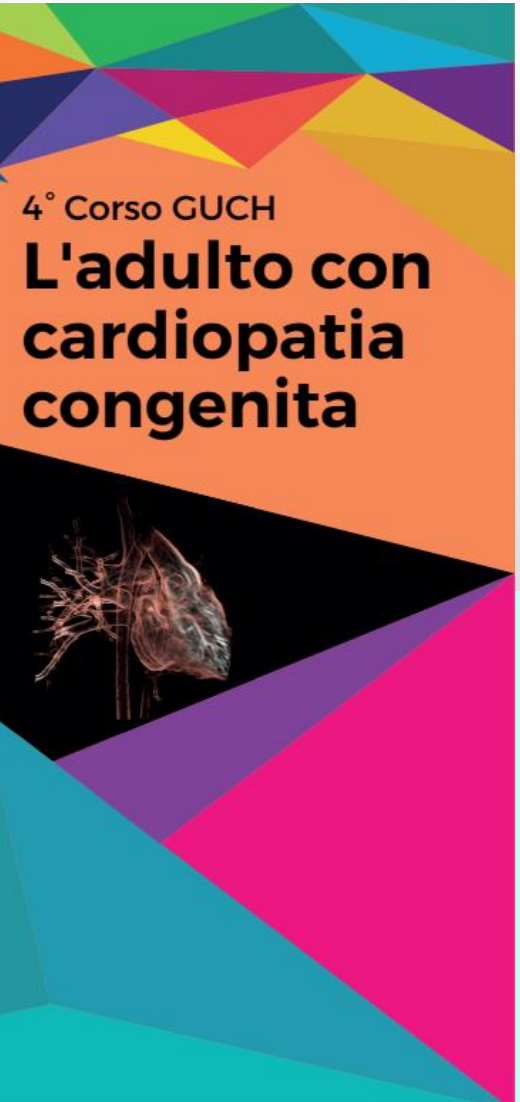
ULTIMO CORSO GUCH 2019
VIVERE CON UNA CARDIOPATIA CONGENITA



- Le CC sono M CRONICHE (ESC 2020)
- I pazienti vivono ma invecchiano prima
- I Registri
- PAH
- La Gravidanza
- Il Fallot
- La rete

Cosa e cambiato?

- LATE FONTAN
- ARITMOLOGIA
- PAH
- ASSISTENZE CIRC
- TAVOLA ROTONDA

CORSO TEORICO PRATICO IN CARDIOLOGIA PEDIATRICA 2023

I EDIZIONE
Aprile-Giugno

II EDIZIONE
Ottobre-Dicembre

RESPONSABILE SCIENTIFICO
Giuseppe Annoni

COMITATO SCIENTIFICO
Gabriella Agnoletti
Roberto Bordese
Giuseppe Mazza
Anna Maria Villar

SEDE
OSPEDALE INFANTILE REGINA MARGHERITA
Piazza Polonia 94 - TORINO

Corso di ecocardiografia clinica di II livello indirizzato a cardiologi dell'adulto, medici dello sport, pediatri, neonatologi e anestesisti che vogliono approfondire le loro competenze nelle cardiopatie congenite e nella gestione del neonato, del lattante e del bambino con problematiche cardiologiche congenite o acquisite. È richiesta una conoscenza dell'ecocardiografia di base e delle proiezioni ecocardiografiche standard.

***Il corso, riservato a massimo 20 partecipanti per edizione**, prevede un primo incontro teorico di una giornata in cui verranno trattate tutte le cardiopatie congenite semplici e una parte pratica di 40 ore complessive di frequenza del laboratorio di ecocardiografia, del reparto di cardiologia e neonatologia; un ultimo incontro teorico di mezza giornata chiuderà il corso.*

***Quota di iscrizione: 500 Euro + IVA** comprensiva di materiale didattico, ticket lunch e conseguimento dei crediti ECM in seguito al superamento del test finale.*

Accreditamento ECM: 50 crediti.

COMUNICARE, Torino
Tel. 011 660.42.84
adesionicongressicomunicare@gmail.com
www.eventi-comunicare.it

AZIENDA OSPEDALIERO - UNIVERSITARIA
Città della Salute e della Scienza di Torino

IL PAZIENTE ADULTO CON CARDIOPATIA CONGENITA OGGI

G AGNOLETTI

GLI INGREDIENTI

- PERCHÈ NON CHIAMARLI PIU' GUCH
- CERTIFICAZIONE ACHD
- INVECCHIAMENTO DELLA POPOLAZIONE
- MALATTIA E MORTALITA
- TAVI
- TRAPIANTO (IN FONTAN)
- NUOVI SCORES
- DIVERSI?
- IL DIA

PERCHE' ACHD?

- NON SONO PIU' "BAMBINI CRESCIUTI"
- GUCH SOMMERVILLE FINE ANNI 80
- ISACHD 1992
- SPECIALISTI ACHD
- CERTIFICAZIONE ACHD (2 ANNI POST SPECIALITA)
- CENTRI ACHD: NAZIONALE: OGNI 3-10 ML, REGIONALE OGNI 2 ML


European Heart Journal (2010) **31**, 2915–2957
doi:10.1093/eurheartj/ehq249

ESC GUIDELINES

ESC Guidelines for the management of grown-up congenital heart disease (new version 2010)

The Task Force on the Management of Grown-up Congenital Heart Disease of the European Society of Cardiology (ESC)

Endorsed by the Association for European Paediatric Cardiology (AEPC)


ESC European Society of Cardiology

European Heart Journal (2021) **42**, 563–645
doi:10.1093/eurheartj/ehaa554

ESC GUIDELINES

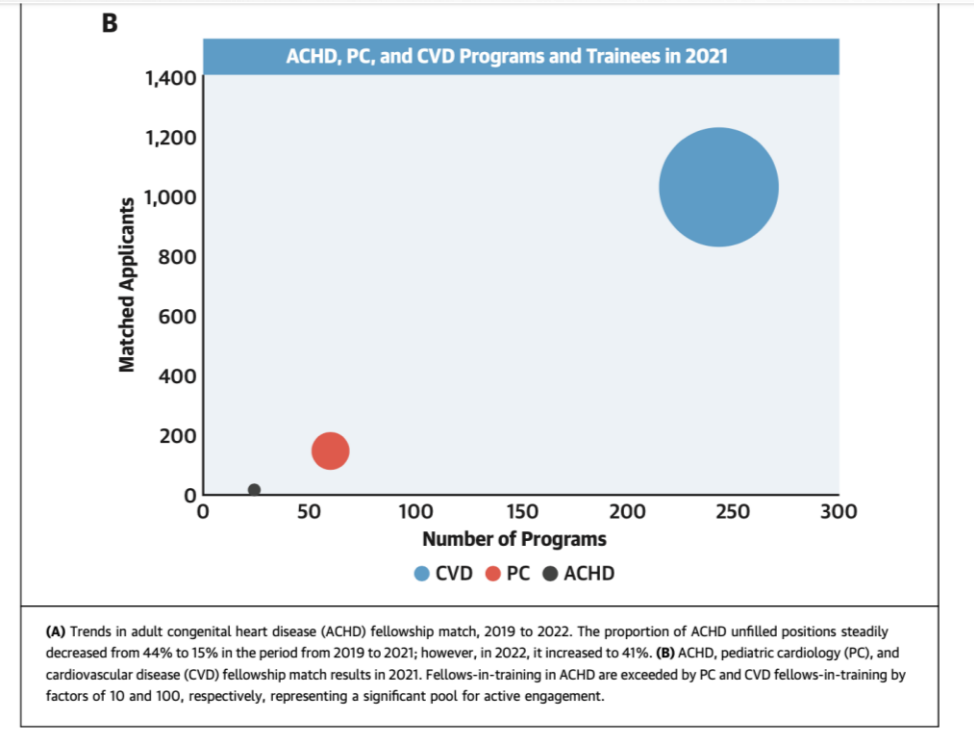
2020 ESC Guidelines for the management of adult congenital heart disease

The Task Force for the management of adult congenital heart disease of the European Society of Cardiology (ESC)

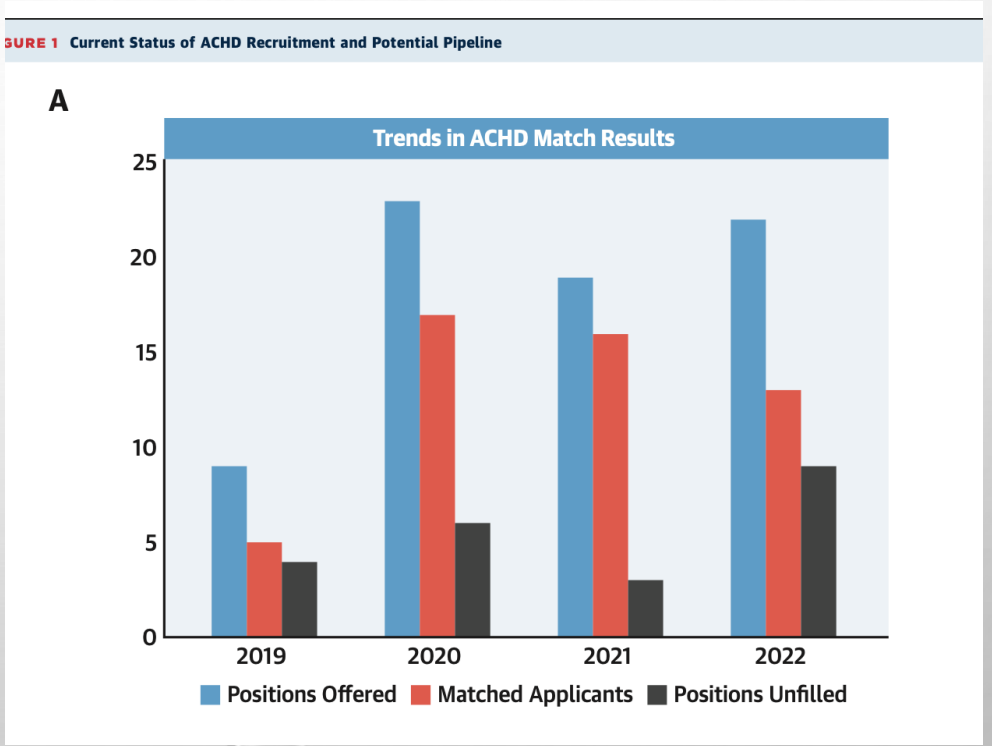
Endorsed by: Association for European Paediatric and Congenital Cardiology

ACHD TRAINING

- CHD: IL PIU' COMMUNE DIFETTO CONGENITO (9/1000)
- IL 90% DI MORTALITA SI E TRASFORMATO NEL 90% DI SOPRAVVIVENZA
- ENORME MANCANZA DI SPECIALISTI



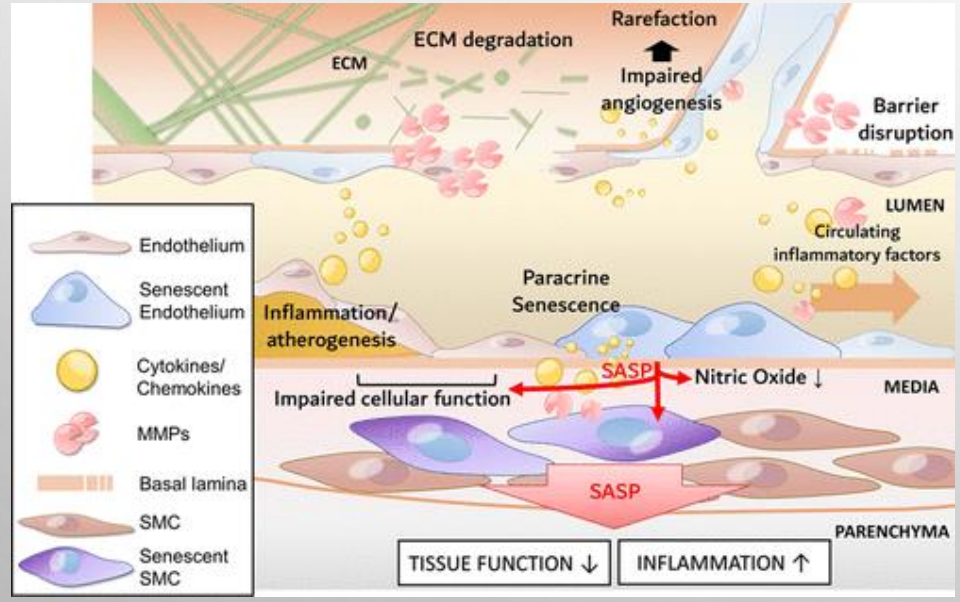
(A) Trends in adult congenital heart disease (ACHD) fellowship match, 2019 to 2022. The proportion of ACHD unfilled positions steadily decreased from 44% to 15% in the period from 2019 to 2021; however, in 2022, it increased to 41%. **(B)** ACHD, pediatric cardiology (PC), and cardiovascular disease (CVD) fellowship match results in 2021. Fellows-in-training in ACHD are exceeded by PC and CVD fellows-in-training by factors of 10 and 100, respectively, representing a significant pool for active engagement.

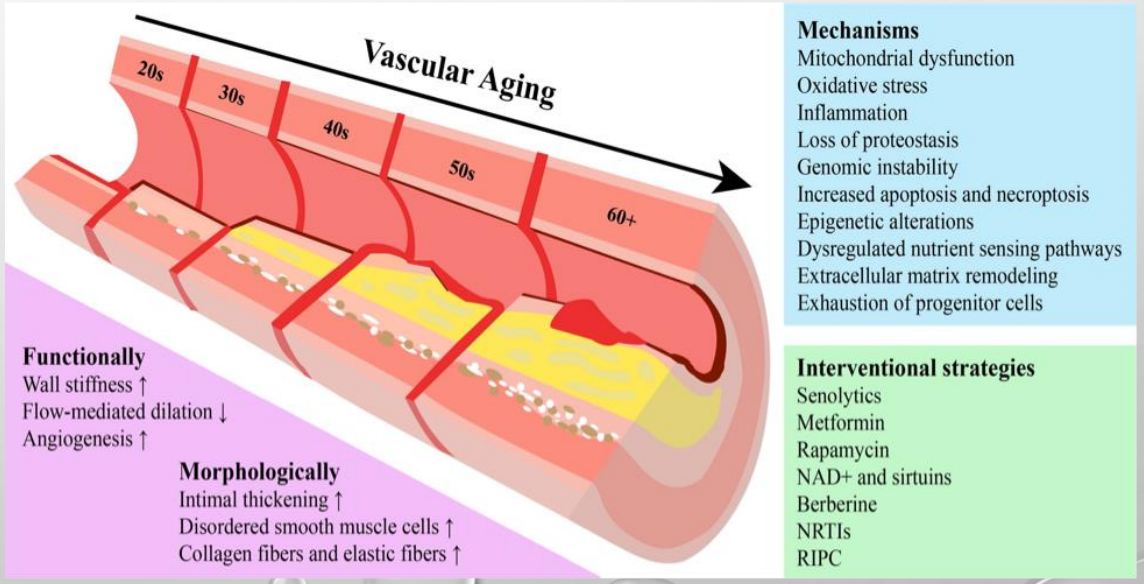


JACC 2022

VASCULAR AGING
(EARLY VASCULAR AGING)
UN UOMO È VECCHIO QUANTO LE SUE ARTERIE

GLI ACHD INVECCHIANO
HANNO PRECOCEMENTE LE MALATTIE DELLA VECCHIAIA
TUMORI-POLMONITE-M CARDIOVASCOLARI





AZIENDA OSPEDALIERO - UNIVERSITARIA
Città della Salute e della Scienza di Torino

ACCELERATED CARDIAC AGING

frontiers | Frontiers in Cardiovascular Medicine

REVIEW
published: 26 May 2022
doi: 10.3389/fcvm.2022.892861

Check for updates

Accelerated Cardiac Aging in Patients With Congenital Heart Disease

*Dominga Iacobazzi, Valeria Vincenza Alvino, Massimo Caputo and Paolo Madeddu**

Bristol Medical School, Faculty of Health Sciences, University of Bristol, Bristol, United Kingdom

- Cardiac aging
- Senescence
- Proinflammatory state
- Repeated stress

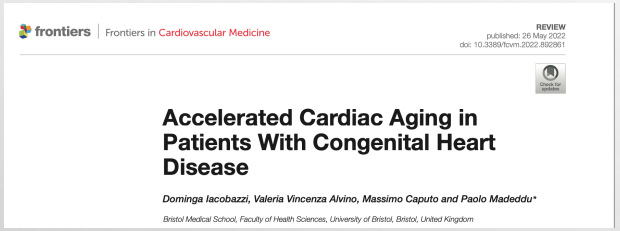
CHF nel 25% of ACHD by the age of 30

NOT limited to complex CHD

Conventional treatment unsupported by clinical evidence

CHF DIVERSA E REFRATTARIA

- L'ETÀ E' IL MAGGIOR FATTORE DI RISCHIO DELLE M. CARDIOVASCOLARI


frontiers | Frontiers in Cardiovascular Medicine

REVIEW

published: 26 May 2022

doi: 10.3389/fcvm.2022.892981

Accelerated Cardiac Aging in Patients With Congenital Heart Disease

*Dominga Iacobazzi, Valeria Vincenza Alvino, Massimo Caputo and Paolo Madeddu**

Bristol Medical School, Faculty of Health Sciences, University of Bristol, Bristol, United Kingdom

LA STORIA SI RIPETE

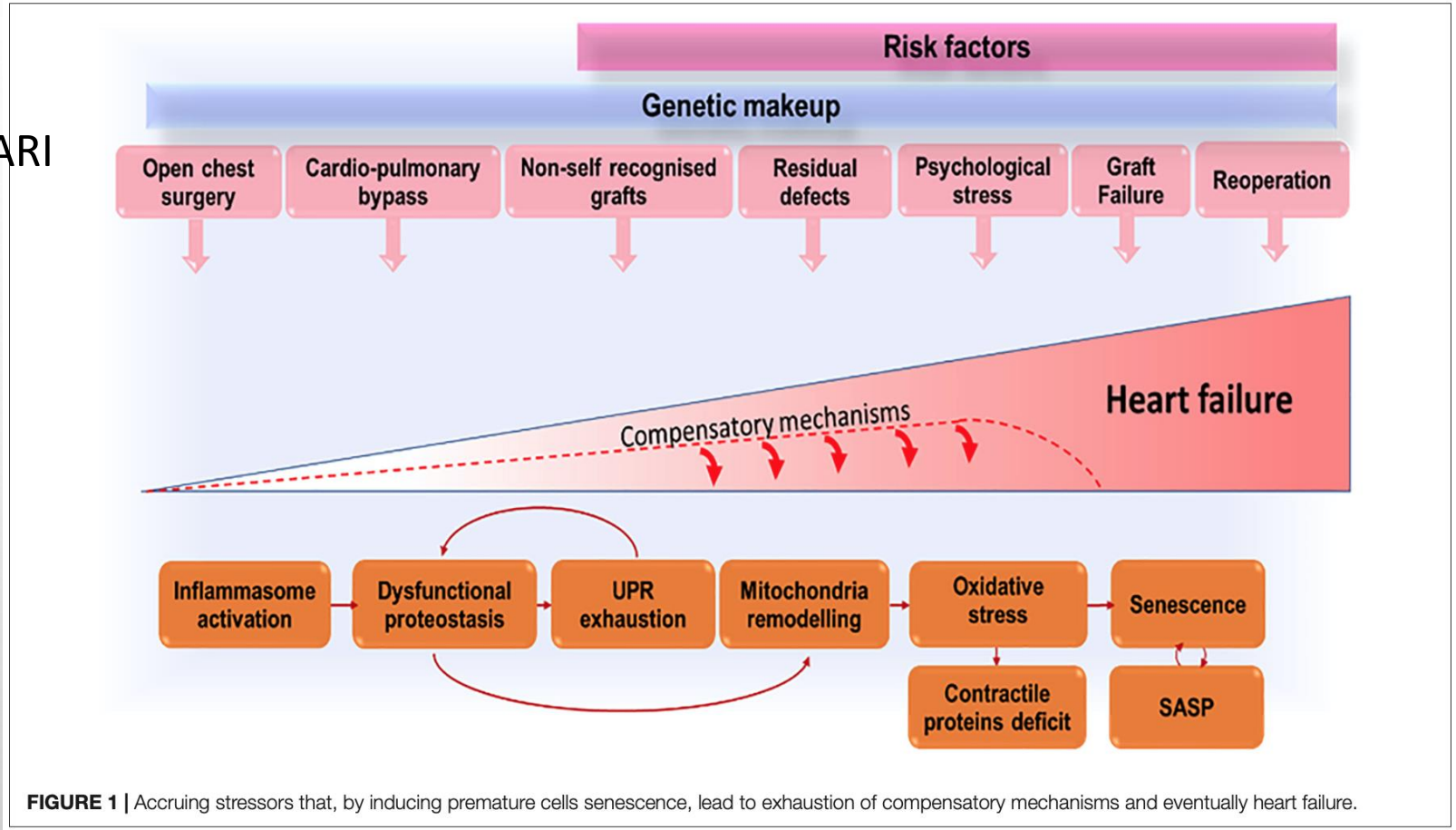


FIGURE 1 | Accruing stressors that, by inducing premature cells senescence, lead to exhaustion of compensatory mechanisms and eventually heart failure.

VASCULAR AGING

Review Article

Vascular aging in adult congenital heart disease-a narrative review

Tomoaki Murakami

CIANOSI

Cardiovascular Diagnosis and Therapy, Vol 12, No 4 August 2022

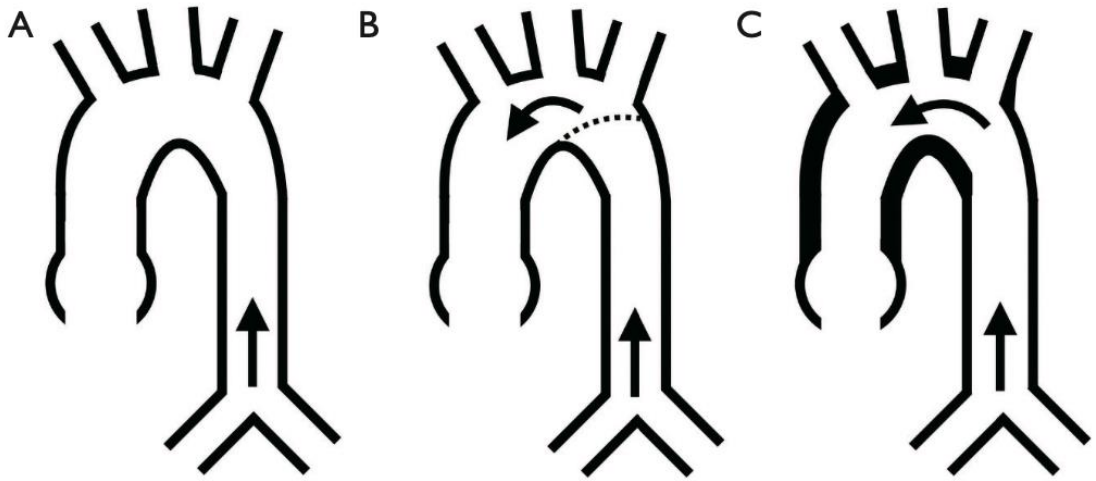


Figure 5 Possible origins of the reflected pressure wave. (A) Normal aorta. (B) Repaired aortic coarctation. (C) Cyanotic heart disease. Arrow indicates the reflected pressure wave.

NON SOLO CUORE

- M METABOLICA
- M ISCHEMICA
- AORTOPATIA
- IPERTENSIONE ARTERIOSA (OVERLOAD, CIANOSI, SHUNTS, RV SISTEMICO)
- M CEREBROVASCOLARE
- M RENALI (CIANOSI , CCH)
- AUMENTATA MORTALITA PER M ACQUISITE

Review Article

Vascular aging in adult congenital heart disease-a narrative review

Tomoaki Murakami

Department of Pediatrics, Sapporo Tokushukai Hospital, Sapporo, Japan

Correspondence to: Tomoaki Murakami, MD, PhD. Department of Pediatrics, Sapporo Tokushukai Hospital, 1-1, Higashi 1-chome, Ohyachi, Atsubetsu-ku, Sapporo 004-0041, Japan. Email: murat@seagreen.ocn.ne.jp.

Cardiovasc Diagn Ther 2022

FRAILTY

International Journal of Cardiology 363 (2022) 30–39

Contents lists available at ScienceDirect

International Journal of Cardiology

journal homepage: www.elsevier.com/locate/ijcard

Rationale, design and methodology of APPROACH-IS II: International study of patient-reported outcomes and frailty phenotyping in adults with congenital heart disease

APPROACH-IS-II

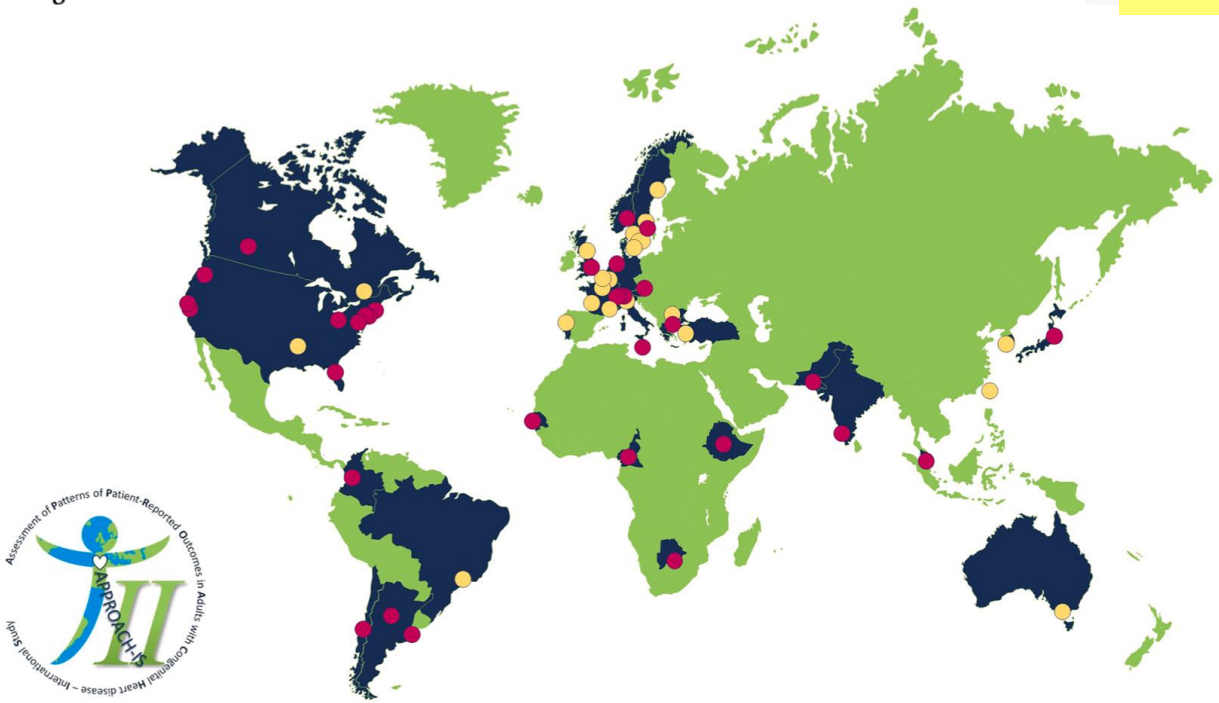


Fig. 2. Geographic distribution of the APPROACH-IS II participating centers.
Yellow dots indicate centers that are participating in Part 1 and Part 2 of the study ($n = 21$). Pink dots indicate centers that are participating in Part 1 only ($n = 32$).
(For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

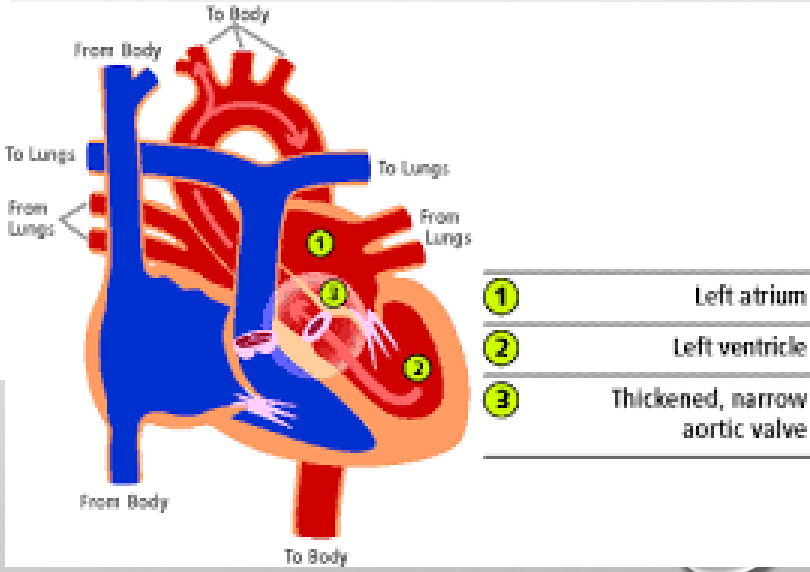
Gli studi multicentrici sovranazionali iniziano dopo gli anni 2000

E POICHE SONO FRAGILI E INVECCHIANO PRIMA
MENO CHIRURGHI, PIU INTERVENTISTI

- TAVI E NON SOLO NEL PAZIENTE ACHD: BAMBINI ADOLESCENTI E GIOVANI ADULTI

Transcatheter and Surgical Aortic Valve Implantation in Children, Adolescents, and Young Adults With Congenital Heart Disease

Dwight M. Robertson, DO[a,b,*], Dana M. Boucek, MD[a], Mary Hunt Martin, MD[a], Robert G. Gray, MD[a], Eric R. Griffiths, MD[c], Aaron W. Eckhauser, MD[c], Zhining Ou, MS[d], Linda M. Lambert, MSN-cFNP[a], Richard V. Williams, MD[a], and S. Adil Husain, MD[c]

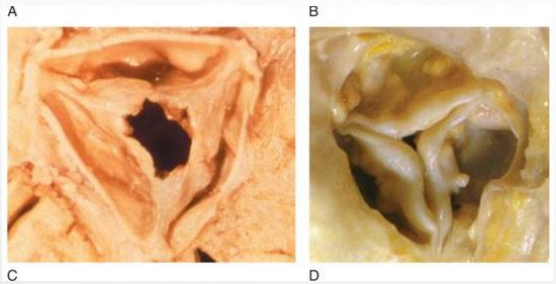


Am J Cardiol 2022

SAVR VS TAVI

ESPERIENZA SALT LAKE

- 30 SAVR E 17 TAVI
- ETA’ 10-21 ANNI
- FU 3.8 E 1.5 AA



Edwards valve
(Sapien 3)

Medtronic valve
EvolutR

- OUTCOME SIMILE IN TERMINI DI LIBERTA’ DA STROKE ENTRO 6 MESI, RIOSPEDALIZZAZIONE ENTRO 30 GG E DECESSO
- PIU LUNGA DEGENZA IN SAVR, PIU RISCHIO DI REINTERVENTO IN TAVI

TRAPIANTO CARDIACO

ELSEVIER

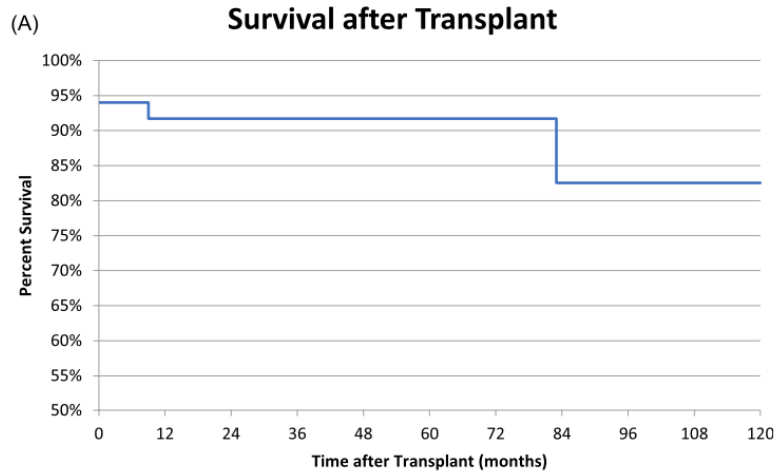
ORIGINAL CONTRIBUTION

Observations and Single-Center Outcomes in Orthotopic Heart Transplant for Patients With Adult Congenital Heart Disease: A Call for Equity and Parity

Joshua Rezkalla[a*], Megan Kamath[b], and Leigh Reardon[c]

[a]Department of Medicine-Pediatrics, David Geffen School of Medicine, University of California Los Angeles, Los Angeles, California; [b]Ahmanson/UCLA Cardiomyopathy Center, Los Angeles, California; and [c]Ahmanson/UCLA Adult Congenital Heart Disease Center, Los Angeles, California

- Selezione
- Criteri non uniformi
- Timing (messa in lista tardiva)
- Disfunzione multiorgano
- Indicazioni all'assistenza meccanica
- Carenza di chirurghi congenitalisti



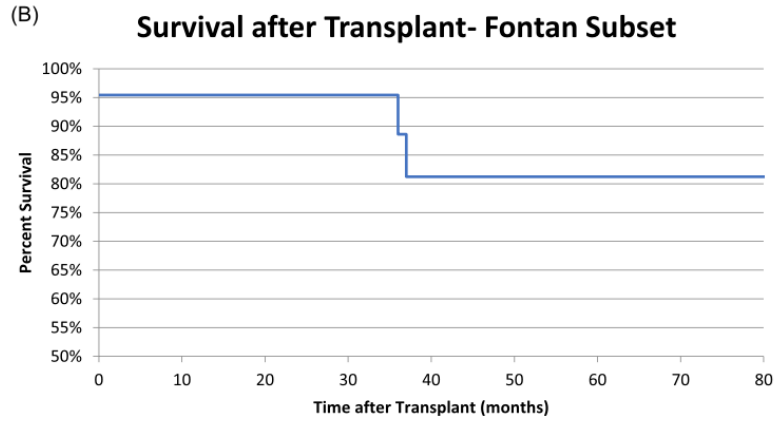
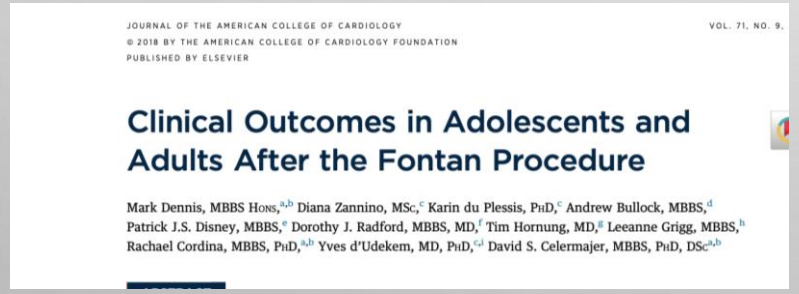


Figure 1. Kaplan Meier survival of ACHD patients undergoing heart transplantation +/- other organ transplantation as needed for (A) all ACHD patients and (B) patients palliated by the Fontan circulation.

TRAPIANTO IN FONTAN

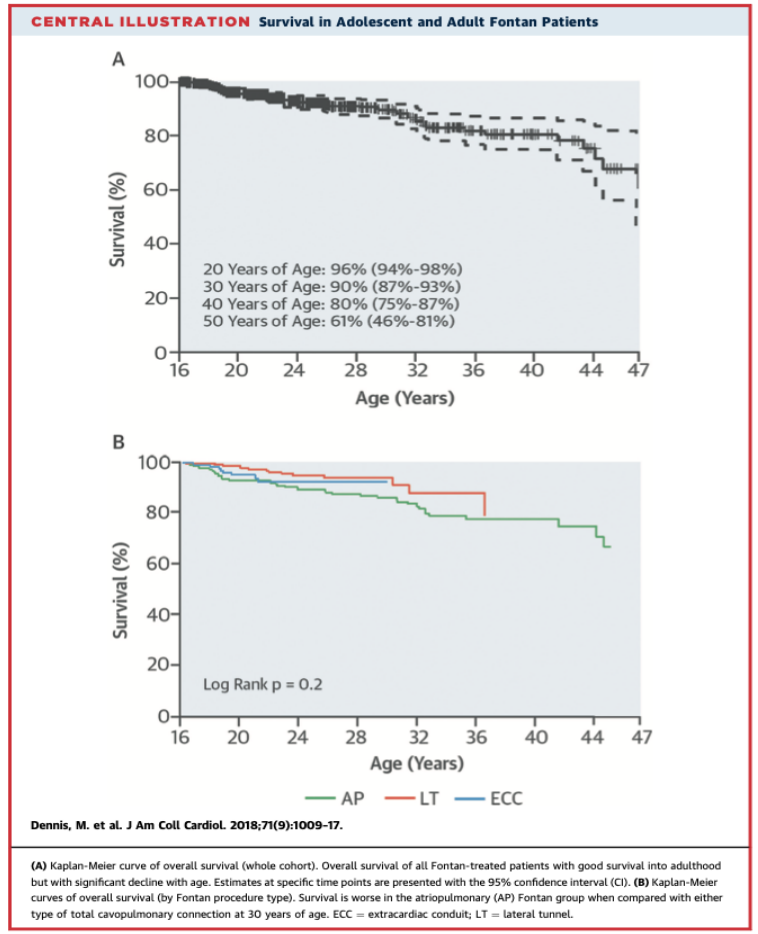
ANZFR
201 atriopolmonari
482 cavopolmonari totali

- PRIMA FONTAN 1971
- PRIMA DCPT (MARCELLETTI) 1990
- SOPRAVVIVENZA AI 30 AA 90%, AI 40 AA: 80%
- IL 60% HA AVUTO UN EVENTO GRAVE ENTRO I 40 ANNI
- E QUINDI TRAPIANTO ????


JOURNAL OF THE AMERICAN COLLEGE OF CARDIOLOGY VOL. 71, NO. 9,
© 2018 BY THE AMERICAN COLLEGE OF CARDIOLOGY FOUNDATION
PUBLISHED BY ELSEVIER

Clinical Outcomes in Adolescents and Adults After the Fontan Procedure

Mark Dennis, MBBS Hons,[a,b] Diana Zannino, MSc,[c] Karin du Plessis, PhD,[c] Andrew Bullock, MBBS,[d] Patrick J.S. Disney, MBBS,[e] Dorothy J. Radford, MBBS, MD,[f] Tim Hornung, MD,[g] Leeanne Grigg, MBBS,[h] Rachael Cordina, MBBS, PhD,[a,b] Yves d'Udekem, MD, PhD,[c,i] David S. Celermajer, MBBS, PhD, DSc[a,b]



(8%) had a pulmonary embolism. Only 1 patient had multiple thromboembolic events.

The median age at reintervention was 8 years (range 1.7 to 15.9 years), and 51 (7%) patients required a second reintervention (median age 9.8 years [range 3.1 to 15.7 years]). PLE occurred in 11 patients (2%) at a median age of 12 years (range 3.4 to 15.3 years).

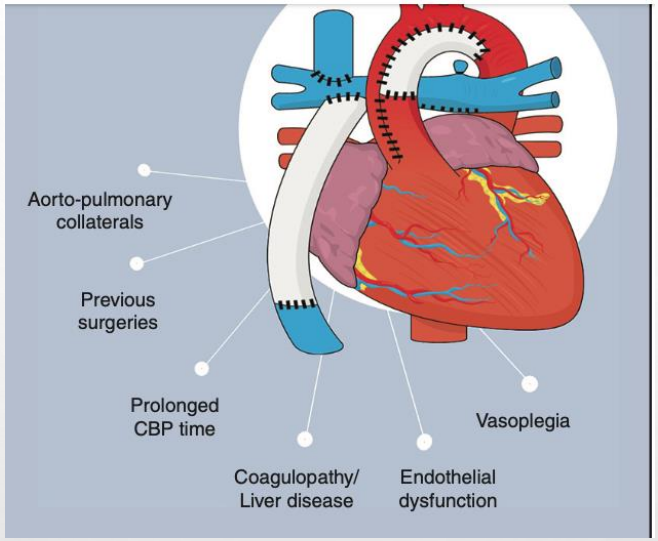
TRAPIANTO IN FONTAN

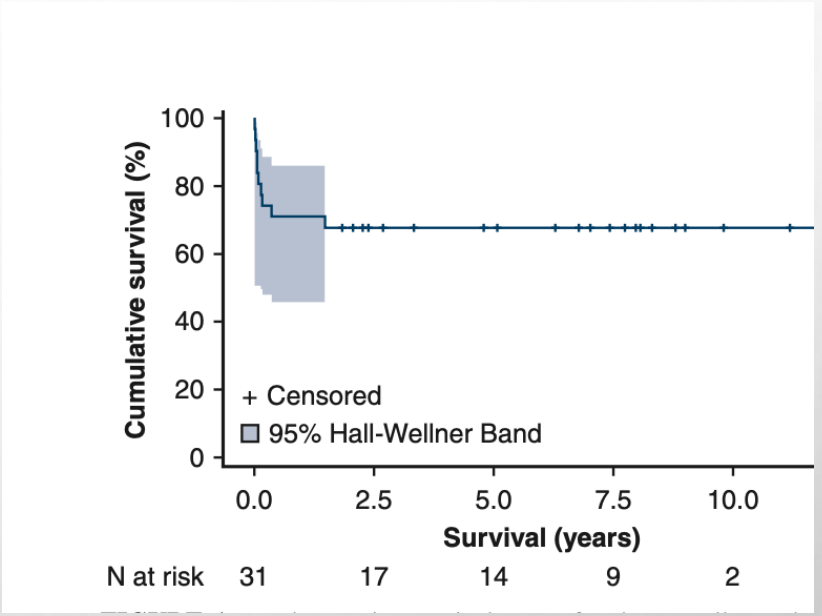
CONGENITAL: FONTAN

Improving outcomes for transplantation in failing Fontan—what is the next target?

Check for updates

Barbara Cardoso, MD,[a] Andras Kelecsenyi, MD,[b] Jonathan Smith, MB ChB, MRCP (UK), FRCA,[b,c] Katrijn Jansen, MD,[a,c] Fabrizio De Rita, MD,[a,c,d] Mohamed Samy Nassar, MD, FRCS,[a,c,d,e] and Louise Coats, MBBS, PhD[a,c]





- Sopravvivenza a 30 gg, 1 e 5aa : 81%, 71%, e 67%.
- Prima causa di morte: sanguinamento intraoperatorio
- 77.4% danno renale postoperatorio CHE NECESSITA TRAPIANTO

JTCVS2021

SCORES DI RISCHIO

- ACAP
- GUCH
- ACHS
- EUROSCORE I & II
- PEACH

Contents lists available at ScienceDirect

Journal of Cardiothoracic and Vascular Anesthesia

journal homepage: www.jcvaonline.com

Expert Review

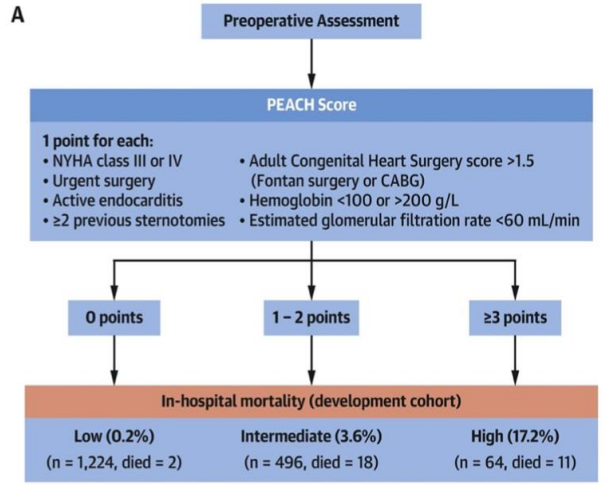
Mortality in Adult Congenital Heart Disease: Analysis of Outcomes and Risk Stratification

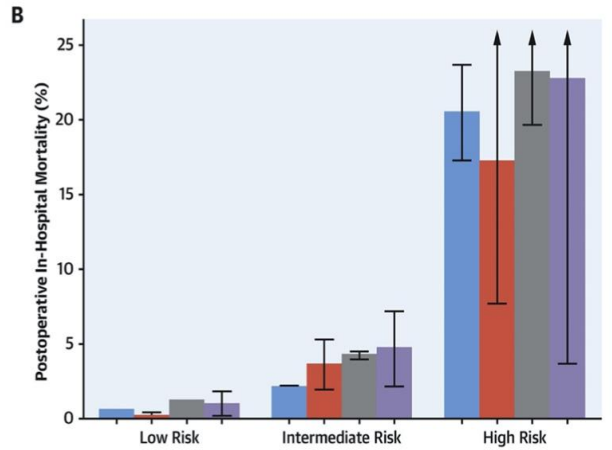
Table 3
A Brief Comparison of Major Perioperative Risk Models in Adult Congenital Heart Disease

Score System	Score Basis	Advantages	Disadvantages
PEACH Score	Patient- and procedure-specific factors specifically validated factors related to patients with ACHD and procedures in an ACHD cohort	Specifically validated in ACHD population, easy to calculate, validated against an external cohort	Recently developed, not yet validated by other groups, excludes some likely important factors due to lack of data, limited number of events in cohort
EuroSCORE I & II	Patient-specific factors based on an adult cardiac surgery cohort	Based on large dataset	The design of the score specifically excluded patients with ACHD. Most procedures used to create the dataset are not common for the ACHD population
ACHS Score	Procedure-specific risk score	Simple to calculate	Ignores patient-specific risk factors
GUCH Score	Super-score of other pediatric CHD risk models		Not yet externally validated. Complicated to calculate
ACAP Score	Anatomy and physiology of the patient	Outperforms ACHS score, simple to calculate	Ignores other patient-specific risk and procedure-specific risk factors. Has yet to be externally validated

Abbreviations: ACHD, Adult Congenital Heart disease; ACHS, Adult Congenital Heart Surgery; GUCH, Grown-Ups with Congenital Heart disease; PEACH, Perioperative Adult Congenital Heart Disease; EuroSCORE, European System for Cardiac Operative Risk Evaluation.

CENTRAL ILLUSTRATION: The PEACH Score: Risk Score Calculation, Predicted and Observed In-Hospital Mortality





IL PESO DELL'ANIMA

Where Adults with Congenital Heart Disease Die: Insights from the CDC-WONDER Database

ESC European Society of Cardiology
European Heart Journal (2022) **00**, 1–10
https://doi.org/10.1093/eurheartj/ehac484

FASTTRACK CLINICAL RESEARCH
Congenital heart disease

Last year of life of adults with congenital heart diseases: causes of death and patterns of care

Liesbet Van Bulck [1,2], Eva Goossens [1,3], Lucas Morin [4,5], Koen Luyckx [6,7], Fouke Ombelet [1,8,9], Ruben Willems [10], Werner Budts [11,12], Katya De Groote [13], Julie De Backer [14], Lieven Annemans [10], Stéphane Moniotte [15], Michèle de Hosson [14], Arianne Marelli[16], .CODAC consortium

ESC European Society of Cardiology
European Heart Journal (2022) **00**, 1–3
https://doi.org/10.1093/eurheartj/ehac492

EDITORIAL

A view from the end: what the last year of life can teach us about palliative care on the adult congenital heart disease journey

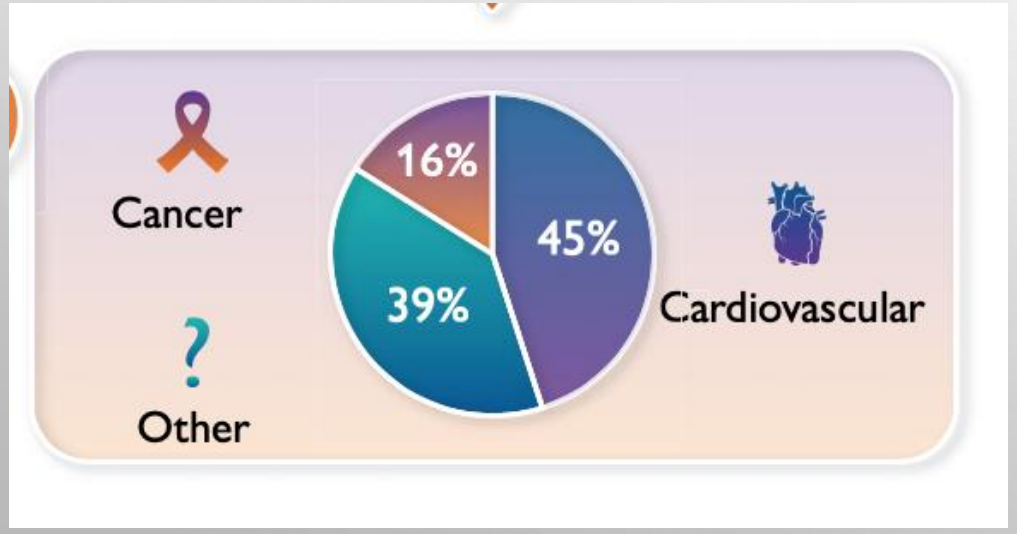
Jill M. Steiner [1]* and James N. Kirkpatrick[2]

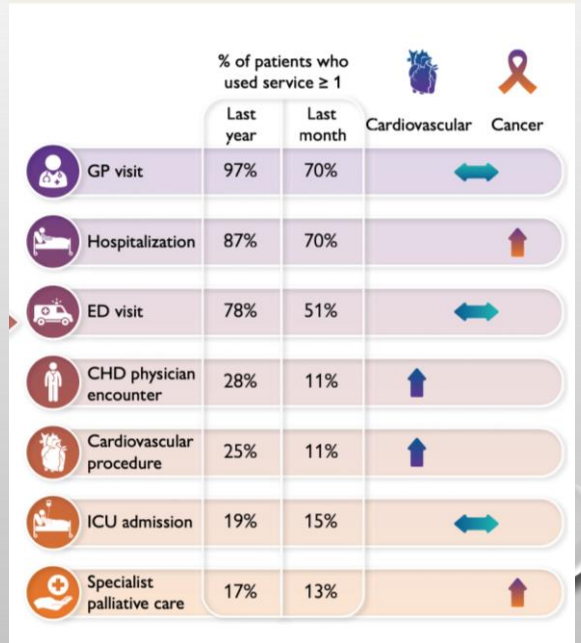
[1]Division of Cardiology, Department of Medicine & Cambia Palliative Care Center of Excellence, University of Washington, 1959 NE Pacific St., HSB C502, Box 356422 Seattle, WA 98195, USA; and [2]Division of Cardiology, Department of Medicine & Department of Bioethics and Humanities, University of Washington, 1959 NE Pacific St., Seattle, WA 98195, USA

MORTALITA

DOVE SONO GLI SPECIALISTI ACHD?

- GLI ACHD MUOIONO IN OSPEDALE (64% VS 46% -POPOLAZIONE GENERALE)
- 390 PTS: 45% CAUSA CARDIOVASCOLARE EUR J CARDIOL22 (BELGA)
- ULTIMO ANNO DI VITA OSPEDALIZZAZIONE: 87%, 78% DEA, 19% ICU, 17% CURE PALLIATIVE DI CUI IL 4% DEI DECESSI PER CAUSA CARDIOVASCOLARE






ESC European Society of Cardiology
European Heart Journal (2022) 00, 1–10
https://doi.org/10.1093/eurheartj/ehac484
FASTTRACK CLINICAL RESEARCH
Congenital heart disease

Last year of life of adults with congenital heart diseases: causes of death and patterns of care

Liesbet Van Bulck [1,2], Eva Goossens [1,3], Lucas Morin [4,5], Koen Luyckx [6,7], Fouke Ombelet [1,8,9], Ruben Willems [10], Werner Budts [11,12], Katya De Groote [13], Julie De Backer [14], Lieven Annemans [10], Stéphane Moniotte [15], Michèle de Hosson [14], Arianne Marelli[16], Philip Moons [1,17,18]*, and BELCODAC consortium

LA PARADOSSALE FORZA DELLA FRAGILITA

ACHD

PIU' UMANI DEGLI UMANI?

PUBBLICAZIONE ESC SU COVID INCLUDONO PARTI SCRITTE DAI PAZIENTI

Graphical Abstract

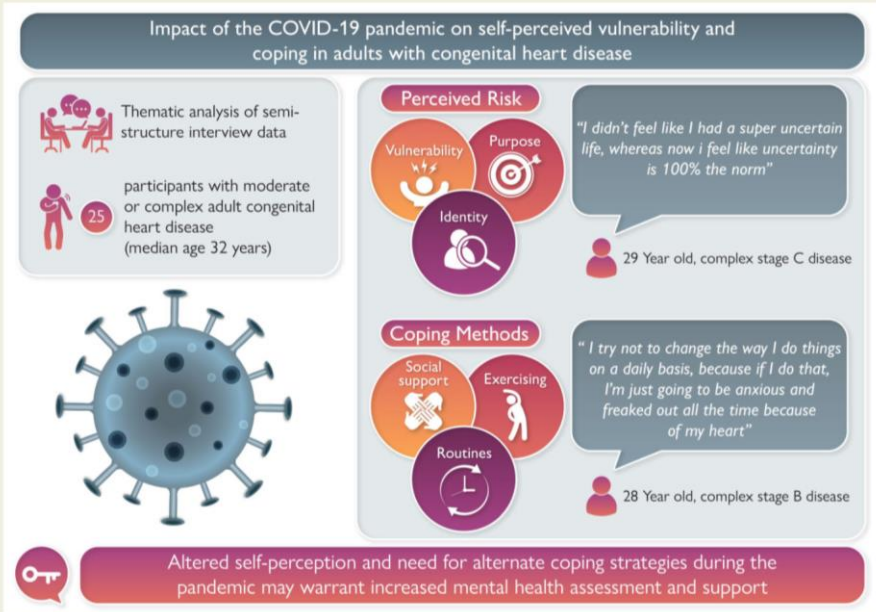


Table 2 **Key participant quotations**

COVID affected participants' sense of vulnerability

[Previously], when I thought of myself as a vulnerable population, I thought of it more as because I was pregnant not, 'Oh, and you have this heart condition.' Which is strange, … a double whammy. When I had a heart appointment during my pregnancy, one of the cardiologists said, 'Yeah, it's good that you're being extra cautious because you are a vulnerable population, because of your heart condition.' I was like, 'Oh, yeah.'—32 years old, moderate Stage C disease

Before COVID, I was just like, 'Oh, I have this job, it's just a job to me, but I'm getting by and I'm reasonably happy.' Then COVID happened, and then we all kind of had to… confront the idea that we could get a terrible disease and die. I think, when I was kid, having to go through sort of a realization that I could die, it had some positive effect. It had some self-actualization in, it granted me some immediacy. I would say that that's what that did for me now, is, I feel like I do actually need to do something.—25 years old, moderate Stage B disease

My family was told to prepare for this, prepare for that. 'He may not make it to this age and that age'. So I've been preparing the whole time through my life because my mother shared this with me… And I don't know if that helped or hurt me, but I'm not going to sit here and pass my life in fear. I'm aware of the COVID… but I try not to live my life thinking, 'Oh, well I got to be super cautious in this and that'. So I try to live my life, and go through my daily routine, without thinking of it too much.—44 years old, moderate Stage D disease

I am one of the numbers of person that would totally die if I got it. I respect that deeply. And I've changed my life a little bit for that, but no more than anybody that was already expecting to die tomorrow… I laugh with my friends, like, 'Wouldn't it be weird if I lived all this extra time, and then this stupid thing got me?' It's a waste of a defeat of all these other, bigger diseases in my life I've conquered.—37 years old, complex Stage C disease

It's funny because I never saw my heart condition as … It never caused that much unsettling uncertainty. There was always uncertainty, but it was enough able to be put in the back of my head. I didn't feel like I had a super uncertain life whereas now I feel like uncertainty is 100% the norm.—29 years old, complex Stage C disease

COVID impacted use of existing coping strategies

AZIENDA OSPEDALIERO - UNIVERSITARIA
Città della Salute e della Scienza di Torino

ACHD
PIU' UMANI DEGLI UMANI?

- LINE GUIDA PH 2022: INCLUDONO ASSOCIAZIONI DI PAZIENTI

New standards for PH centres have been presented and, for the first time, patient representatives were actively involved in developing these guidelines.


EUROPEAN RESPIRATORY JOURNAL
ERS OFFICIAL DOCUMENTS
M. HUMBERT ET AL.

2022 ESC/ERS Guidelines for the diagnosis and treatment of pulmonary hypertension

Developed by the task force for the diagnosis and treatment of pulmonary hypertension of the European Society of Cardiology (ESC) and the European Respiratory Society (ERS)

Endorsed by the International Society for Heart and Lung Transplantation (ISHLT) and the European Reference Network on rare respiratory diseases (ERN-LUNG)

PAH : 4-6% di ACHD

AZIENDA OSPEDALIERO - UNIVERSITARIA
Città della Salute e della Scienza di Torino

ACHD
PIU' UMANI DEGLI UMANI?

- LE CC SONO M CRONICHE: **TUTTE**
- PERSONE A CUI E STATO DATO IL BENESSERE FISICO, LA POSSIBILITA DI ESSERE PARTE ATTIVA DELLA SOCIETA, SPESSO LA VITA
- CONTINUANO AD AVER BISOGNO DI REINTERVENTI E CURE
- DISAGIO PSICOLOGICO
- DIFFICOLTA' NEL MONDO DEL LAVORO

IL DIA E ANCORA UNA CHD SEMPLICE?

«QUESTO PAZIENTE HA UN DIA, LO POSSO GESTIRE DA SOLO»

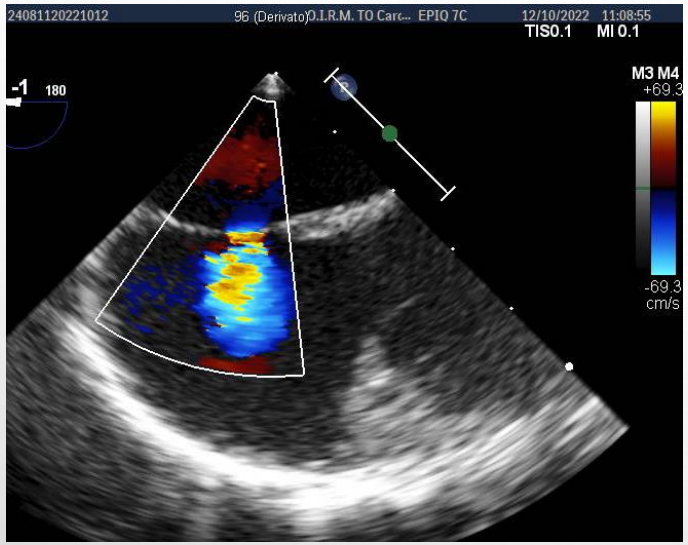
AZIENDA OSPEDALIERO - UNIVERSITARIA
Città della Salute e della Scienza di Torino

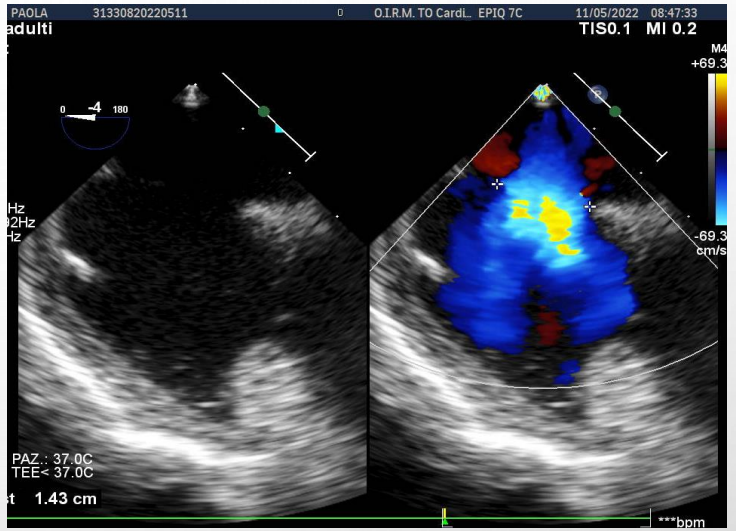
Rischio aumentato di

- FA e stroke (Heart2015, Front Cardiovasc Med 2022)
- polmonite (Am J Cardiol 2014)
- tumore (Eur Heart J 2018)
- problemi psichiatrici (Congen Heart Dis 2019, Am J Cardiol 2020)

IL DIA E ANCORA UNA CHD SEMPLICE?

DIA PICCOLO E GRANDE





I pz con DIA piccolo in storia naturale:
stesse problematiche dei pz con DIA ampio
Danish national registry
Int J cardiol 2019

MORTALITA DEI PAZIENTI CON DIA

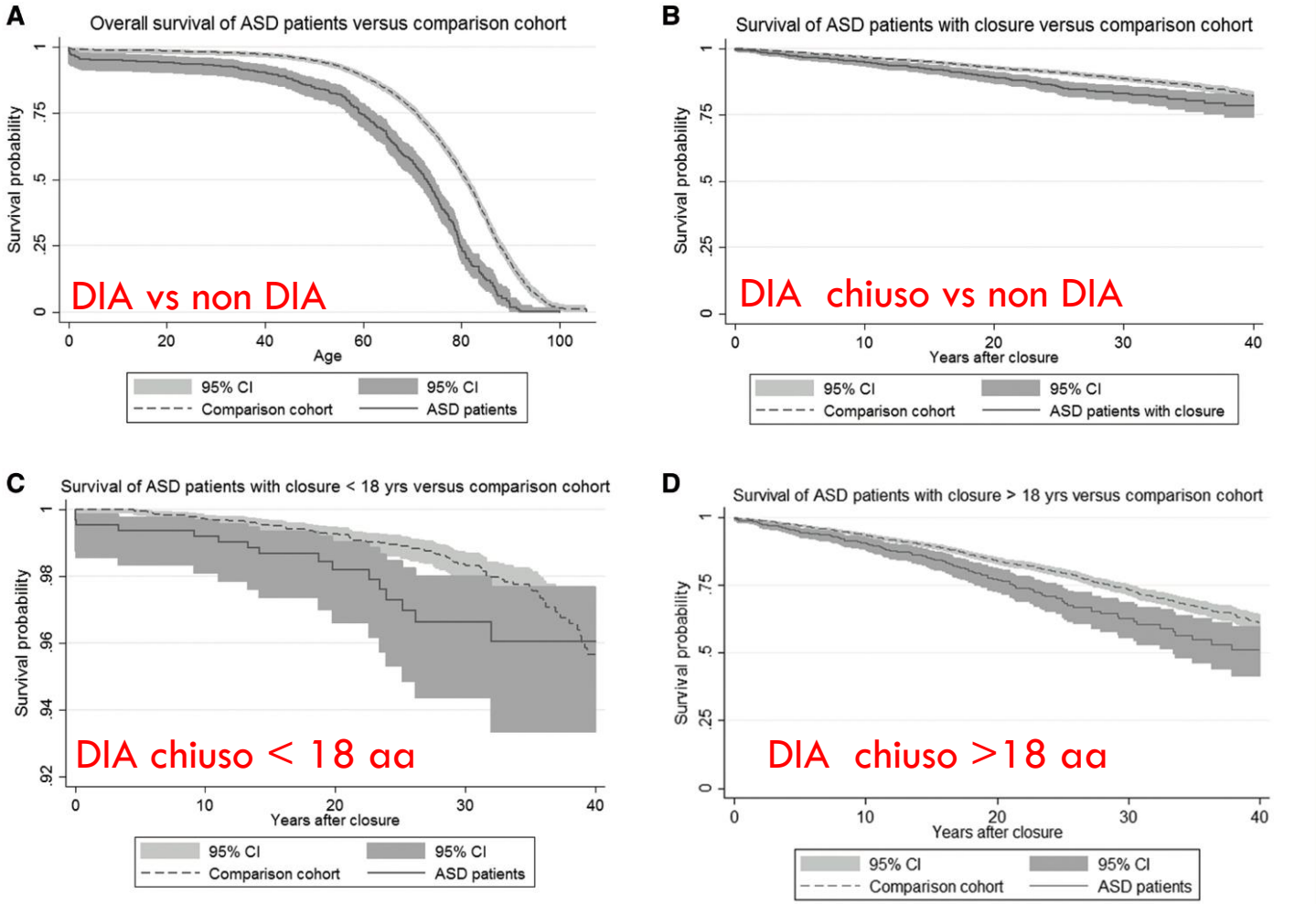


Figure 1 (*A*) Survival in years in atrial septal defect (ASD) patients without closure compared with the comparison cohort with age as an underlying time scale. (*B*) Survival in ASD patients after closure compared with the comparison cohort with years after closure as an underlying time scale. (*C*) Survival in patients with closure before the age of 18 compared with the comparison cohorts with years after closure as an underlying timescale.

Mortalita' piu' alta, sia che il DIA sia stato chiuso o meno

Eur Heart J. 2018

CHIUSURA VS STORIA NATURALE

TUTTI

DIAGNOSI TARDIVA

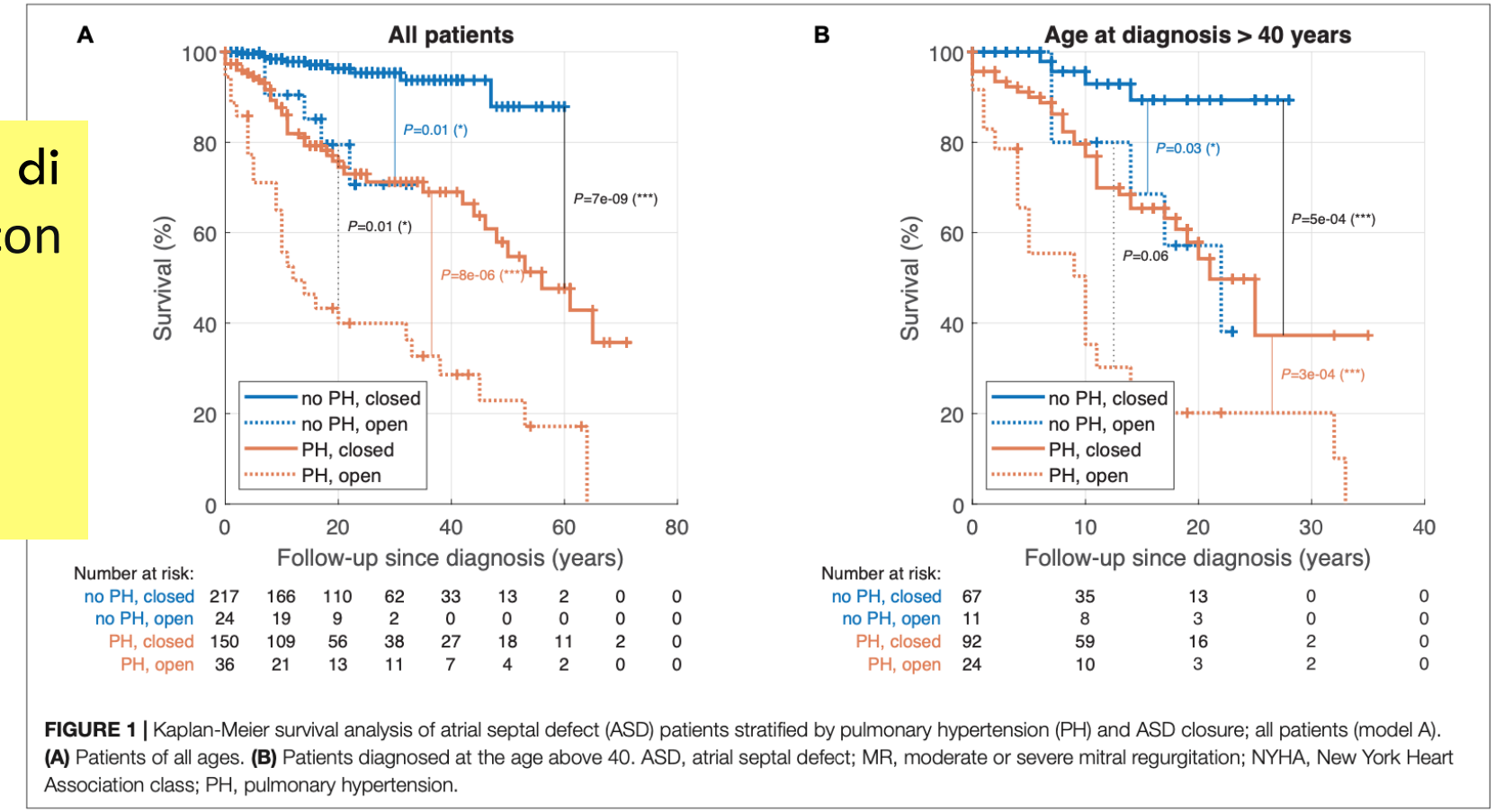


FIGURE 1 | Kaplan-Meier survival analysis of atrial septal defect (ASD) patients stratified by pulmonary hypertension (PH) and ASD closure; all patients (model A). **(A)** Patients of all ages. **(B)** Patients diagnosed at the age above 40. ASD, atrial septal defect; MR, moderate or severe mitral regurgitation; NYHA, New York Heart Association class; PH, pulmonary hypertension.

Mortalita' e incidenza di CHF piu' alta nei pz con

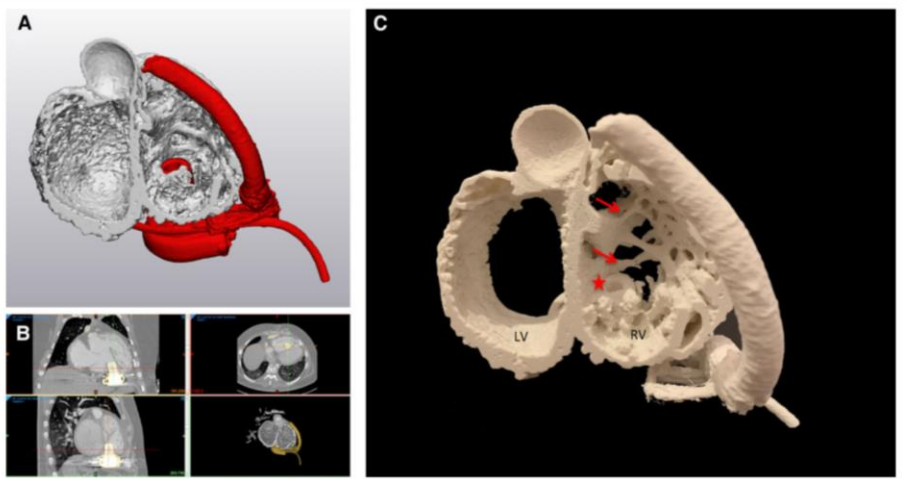
- DIA aperto
- Diagnosi tardiva
- PH

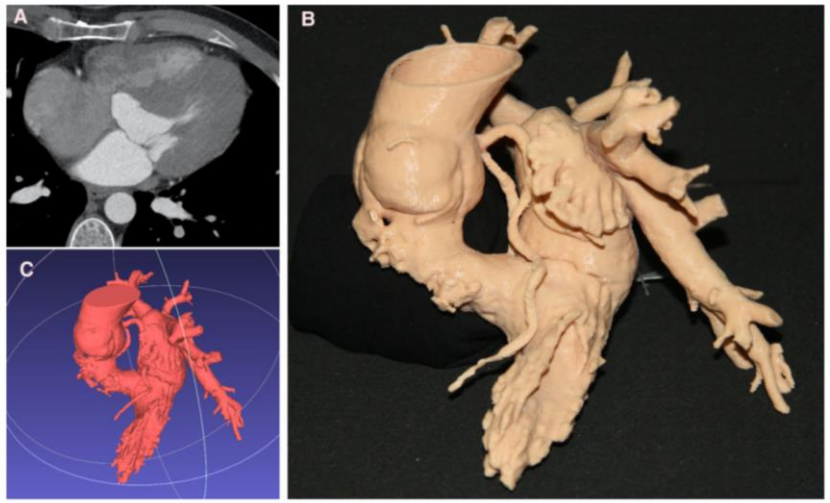
BLU: NO PH

ROSSO: PH

Frontiers cardiovasc medicine 2022

ARRIVA IL METAVERSO





Virtual reality and augmented reality: imaging or imagining?

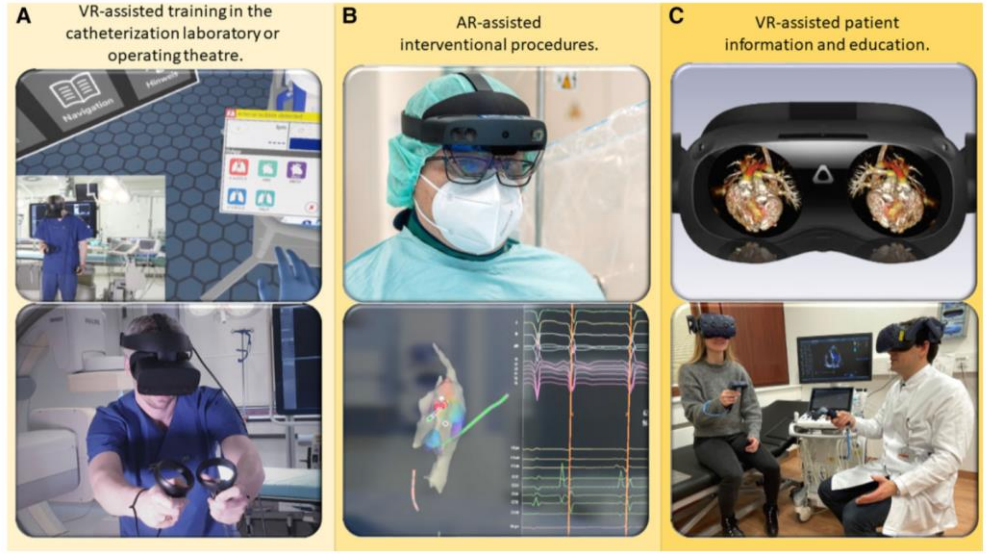


Figure 7 (*A*) Virtual reality-assisted training the catheterization laboratory or operating theatre. (*B*) Augmented reality-assisted interventional procedures; (*C*) virtual reality-assisted patient information and education.

ESC European Society of Cardiology
European Heart Journal (2022) **43**, 2672–2684
https://doi.org/10.1093/eurheartj/ehac266

STATE OF THE ART REVIEW
Congenital heart disease

Three-dimensional printing, holograms, computational modelling, and artificial intelligence for adult congenital heart disease care: an exciting future