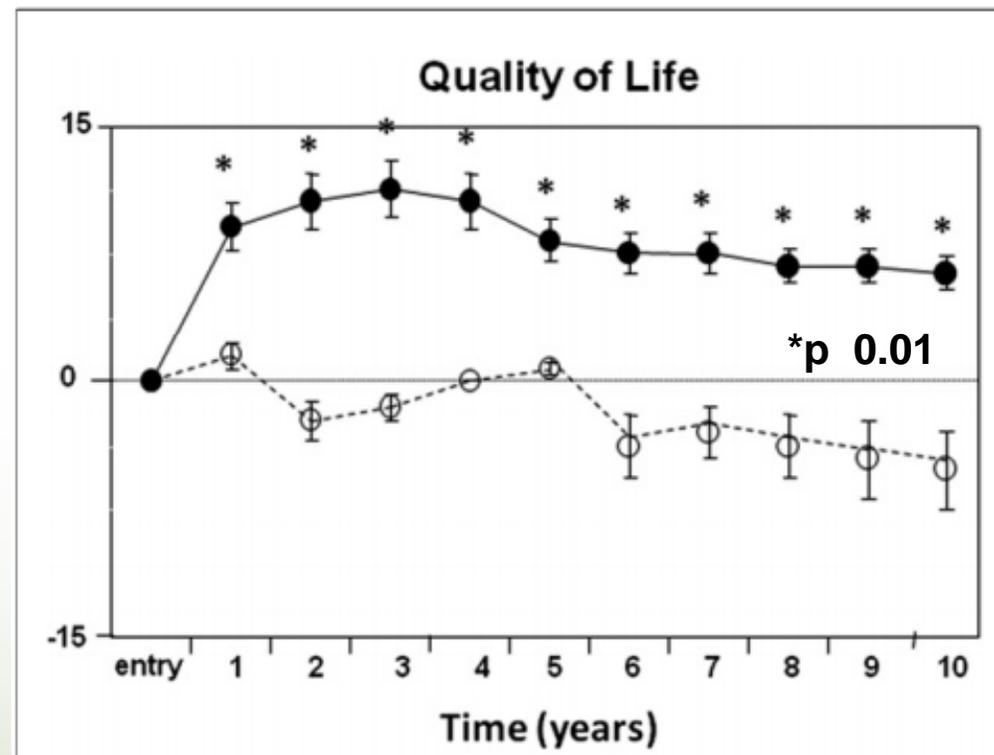
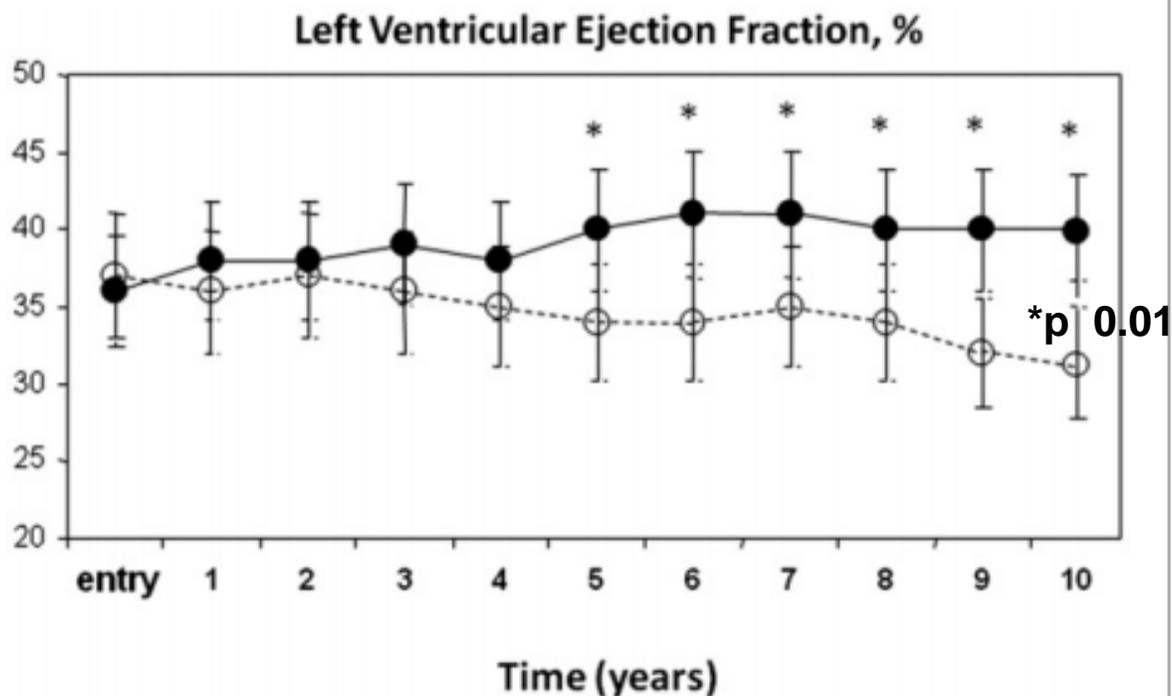
10-Year Exercise Training in Chronic Heart Failure



A Randomized Controlled Trial

Belardinelli et al. **Long-Term Exercise Training in Heart Failure.**

JACC Vol. 60, No. 16, 2012

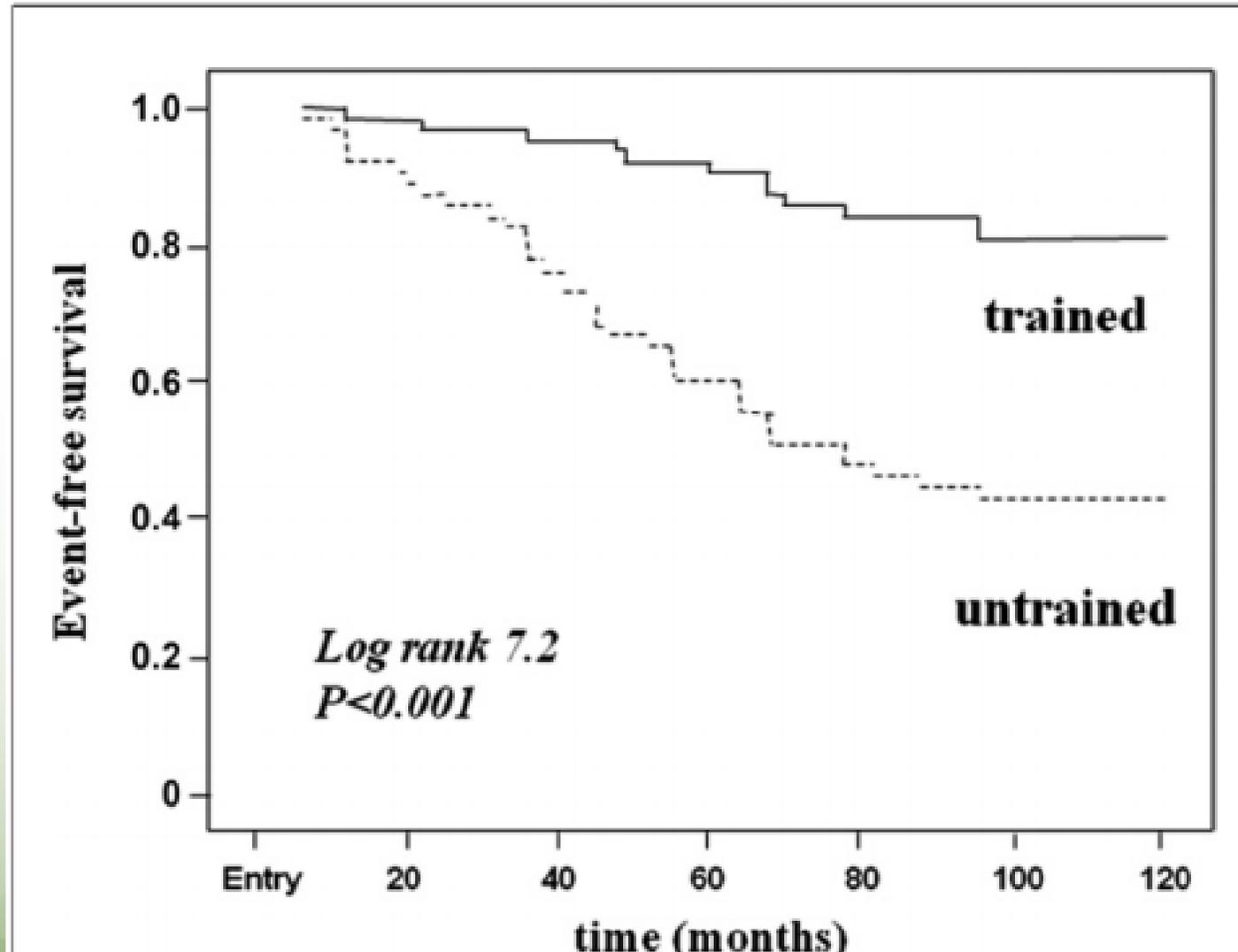


Trained patients (solid line) and controls (empty circles, dotted lines)

10-Year Exercise Training in Chronic Heart Failure

A Randomized Controlled Trial

Belardinelli et al. Long-Term Exercise Training in Heart Failure
JACC Vol. 60, No. 16, 2012



Exercise-Based Rehabilitation for Heart Failure

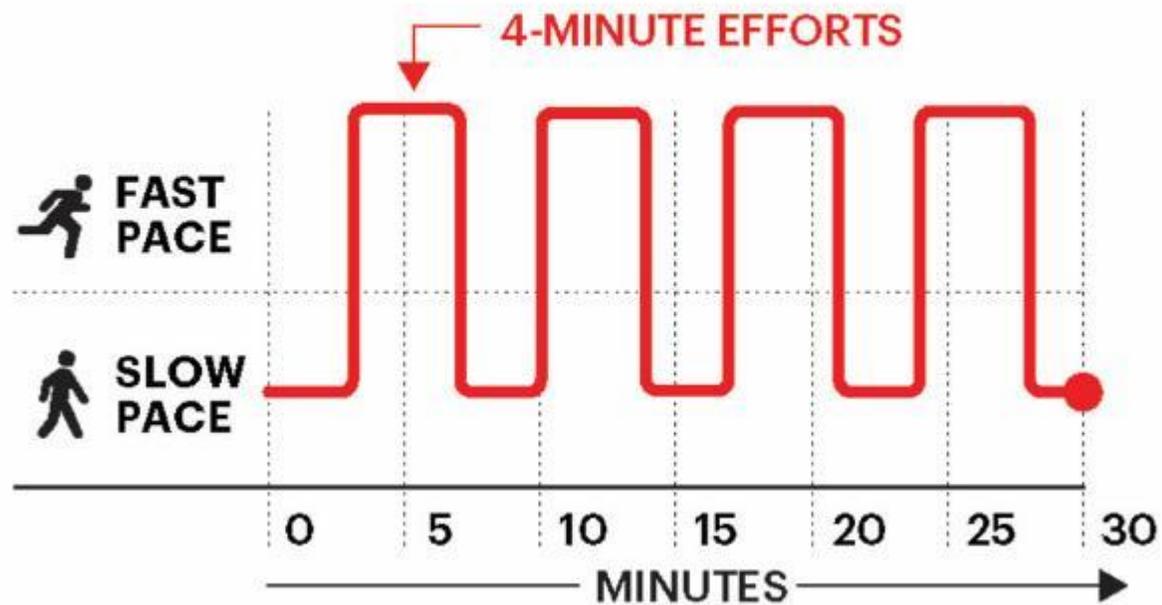
Taylor RS et al. **Cochrane Systematic Review, Meta-Analysis, and Trial Sequential Analysis.** JACC: HEART FAILURE VOL. 7, NO. 8, 2019

In HF patients, CR leads to:

Trends for reductions in total mortality in the longer term (>12 months, RR 0.88);

Significant reductions in total number of hospitalisations (up to 1 year follow-up, RR 0.70), and HF-specific hospitalisations (RR 0.59).

TREINAMENTO CONVENCIONAL NA INSUFICIÊNCIA CARDÍACA: MODERADO CONTÍNUO, INTERVALADO MODERADO, INTERVALADO DE ALTA INTENSIDADE.



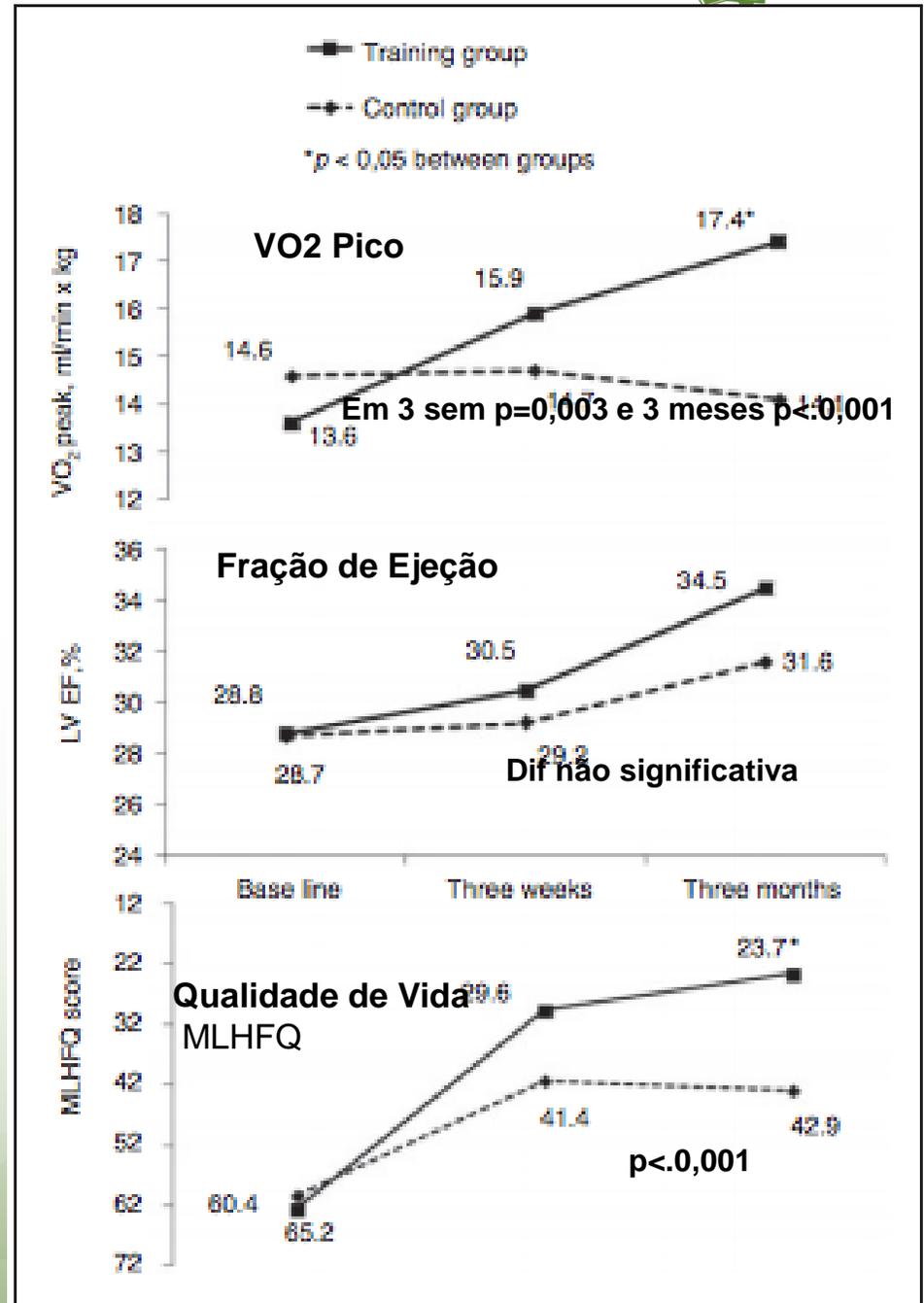
TREINAMENTO INTERVALADO DE MODERADA INTENSIDADE

Artem Doletsky et al. Interval training early after heart failure decompensation is safe and improves exercise tolerance and quality of life in selected patients. European Journal of Preventive Cardiology 2018, 25(1) 9-18

Aims: To evaluate safety and efficacy of moderate intensity interval exercise training early after heart failure decompensation on exercise tolerance and health-related quality of life (HRQoL).

Artem Doletsky et al. **Interval training early after heart failure decompensation is safe and improves exercise tolerance and quality of life in selected patients.**

European Journal of Preventive Cardiology 2018.
25(1), 9–18



Diretriz Brasileira de Reabilitação Cardiovascular – 2020

Carvalho T, Milani M et al. Arq Bras Cardiol. 2020;114(5):943-87.

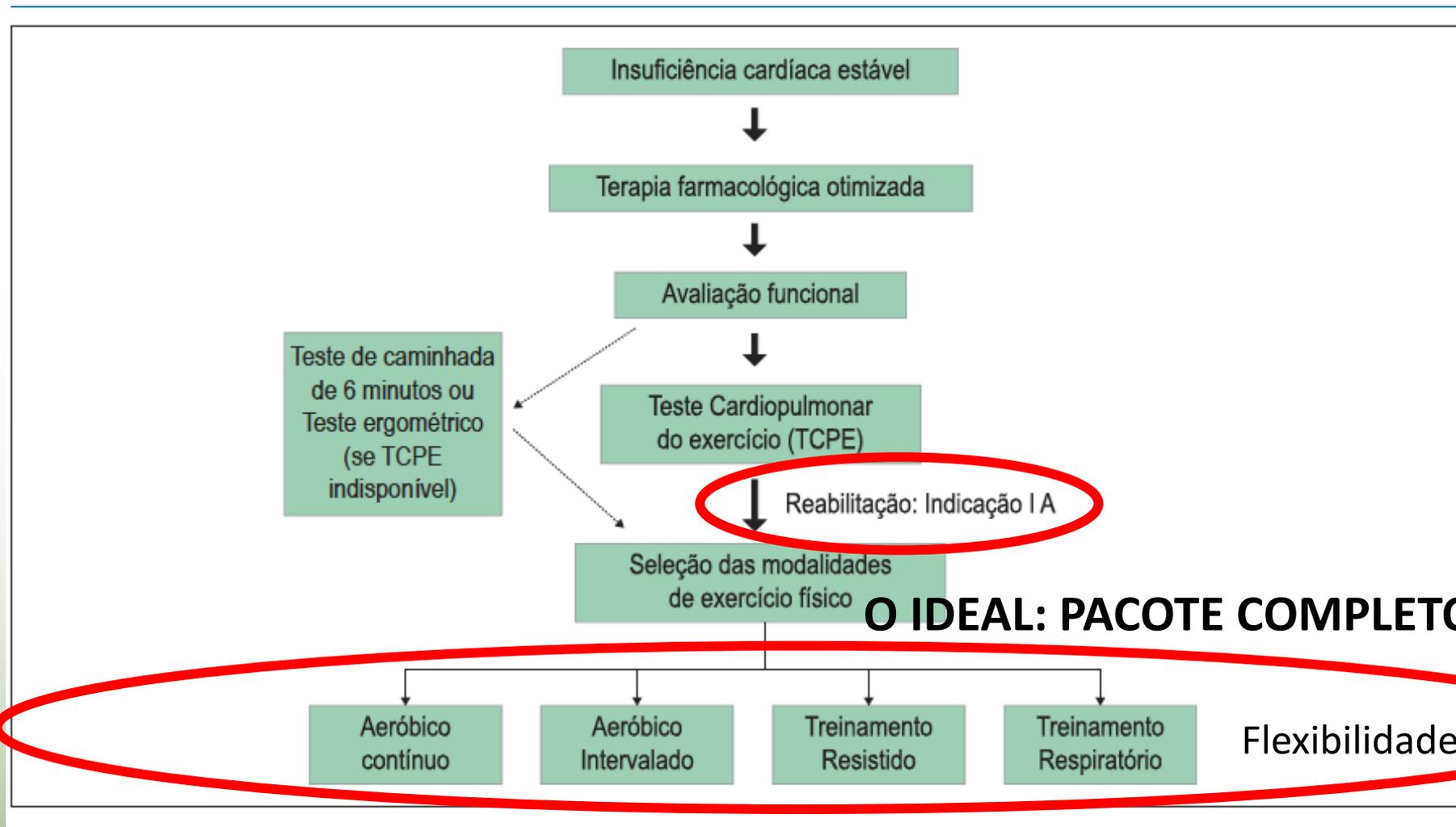
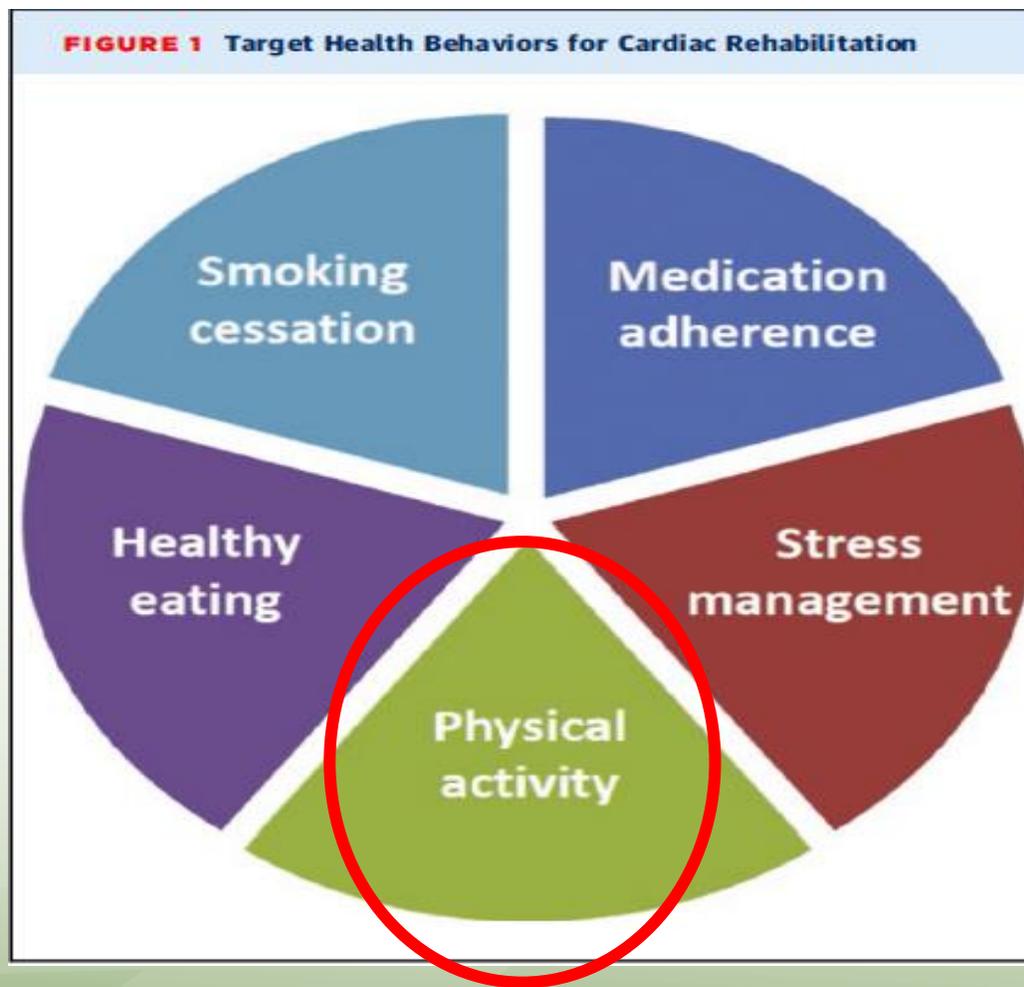


FIGURA 1. FLUXOGRAMA DA REAB CV NA INSUFICIÊNCIA CARDÍACA

Home-Based Cardiac Rehabilitation

A Scientific Statement From the American Association of Cardiovascular and Pulmonary Rehabilitation, the American Heart Association, and the American College of Cardiology **May 15, 2019**

FIGURE 1 Target Health Behaviors for Cardiac Rehabilitation





Home-based versus centre-based cardiac rehabilitation (Review). 2017

Anderson L, Sharp GA, Norton RJ, Dalal H, Dean SG, Jolly K, Cowie A, Zawada A, Taylor RS

ANGINA, IAM, RM, IC

23 trials , 2890 participants

**Sem diferença em relação à mortalidade,
eventos cardiovasculares, capacidade física e
qualidade de vida.**

COVID-19

RCV NA QUARENTENA, MAS SEM TEMPO A PERDER!

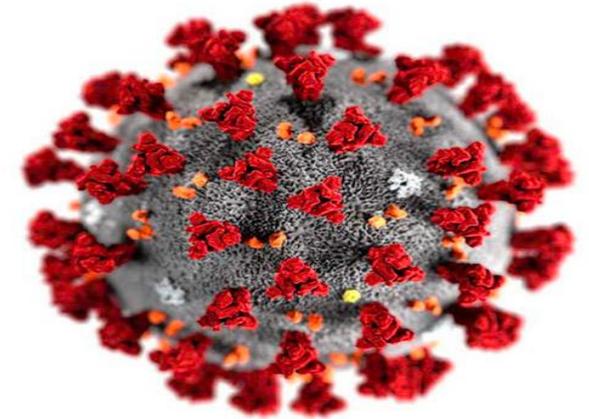


Fig. 2. Illustration of the SARS-CoV-2 virion [56].

Zhang YM et al. **The effects of different initiation time of exercise training on left ventricular remodeling and cardiopulmonary rehabilitation in patients with left ventricular dysfunction after myocardial infarction.** Disabil Rehabil. 2016;38(3):268-76.

Haykowsky M et al. **A meta-analysis of the effects of exercise training on left ventricular remodeling following myocardial infarction: start early and go longer for greatest exercise benefits on remodeling.** Trials. 2011;12:92.

COVID-19

RCV Domiciliar: A PRINCIPAL OPÇÃO!

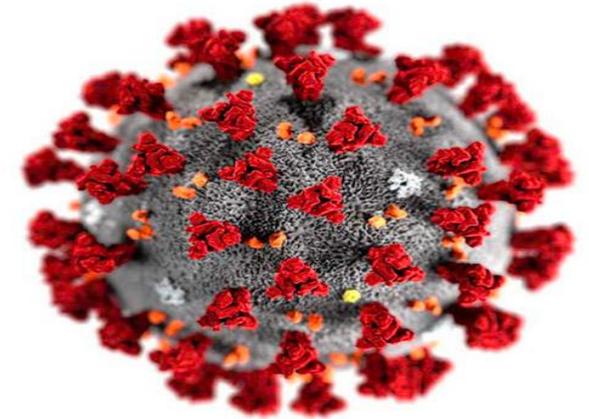


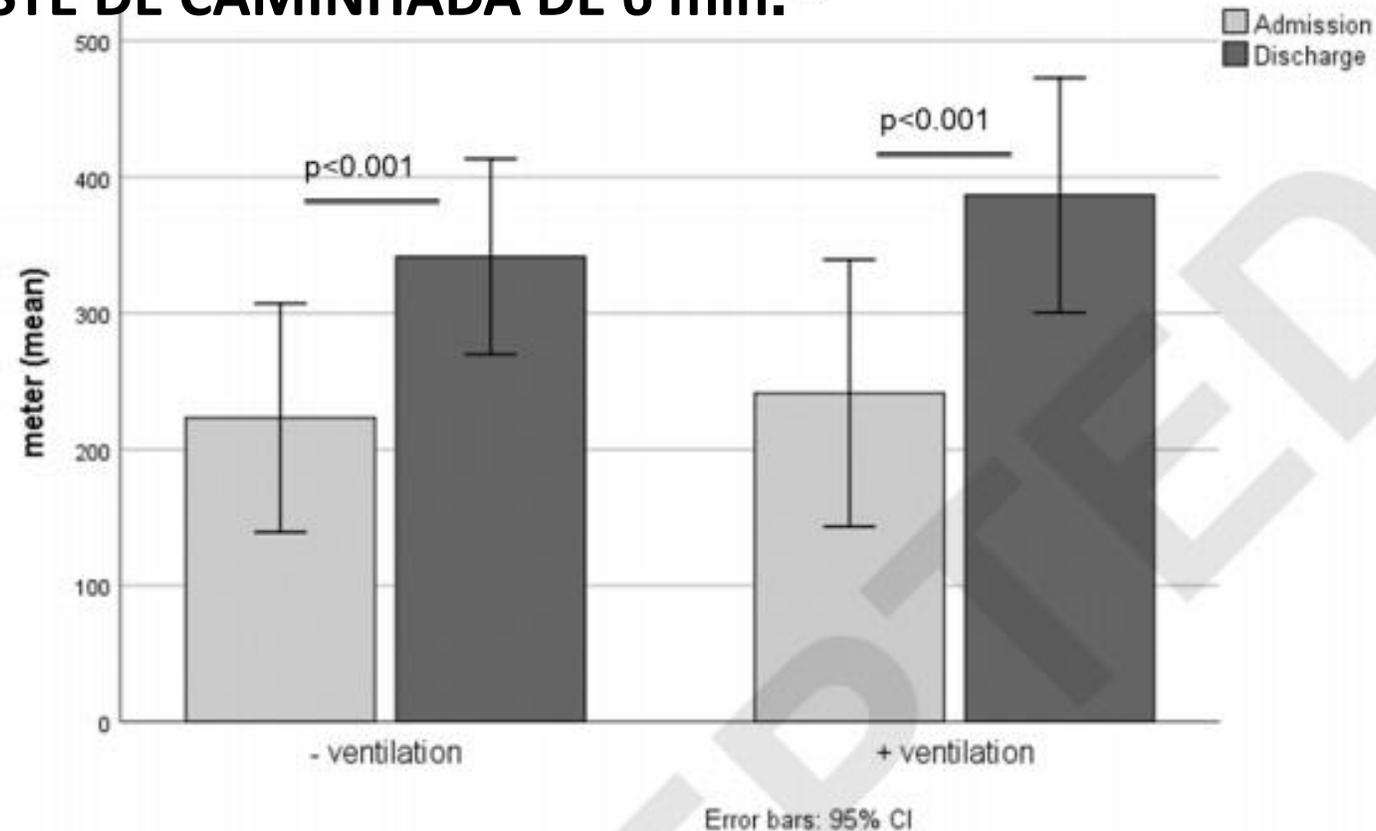
Fig. 2. Illustration of the SARS-CoV-2 virion [56].

Drwal KR et al. **Cardiac Rehabilitation During COVID-19 Pandemic: Highlighting the Value of Home-Based Programs**. Telemed J E Health. 2020.

Lavie CJ et al. **Expanding traditional cardiac rehabilitation in the 21st century**. J Am Coll Cardiol 2020;75:1562-4.

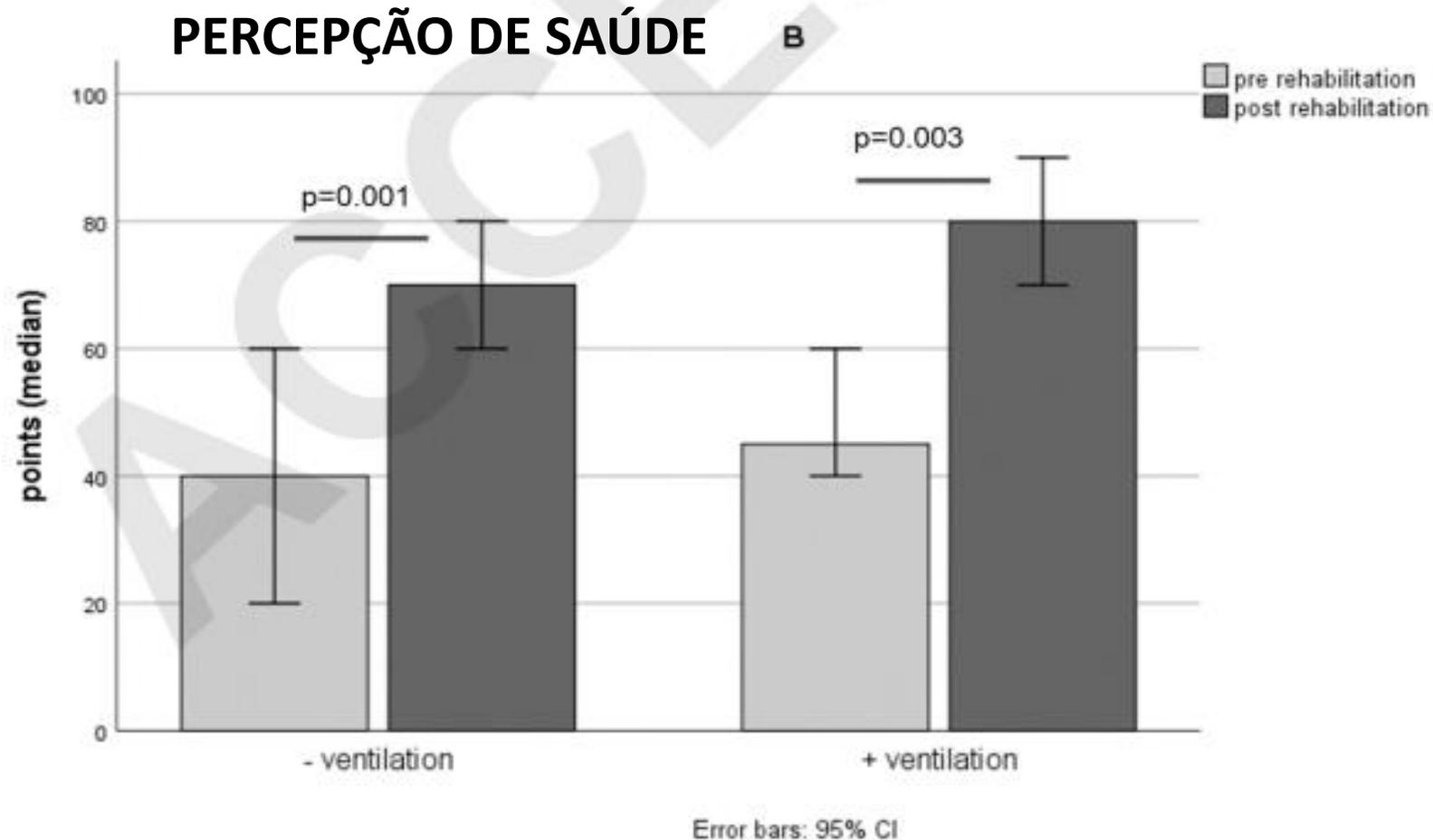
Hermann M et al. Feasibility and Efficacy of Cardiopulmonary Rehabilitation following COVID-19. Am J Phys Med Rehabil. 2020.

Figure (A, B): change during rehabilitation. Improvement in 6-MWT (A) and Feeling Thermometer (B) **TESTE DE CAMINHADA DE 6 min.^A**



Hermann M et al. Feasibility and Efficacy of Cardiopulmonary Rehabilitation following COVID-19. Am J Phys Med Rehabil. 2020

Figure (A, B): change during rehabilitation. Improvement in 6-MWT (A) and Feeling Thermometer (B)

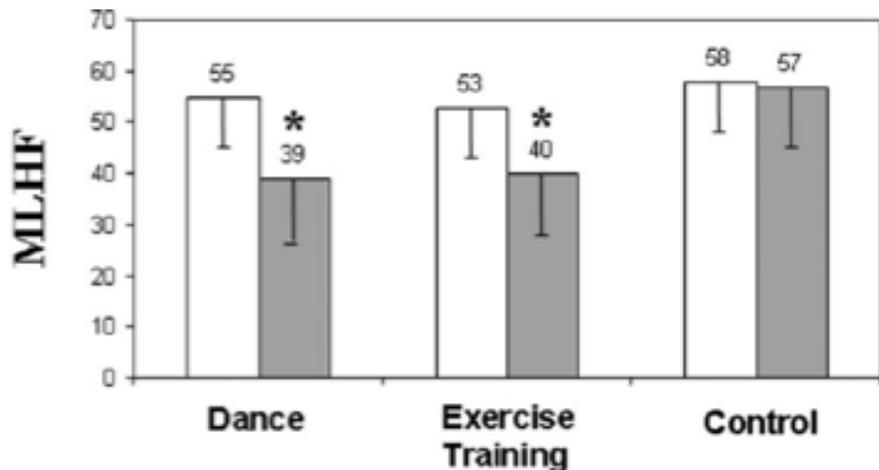


Hermann M et al. Feasibility and Efficacy of Cardiopulmonary Rehabilitation following COVID-19. Am J Phys Med Rehabil. 2020

Em conclusão:

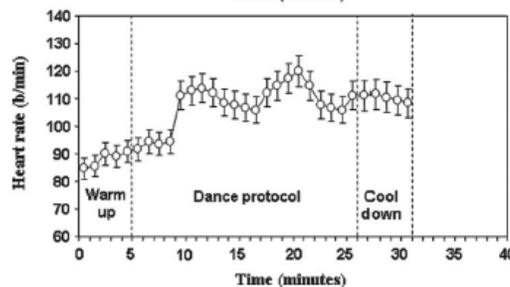
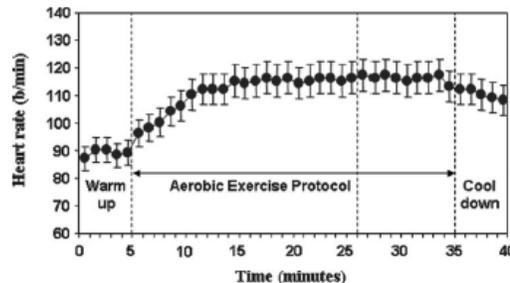
- A Reab Cardiopulmonar de pacientes PÓS-COVID-19 grave é segura, viável e eficaz.
- As melhorias no desempenho físico e da percepção positiva de saúde ocorreram independentes da necessidade de ventilação pulmonar prévia.

DANÇANDO NA REABILITAÇÃO

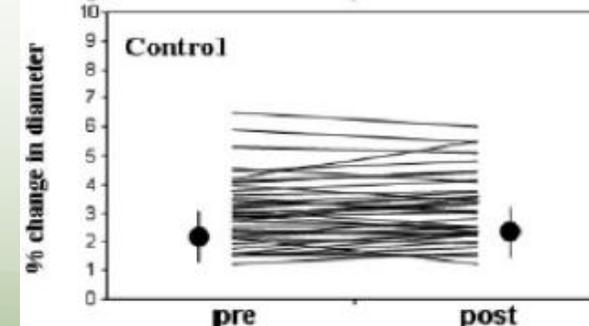
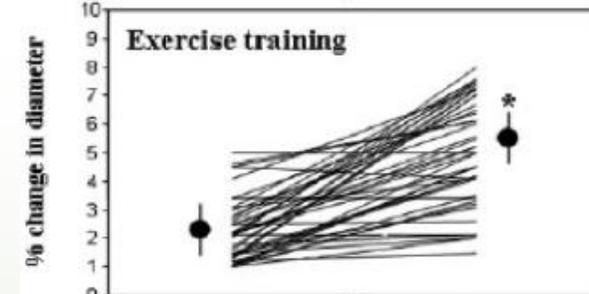
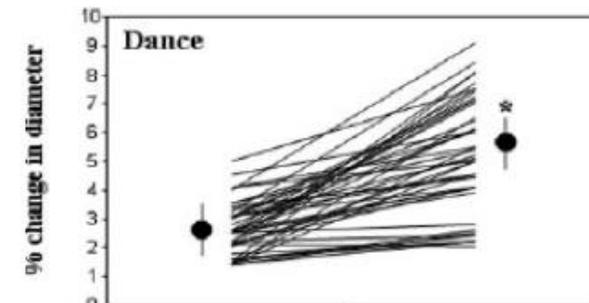


Waltz Dancing in Patients With Chronic Heart Failure: New Form of Exercise Training
Romualdo Belardinelli, Francesca Lacalaprice, Chiara Ventrella, Loretta Volpe and Ernesto Faccenda

RESPOSTA CRONOTRÓPICA



FUNÇÃO ENDOTELIAL



APTIDÃO CARDIORRESPIRATÓRIA

Table 2. Cardiopulmonary Exercise Testing Results

	Exercise Training		Dance		Control	
	Entry	8 wk	Entry	8 wk	Entry	8 wk
Peak $\dot{V}O_2$, mL/(kg·min)	16.5±4.5	19.6±4.5*	16.8±5.0	19.5±5.0*	16.1±4.5	15.8±4.5
$\dot{V}O_2AT$, mL/(kg·min)	9.8±3.2	11.9±3.0*	9.9±3.4	11.6±3.3*	9.6±3.0	9.4±3.0
$\dot{V}_E/\dot{V}CO_2$ slope	39.5±11	31.8±12*	38.8±12	32.5±12*	39.1±13	38.9±11
$\dot{V}O_2/W$ slope	8.3±1.5	9.5±1.3*	8.1±1.3	9.4±1.1*	8.4±1.1	8.3±1.1
Peak O_2 pulse, mL/beat	10.5±1.8	12.3±1.8*	10.7±1.7	12.6±1.7*	10.2±1.6	10.5±1.6
RER	1.18±0.9	1.20±1.0	1.17±0.8	1.20±0.9*	1.16±1.0	1.17±1.0
Peak heart rate, bpm	129±15	135±16*	131±14	138±16*	132±13	131±14
Systolic blood pressure, mm Hg	155±18	168±16*	150±20	165±20*	148±18	150±20

RER indicates respiratory exchange ratio.

*P<0.05 vs controls.



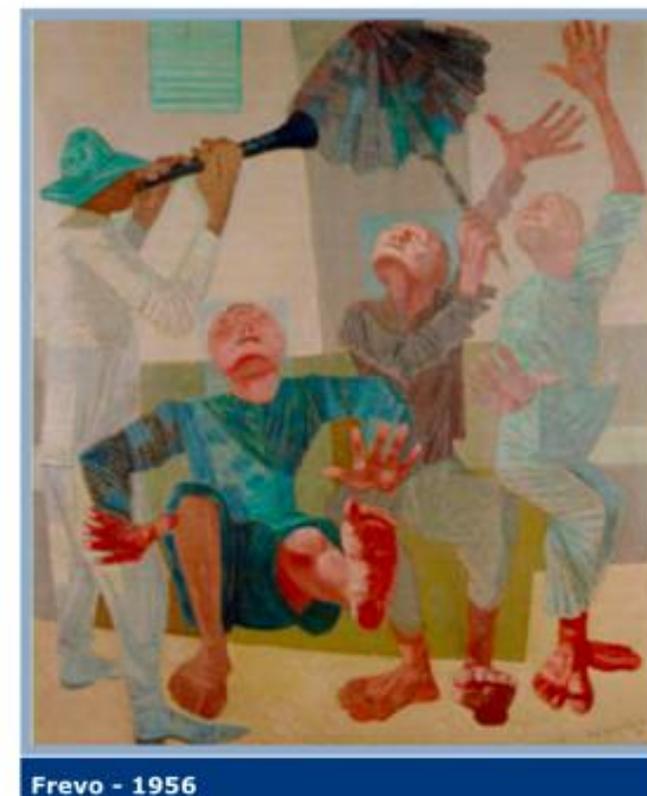
CMG3311.AVI



CMG3311.AVI

A DANÇA NA REABILITAÇÃO

Candido Portinari



Frevo - 1956

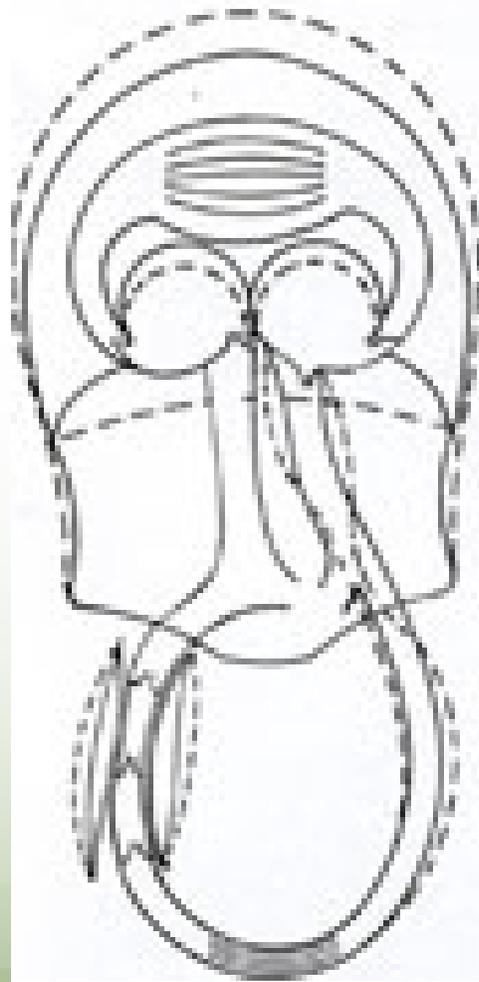


EXERCÍCIOS VENTILATÓRIOS

Publicações SBC

CAMINHOS DA CARDIOLOGIA

Os seis corações do homem: Um ensaio



Mário Rigatto, meu Mestre
(28/12/1928 ³/₄ 17/1/2000)





Hulzebos EHJ, Smit Y, Helders PPJM, van Meeteren NLU



Treinamento muscular inspiratório no pré-operatório imediato de cirurgia de revascularização miocárdica reduz complicações pulmonares.

Bonorino KC, Panigas TF e Carvalho T.

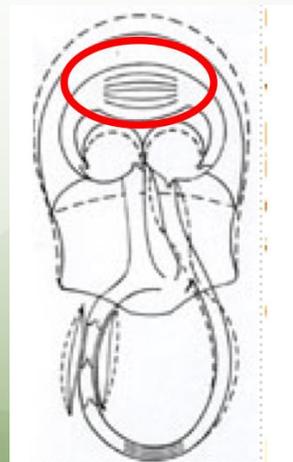
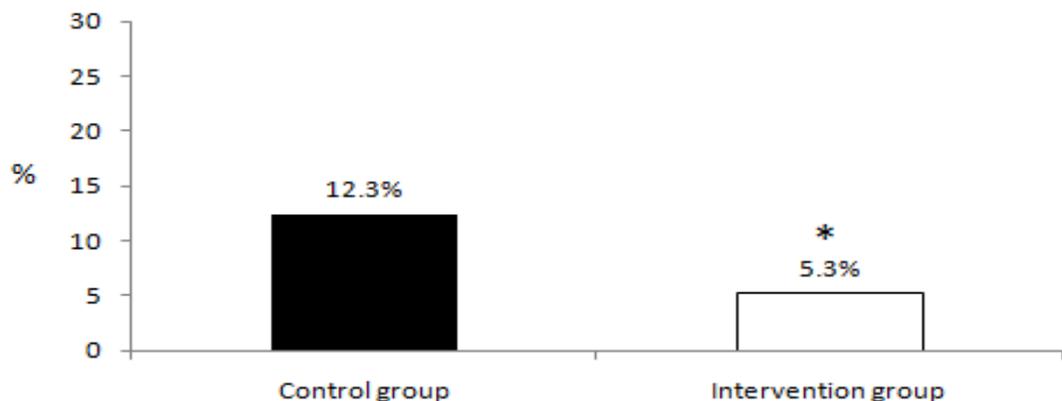


Figure 1

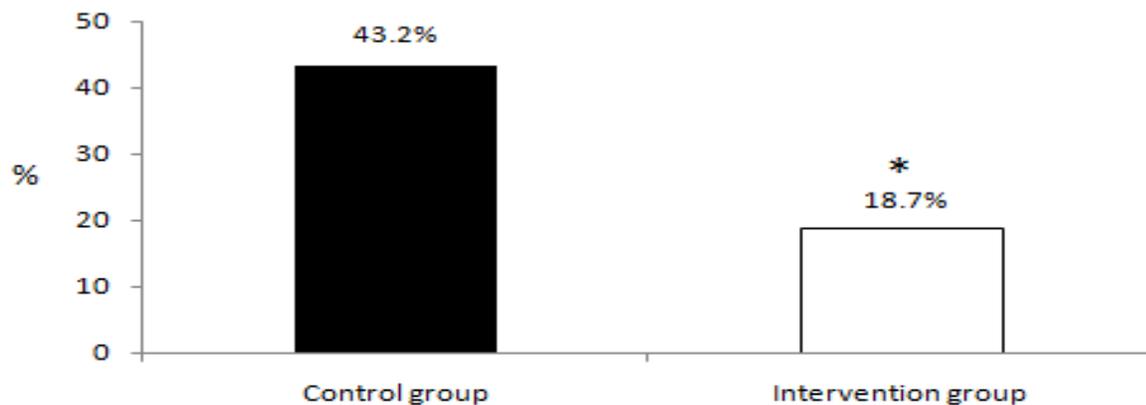
Incidence pneumonia



* p<0.05

Figure 2

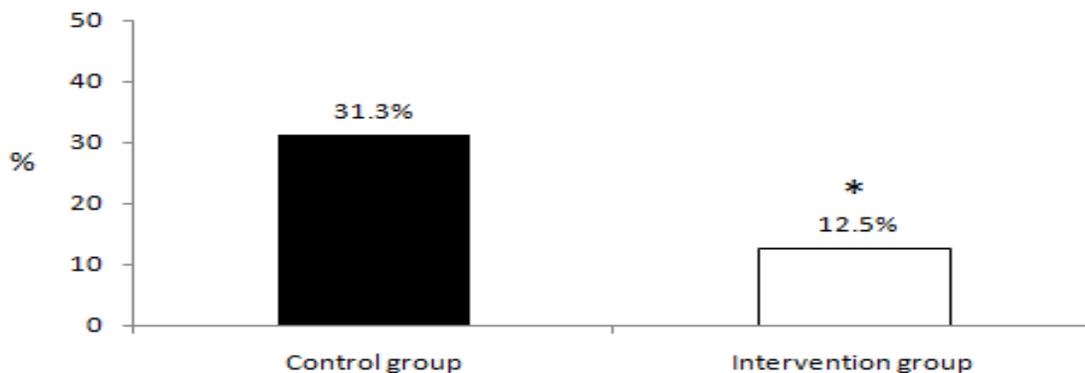
Incidence atelectasis



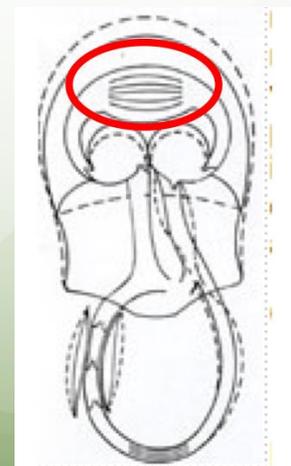
* p<0.05

Figure 3

Incidence pleural effusion



* p<0.05



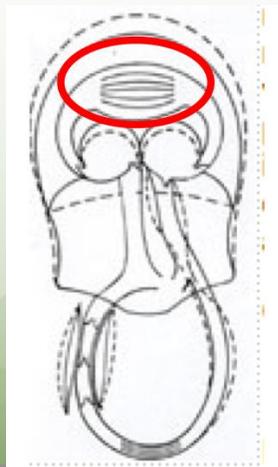
Int J Cardiol. 2013 Aug 20;167(4):1502-7. doi: 10.1016/j.ijcard.2012.04.029. Epub 2012 May 3.

Efficacy of inspiratory muscle training in chronic heart failure patients: a systematic review and meta-analysis.

Smart NA¹, Giallauria F, Dieberg G.

META-ANÁLISE

Os exercícios ventilatórios (inspiratórios) melhoram a aptidão cardiorrespiratória e a QV em uma magnitude semelhante ao treinamento físico convencional, sendo uma boa alternativa inicial para os pacientes com ICC mais debilitados, que posteriormente poderão fazer a transição para o treinamento convencional.



Kai Liu et al. Respiratory rehabilitation in elderly patients with COVID-19: A randomized controlled study.

Complementary Therapies in Clinical Practice 39 (2020) 101166

- ✓ **Objective:** To investigate the effects of 6-week respiratory rehabilitation training on respiratory function, QoL, mobility and psychological function in elderly patients with COVID-19.
- ✓ **Primary Outcome Measures:** Respiratory function.
- ✓ **Secondary Outcome Measures:** Exercise endurance (6-min walk distance), ADL and Mol, psychological status assessment (anxiety, depression scores).

Kai Liu et al. Respiratory rehabilitation in elderly patients with COVID-19: A randomized controlled study.

Complementary Therapies in Clinical Practice 2020

- ✓ **Respiratory muscle training:** With a hand-held resistance device, three sets with 10 breaths in each set; parameters were set at 60% of the individual's maximal expiratory mouth pressure, with a rest period of 1 min between the two sets.
- ✓ **Cough exercises:** Three sets of 10 active coughs.
- ✓ **Diaphragmatic training:** Thirty maximal voluntary diaphragmatic contractions in the supine position, placing a medium weight (1–3 kg) on the anterior abdominal wall to resist diaphragmatic descent.
- ✓ **Stretching exercises:** The respiratory muscles are stretched under the guidance of a rehabilitation therapist.
- ✓ **Home exercises:** subjects were instructed in pursed-lip breathing and coughing training, and asked to undergo 30 sets per day.

Kai Liu et al. Respiratory rehabilitation in elderly patients with COVID-19: A randomized controlled study. Complementary Therapies in Clinical Practice 39 (2020) 101166

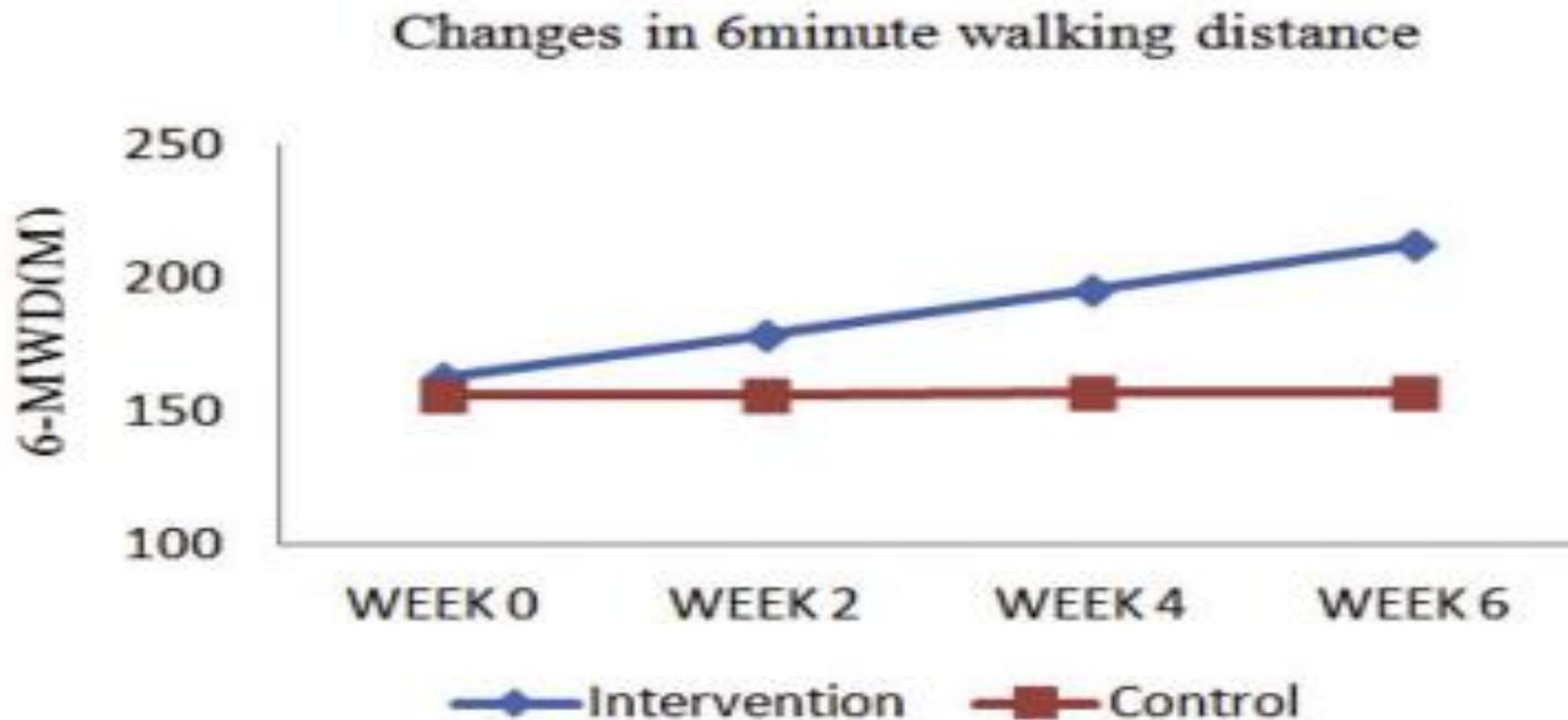


Fig. 3. Changes in 6 min walking distance over a 6 week time frame for the full cohort of patients.

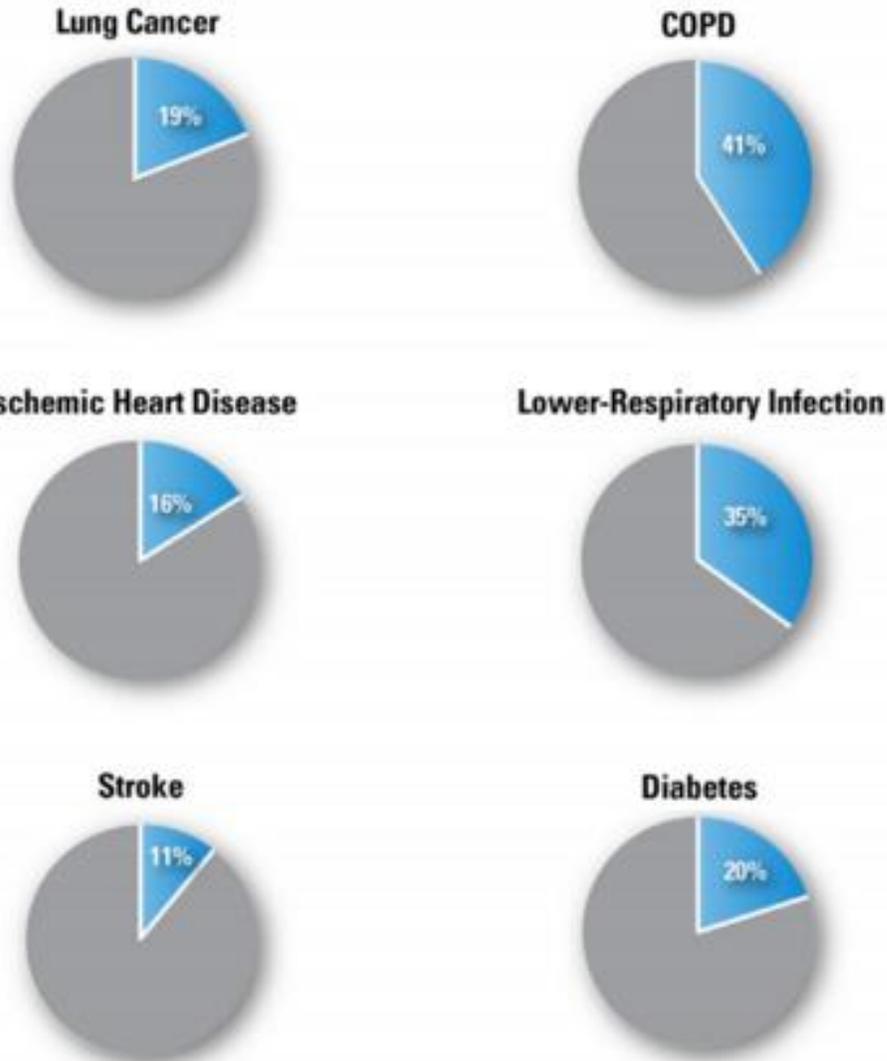
**Kai Liu et al. Respiratory rehabilitation in elderly patients
with COVID-19: A randomized controlled study.
Complementary Therapies in Clinical Practice 39 (2020)
101166**

Conclusões:

Em idosos com COVID-19, seis semanas de reabilitação cardiorrespiratória melhorou a função pulmonar e a QV, reduziu a ansiedade, mas não proporcionou mudança significativa da depressão.

MEIO AMBIENTE

Figure 10. Percentages of global deaths from specific diseases attributable to air pollution in 2017.



Air pollution exposure is linked with increased hospitalizations, disability, and early death from respiratory diseases, heart disease, stroke, lung cancer, and diabetes, as well as communicable diseases like pneumonia.

(COPD = chronic obstructive pulmonary disease.) Explore the data further at the [IHME/GBD Compare site](#).

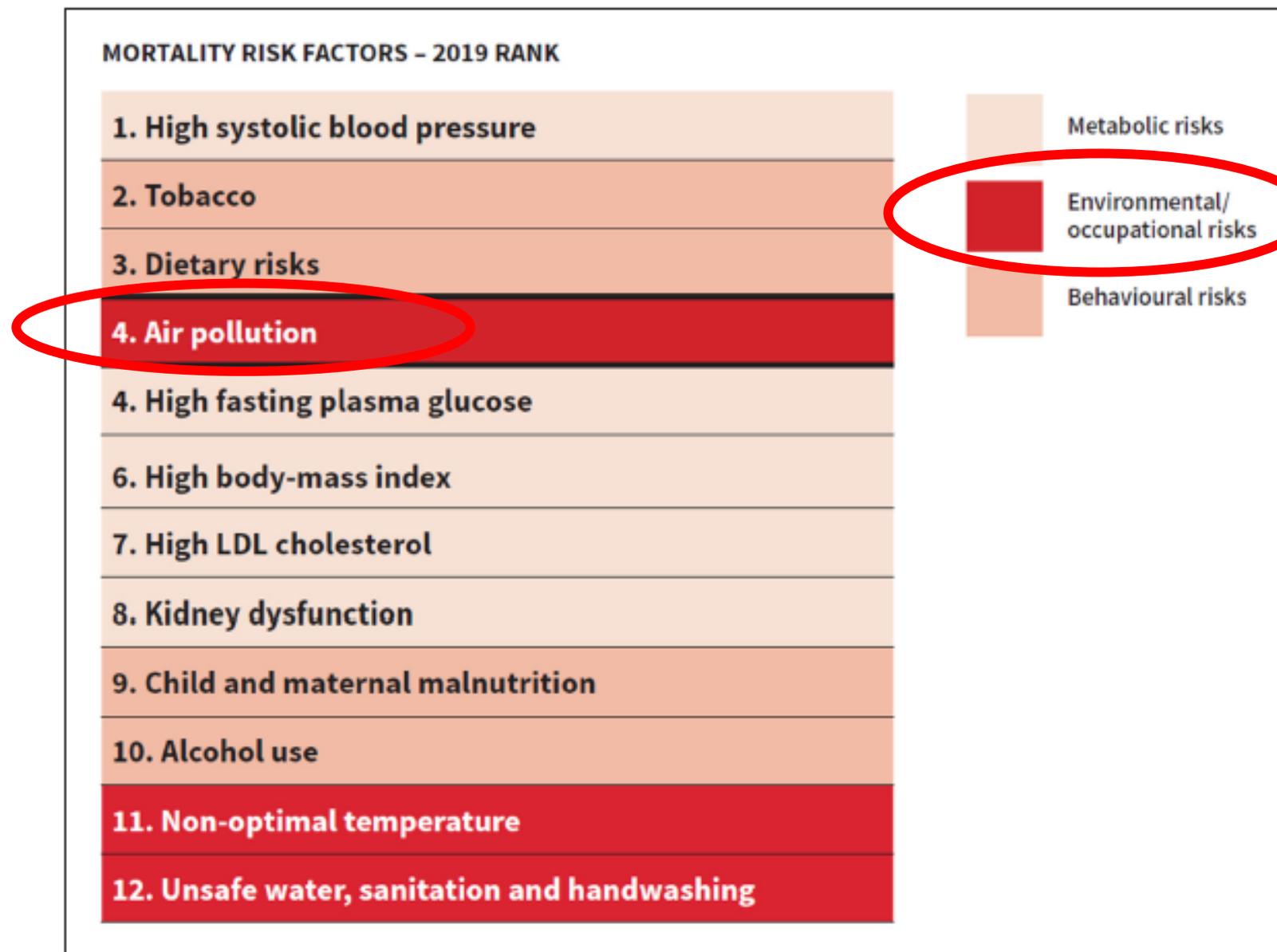
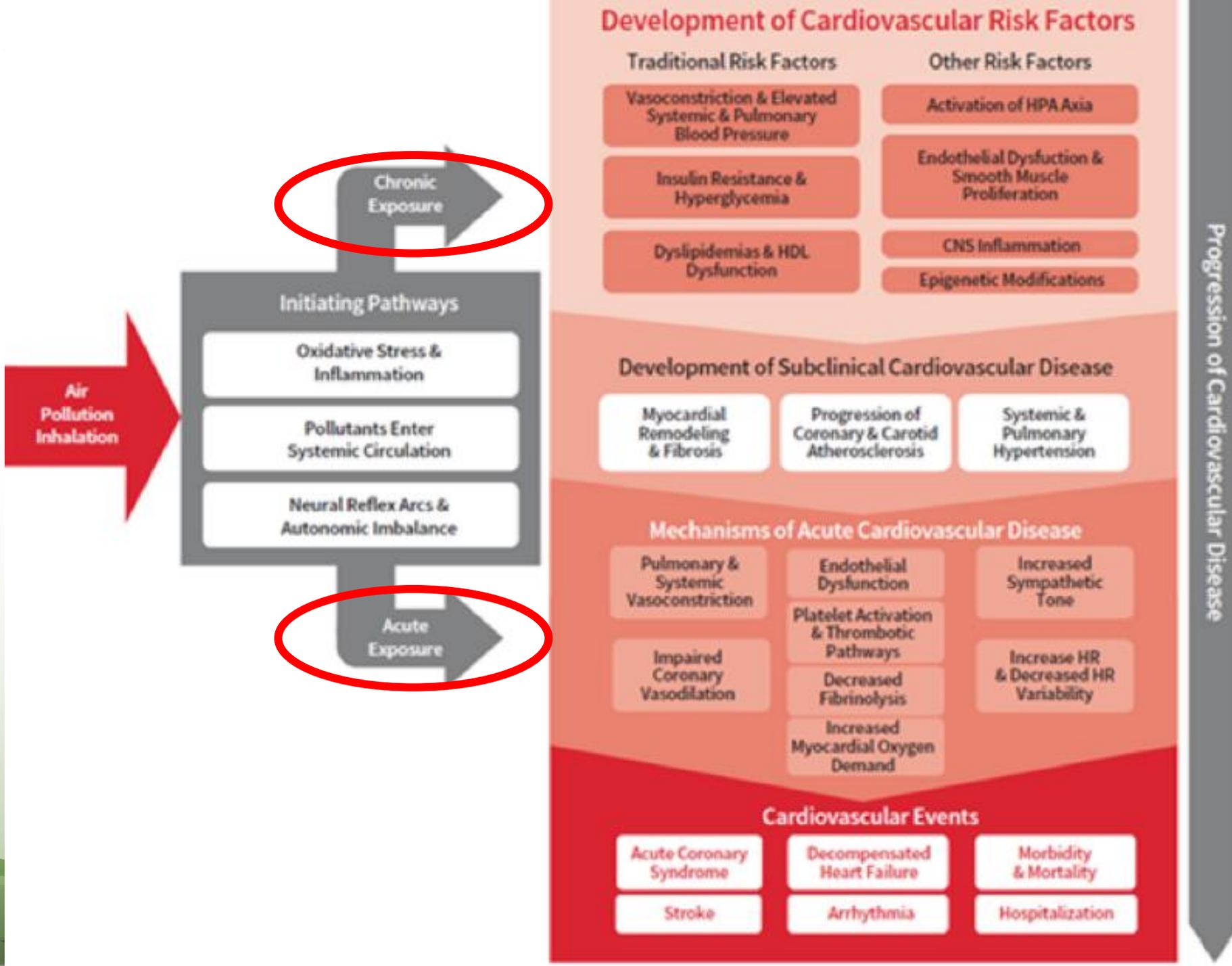
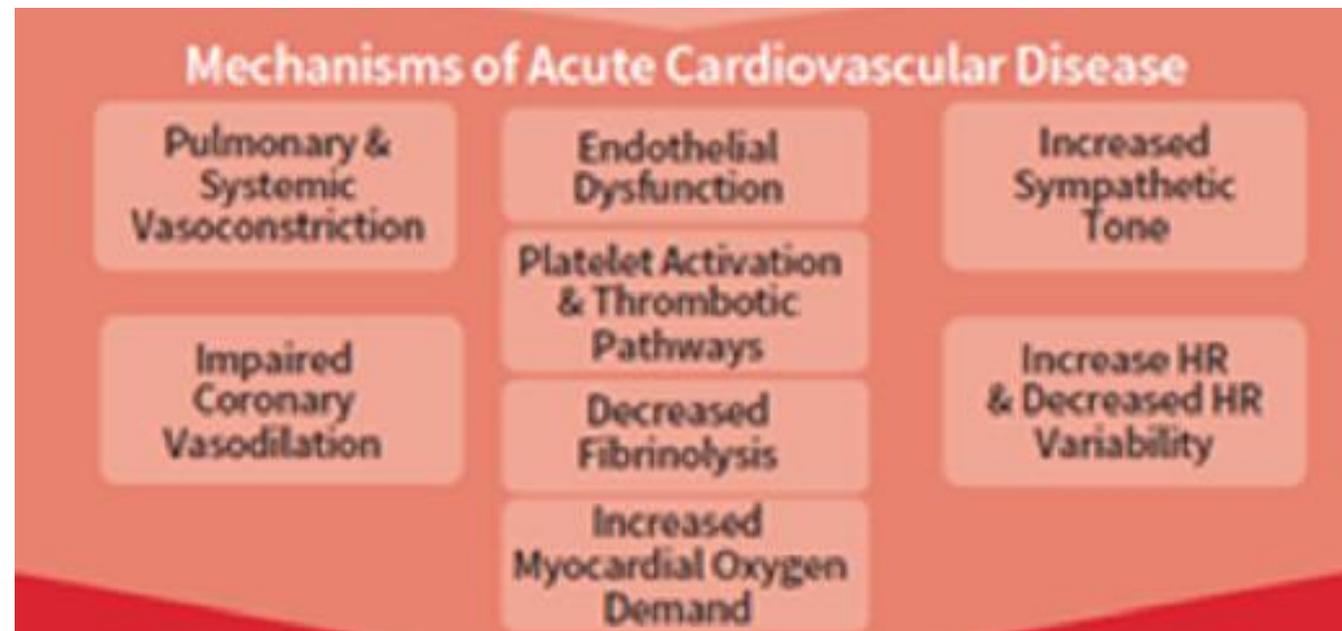
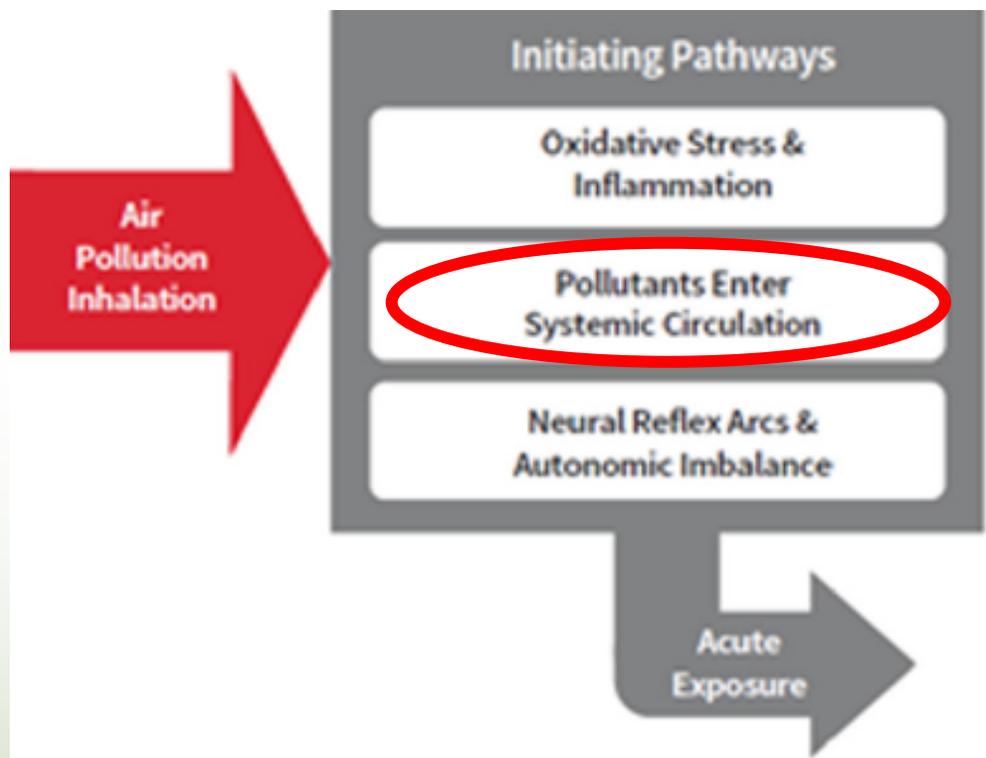


Figure 1: Ranking of air pollution relative to other leading risk factors for global mortality. Mortality Risk Factors, Both sexes, all ages, 2019. Institute for Health Metrics and Evaluation. (Adapted from Institute for Health Metrics and Evaluation, 2020).



Brauer M, et al. Global Heart. 2021





European Society
of Cardiology

European Heart Journal (2021) **42**, 2498–2500

doi:10.1093/eurheartj/ehab227

EDITORIAL

Running in polluted air is a two-edged sword — physical exercise in low air pollution areas is cardioprotective but detrimental for the heart in high air pollution areas

Thomas Münzel  ^{1,2*}, **Omar Hahad**  ^{1,2}, and **Andreas Daiber**  ^{1,2}

¹Department of Cardiology, Cardiology I, University Medical Center Mainz, Mainz, Germany; and ²German Center for Cardiovascular Research (DZHK), Partner Site Rhine-Main, Mainz, Germany

Online publish-ahead-of-print 8 May 2021

This editorial refers to ‘Association of the combined effects of air pollution and changes in physical activity with cardiovascular disease in young adults’, by S.R. Kim et al., doi:10.1093/eurheartj/ehab139.



ESC

European Society
of Cardiology

European Heart Journal (2021) **42**, 2487–2497

doi:10.1093/eurheartj/ehab139

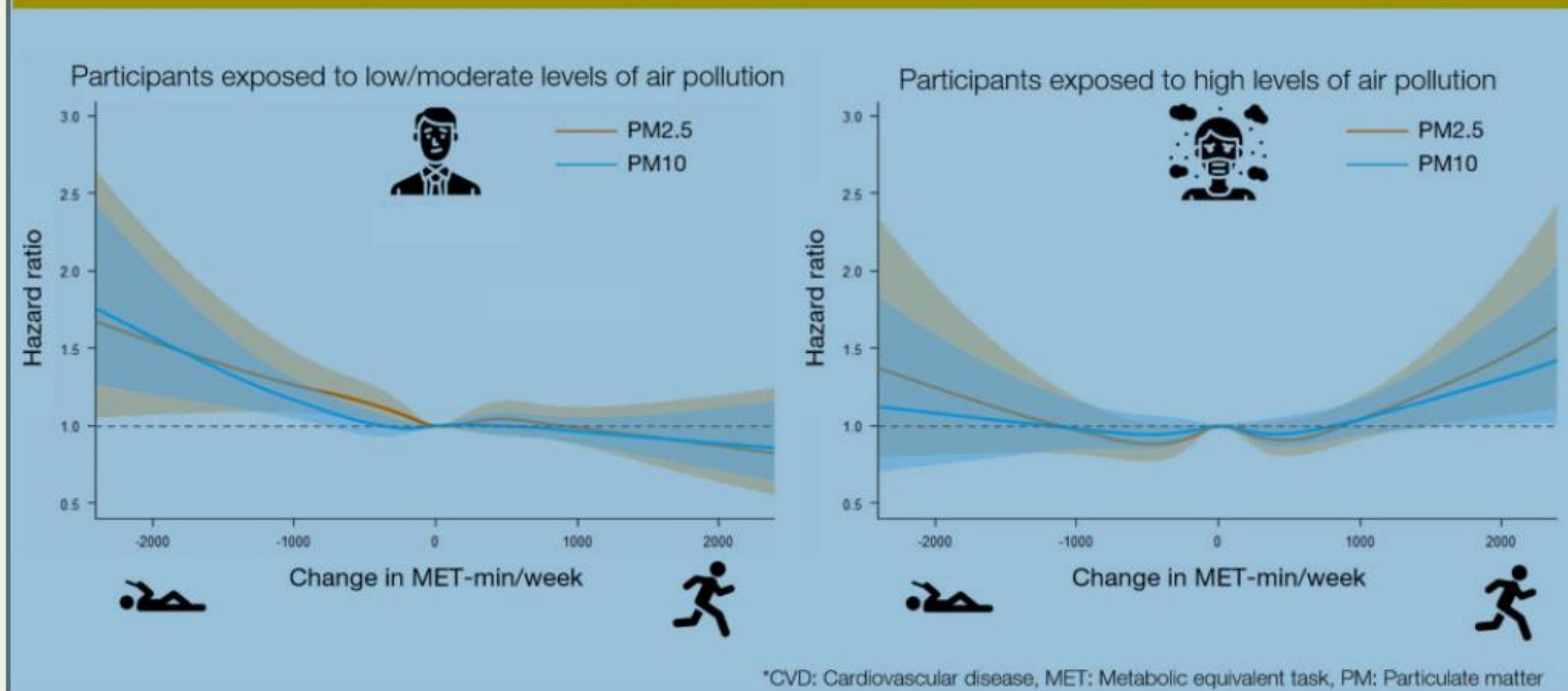
CLINICAL RESEARCH

Epidemiology and Prevention

Association of the combined effects of air pollution and changes in physical activity with cardiovascular disease in young adults

Seong Rae Kim ¹, Seulggie Choi², Kyuwoong Kim ³, Jooyoung Chang²,
Sung Min Kim², Yoosun Cho⁴, Yun Hwan Oh ⁵, Gyeongsil Lee⁴, Joung Sik Son ⁴,
Kvae Hvang Kim ^{4,6}, and Sang Min Park^{2,4*}

Combined effects of air pollution and changes in physical activity on subsequent CVD risk in young adults



Combined effects of air pollution and changes in physical activity with cardiovascular disease in young adults.

**Association of the combined effects
of air pollution and changes in
physical activity with
cardiovascular disease in young
adults**

Seong Rae Kim et al. Eur Heart J. 2021.

Conclusion

- ✓ **Reducing PA may lead to subsequent elevation of CVD risk in young adults exposed to low-to-moderate levels of PM2.5 or PM10;**
- ✓ **Whereas a large increase in PA in a high-pollution environment may adversely affect cardiovascular health.**

**Association of the combined effects
of air pollution and changes in
physical activity with
cardiovascular disease in young
adults**

Seong Rae Kim et al. Eur Heart J. 2021.

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- ✓ Whereas a large increase in PA in a high-pollution environment may adversely affect cardiovascular health.

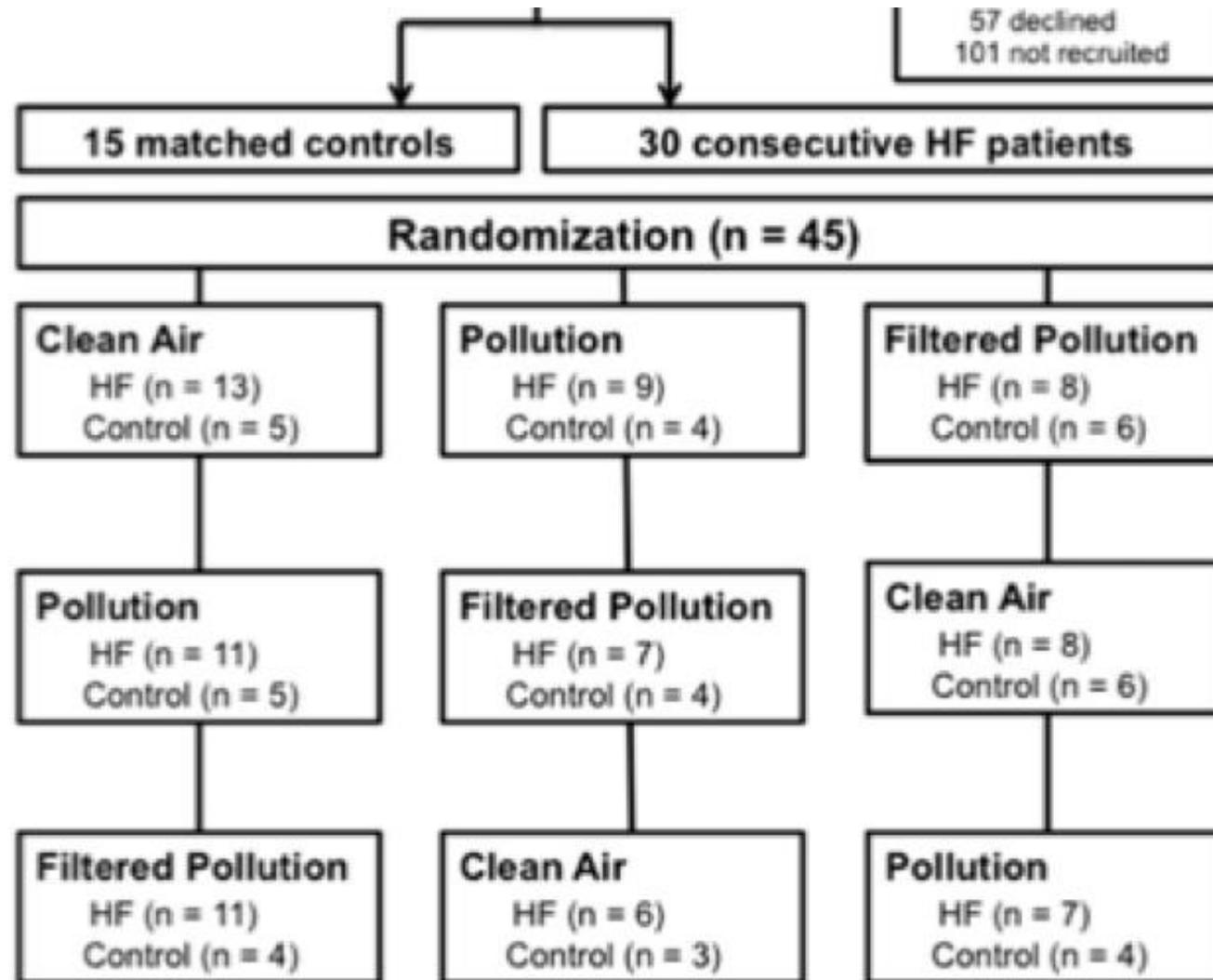
Vieira JL, Guimarães GV, de Andre PA, Cruz FD, Saldiva PHN, Bocchi EA.

Respiratory Filter Reduces the Cardiovascular Effects Associated With Diesel Exhaust Exposure

A Randomized, Prospective, Double-Blind, Controlled Study of Heart Failure: The FILTER-HF Trial

J Am Coll Cardiol HF, 4 (2016), pp. 55-64

Vieira JL, Guimarães GV, de Andre PA, Cruz FD, Saldiva PHN, Bocchi EA. **Respiratory filter reduces the cardiovascular effects associated with diesel exhaust exposure: a randomized, prospective, double-blind, controlled study of heart failure (FILTER-HF Trial).** J Am Coll Cardiol HF, 4 (2016), pp. 55-64



Vieira JL, Guimarães GV, de Andre PA, Cruz FD, Saldiva PHN, Bocchi EA. **Respiratory filter reduces the cardiovascular effects associated with diesel exhaust exposure: a randomized, prospective, double-blind, controlled study of heart failure (FILTER-HF Trial)**. J Am Coll Cardiol HF, 4 (2016), pp. 55-64

CONCLUSIONS

- ✓ To our knowledge, this trial is the first to show that a filter can reduce both endothelial dysfunction and BNP increases in patients with HF during DE.
- ✓ Given these potential benefits, the widespread use of filters in patients with HF exposed to traffic-derived air pollution may have beneficial public health effects and reduce the burden of HF.

Vieira JL, Guimarães GV, de Andre PA, Cruz FD, Saldiva PHN, Bocchi EA. **Respiratory filter reduces the cardiovascular effects associated with diesel exhaust exposure: a randomized, prospective, double-blind, controlled study of heart failure (FILTER-HF Trial)**. J Am Coll Cardiol HF, 4 (2016), pp. 55-64

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- AR
- ÁGUA
- ÁREAS CONTAMINADAS
- RESÍDUOS
- SOLO
- GERENCIAMENTO DE RISCOS
- MUDANÇAS CLIMÁTICAS
- LABORATÓRIOS
- ESCOLA
- CÂMARAS AMBIENTAIS
- TECNOLOGIA AMBIENTAL
- LICENCIAMENTO AMBIENTAL
- CENTRO REGIONAL
- NOTÍCIAS
- PLANO DE SAÚDE
- SIMA



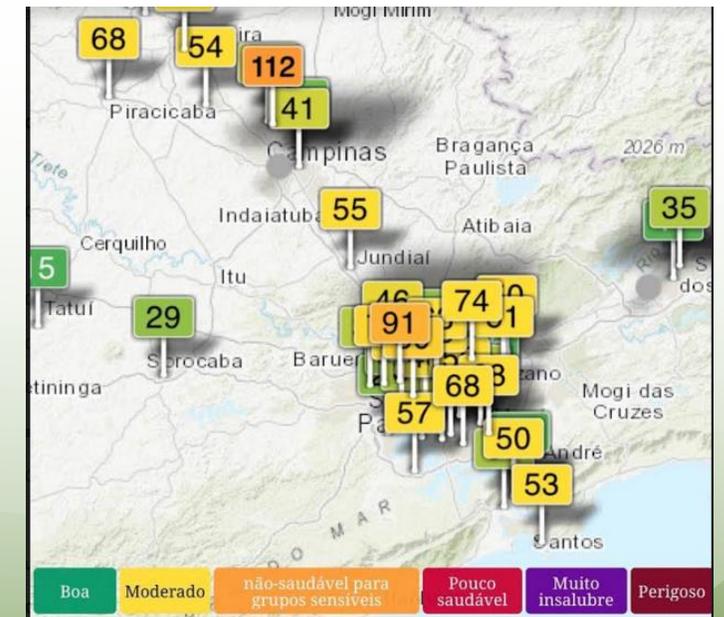
Qualidade do Ar

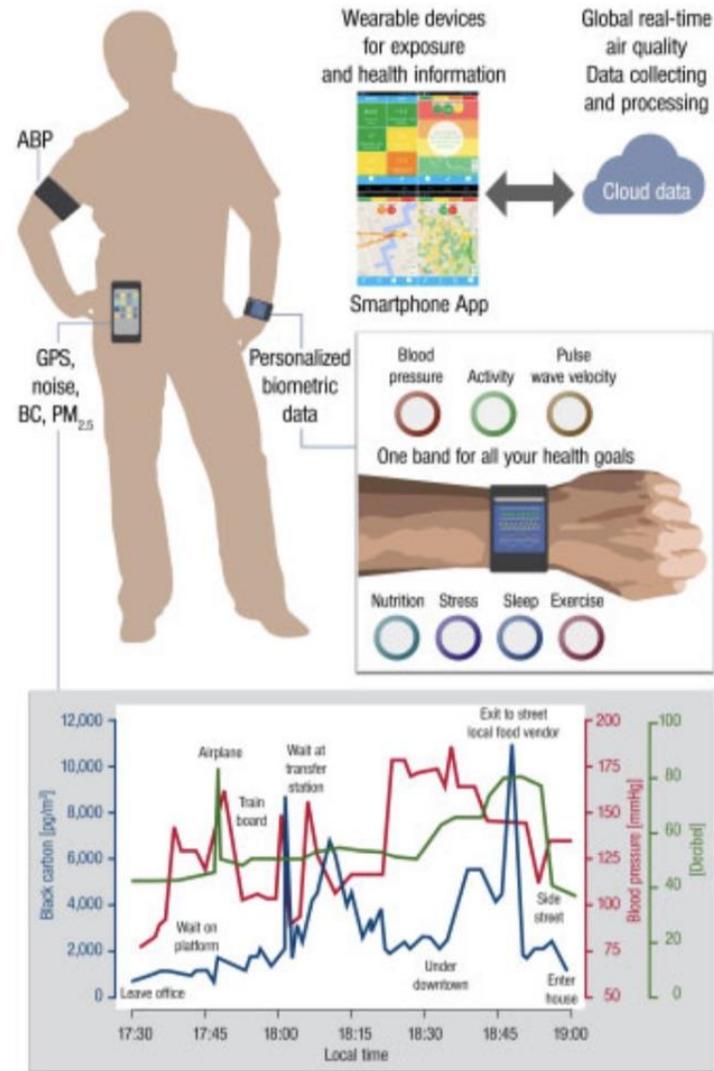
- Início
- Informações Básicas
- Indicadores
- Meteorologia
- PREFE
- Publicações / Relatórios
- Consultas Públicas

Desde 1981, monitoramento automático para a avaliação de SO₂, material particulado inalável (MP10), ozônio (O₃), óxidos de nitrogênio (NO, NO₂ e NO_x), monóxido de carbono (CO) e hidrocarbonetos não-metânicos (NMHC), além dos parâmetros meteorológicos como direção e velocidade do vento, temperatura e umidade relativa do ar.



Poluição do ar em São Paulo: Mapa da qualidade do ar em tempo real





Graphical Abstract Hypothetical framework of investigations that combine technological innovation in biometric data with personalized exposure information in real-time to study interactive effects of environmental risk factors on cardiovascular endpoints. ABP, ambulant blood pressure monitoring; BC, black carbon; PM, particulate matter. With permission from Münzel *et al.*¹⁸

Kyu HH et al. **Global, regional, and national disability-adjusted life-years (DALYs) for 359 diseases and injuries and healthy life expectancy (HALE) for 195 countries and territories, 1990–2017: a systematic analysis for the global burden of disease study 2017.** The Lancet 2018; 392: 1859–922.

- ✓ Antes da pandemia da COVID-19 o estudo “Global Burden of Disease” já havia alertado para os elevados níveis mundiais de incapacidades, que frequentemente não são devidamente tratadas pelos deficitários Serviços de Reabilitação.
- ✓ No mundo PÓS-COVID-19, mais do que nunca, há uma urgente necessidade da redefinição dos Serviços de Reabilitação, processo que tem como primeiro requisito a identificação da população alvo.

Editorial

Reabilitação Cardiovascular Baseada em Domicílio: A Principal Opção na Nova Normalidade Pós-COVID-19

Carvalho T. Rev DERC. 2020; 26(2):47-48

- ✓ A RCVD é tão SEGURA quanto EFICAZ comparada à RCV presencial, com perspectiva de aumentar adesão e reduzir custo;
- ✓ O avanço tecnológico amplia vertiginosamente a possibilidade de monitoramento à distância em larga escala;
- ✓ No mundo PÓS-COVID-19 a RCVD deverá ser PRIORIDADE, principalmente como estratégia de saúde pública!

PROJETO

REABILITAÇÃO DOMICILIAR DA COVID-19 NA ATENÇÃO PRIMÁRIA DO SISTEMA BRASILEIRO DE SAÚDE PÚBLICA

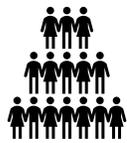
Recrutamento dos pacientes;
Divulgação do projeto;
Busca ativa;



AVALIAÇÃO
1ª etapa
Anamnese, questionários e escalas

Aplicação formulário online Pós-COVID-19

- À distância: autorreferido
- Entrevista por ligação telefônica
- Presencial (entrevista) – casos específicos



Análise dos dados do Rastreamento | Mapeamento dos

casos

GRAU 0
Sem limitação

GRAU 1
Muito Leve

GRAU 2
Leve

GRAU 3
Moderado

GRAU 4
Grave

Orientações Hábitos Saudáveis

Encaminhado

Atenção secundária

Atendimento Especializado



AVALIAÇÃO
2ª etapa
Testes físicos e Antropometria

Aplicação Presencial

PROJETO

REABILITAÇÃO DOMICILIAR DA COVID-19 NA ATENÇÃO PRIMÁRIA DO SISTEMA BRASILEIRO DE SAÚDE PÚBLICA

Prescrição de exercícios físicos

- À distância ou presencial
- Material de apoio: Cartilhas, vídeos, imagens

Sessões mensais de supervisão e Sessões educacionais

- Síncronos (videoconferência/ videochamadas ou presencial)

Monitoramento e acompanhamento

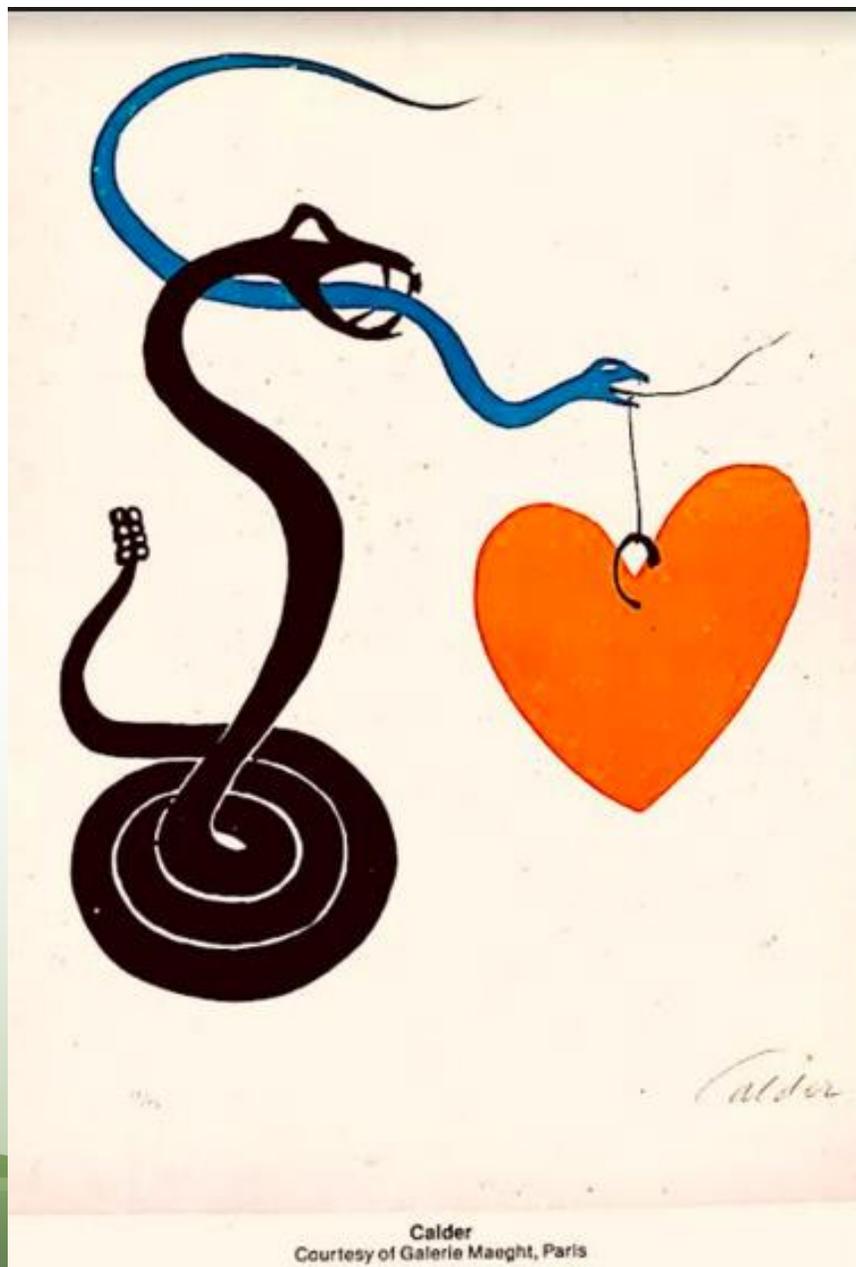
- Assíncrono
- Via whatsapp/ligação telefônica, ACS, etc...

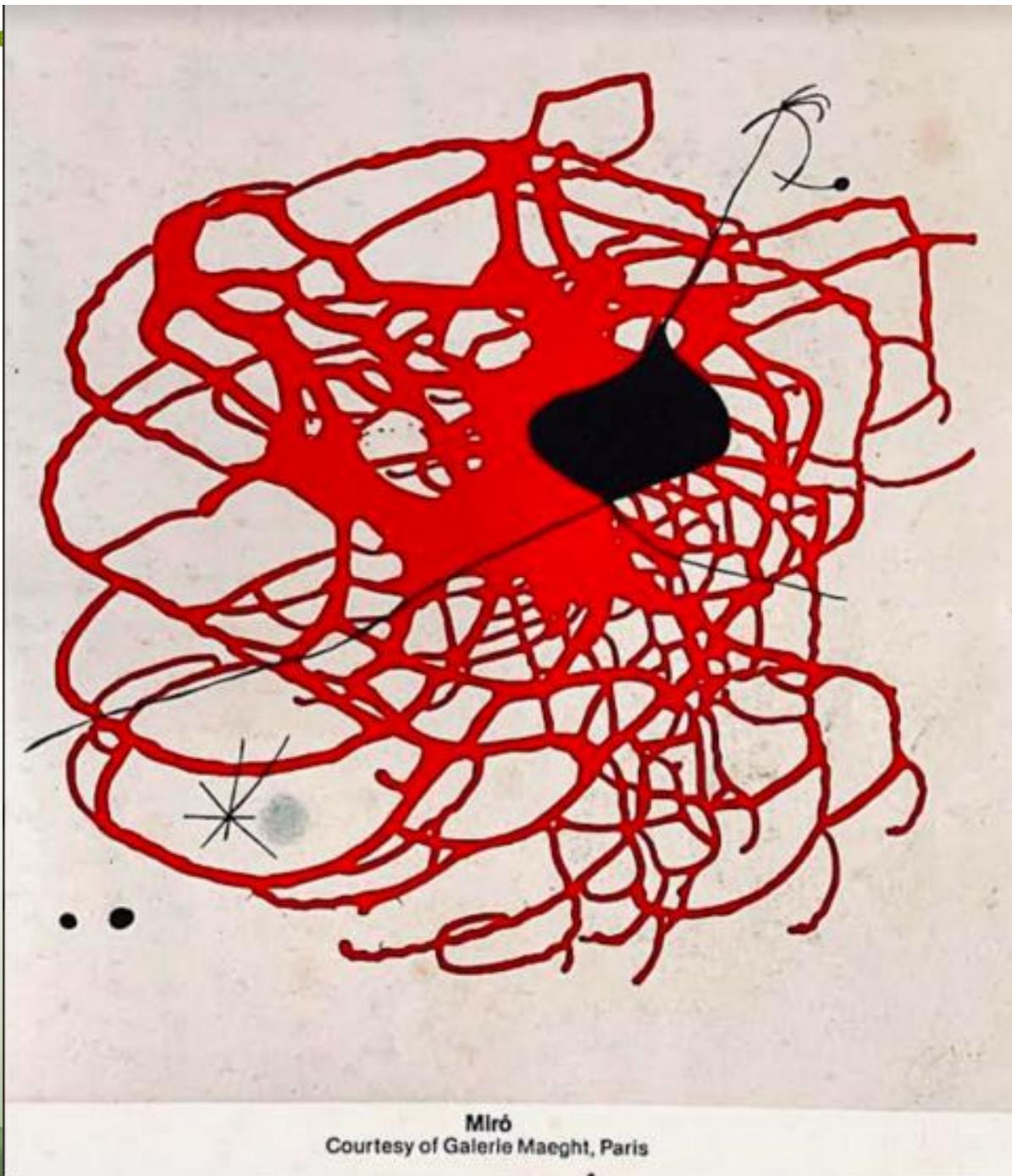
CONSIDERAÇÕES FINAIS

REABILITAÇÃO NA COVID-19:

TODAS AS POSSIBILIDADES DEVEM SER CONSIDERADAS:

- ✓ Convencional e baseada no exercício
- ✓ Presencial e domiciliar (inclusive exclusivamente remota)
- ✓ Exercício moderado contínuo, intervalado moderado, intervalado intenso e resistido
- ✓ Treinamento ventilatório, prática esportiva e a dança
- ✓ Influência do meio ambiente





Miró
Courtesy of Galerie Maeght, Paris

tales@cardiol.br



Perguntas e respostas