

## **Research Center on Heart Valve Disease**

**Director: Prof. Denisa Muraru**

### **Specialized Research Center afferent to the Cardiology Research Laboratory**

#### **Research group members:**

- **Prof. Luigi Badano**
- **Dr. Michele Tomaselli**
- **Dr. Mara Gavazzoni**
- **Prof. Sergio Caravita**
- **Dr. Francesca Heilbron**
- **Dr. Giorgio Oliverio**
- **Dr. Francesco Perelli**
- **Dr. Andrea Cascella**

#### **RESEARCH ACTIVITIES**

The main goal of the **Auxologico Heart Valve Disease (HVD) Research Center** is to develop, evaluate, apply, and implement novel cardiovascular imaging methods for an improved understanding of cardiac anatomy and pathophysiology in various heart valve conditions. Ultimately, the aim is to improve the diagnosis, management and care of adult patients with heart valve disease.

**The Team of the Auxologico HVD Research Center** includes internationally recognized experts in valvular heart disease and advanced imaging modalities. Their commitment is to apply the best performing equipment and multi-modality imaging technologies (such as transthoracic and transesophageal 3D echocardiography, 2D and 3D speckle-tracking strain, cardiac computed tomography, cardiac magnetic resonance etc), offering patients access to early diagnosis, appropriate care and timely referral for innovative treatment pathways that are not yet available in most centers. The Team led by **Prof Denisa Muraru** and **Prof Luigi Badano** has conducted pioneer work in the field of tricuspid regurgitation caused by atrial fibrillation and has promoted the implementation of 3D echocardiography and strain imaging for clinical and research applications.

**The Auxologico HVD Research Team** has also clinically validated, standardized and published original research using many of the current software tools available on the high-end commercially-available scanners to analyze the geometry and function of heart valves and chambers. Over the past 15 years, they have been actively contributing with Industry partners to the improvement and continuous development of 3D echocardiography technology. Finally, they are running successfully numerous workshop, courses, webinars and hands-on tutorials for those interested in applying 3D echocardiography for research and clinical care of patients with heart valve disease.

All cardiologists, imaging specialists and PhD fellows from **Auxologico HVD Research Center** work closely as a team with international research fellows and data scientists to analyze research data and translate results into daily clinical practice, in order to identify novel approaches that will save and improve patients' lives.

## **DISEASES CURRENTLY RESEARCHED**

- Tricuspid regurgitation
- Atrial fibrillation and its relationship with tricuspid and mitral atrial functional regurgitation
- Mitral valve prolapse and its relationship with ventricular arrhythmias
- Mitral regurgitation
- Aortic stenosis

## **RESULTS OF PARTICULAR IMPORTANCE ACHIEVED**

### Publications

- Muraru D, Addetia K, Guta AC, Ochoa-Jimenez RC, Genovese D, Veronesi F, Basso C, Iliceto S, Badano LP, Lang RM. Right atrial volume is a major determinant of tricuspid annulus area in functional tricuspid regurgitation: a three-dimensional echocardiographic study. *Eur Heart J Cardiovasc Imaging*. 2021 May 10;22(6):660-669. doi: 10.1093/ehjci/jeaa286.

<https://doi.org/10.1093/ehjci/jeaa286>

- Praz F, Muraru D, Kreidel F, Lurz P, Hahn RT, Delgado V, Senni M, von Bardeleben RS, Nickenig G, Hausleiter J, Mangieri A, Zamorano JL, Prendergast BD, Maisano F. Transcatheter treatment for tricuspid valve disease. *EuroIntervention*. 2021 Nov 19;17(10):791-808. doi: 10.4244/EIJ-D-21-00695. PMID: 34796878; PMCID: PMC9724890

[https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9724890/pdf/EIJ-D-21-00695\\_Praz.pdf](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9724890/pdf/EIJ-D-21-00695_Praz.pdf)

- Badano LP, Caravita S, Rella V, Guida V, Parati G, Muraru D. The Added Value of 3-Dimensional Echocardiography to Understand the Pathophysiology of Functional Tricuspid Regurgitation. *JACC Cardiovasc Imaging*. 2021 Mar;14(3):683-689. doi: 10.1016/j.jcmg.2020.04.029. Epub 2020 Jul 15. PMID: 32682722.

<https://www.sciencedirect.com/science/article/pii/S1936878X20304320?via%3Dihub>

- Guta AC, Badano LP, Tomaselli M, Mihalcea D, Bartos D, Parati G, Muraru D. The Pathophysiological Link between Right Atrial Remodeling and Functional Tricuspid Regurgitation in Patients with Atrial Fibrillation: A Three-Dimensional Echocardiography Study. *J Am Soc Echocardiogr*. 2021 Jun;34(6):585-594.e1. doi: 10.1016/j.echo.2021.01.004. Epub 2021 Jan 10. PMID: 33440232.
- Tomaselli M, Badano LP, Menè R, Gavazzoni M, Heilbron F, Radu N, Caravita S, Baratto C, Oliverio G, Florescu DR, Parati G, Muraru D. Impact of correcting the 2D PISA method on the quantification of functional tricuspid regurgitation severity. *Eur Heart J Cardiovasc Imaging*. 2022 Oct 20;23(11):1459-1470. doi: 10.1093/ehjci/jeac104. PMID: 35734964.

<https://doi.org/10.1093/ehjci/jeac104>

- Muraru D, Gavazzoni M, Heilbron F, Mihalcea DJ, Guta AC, Radu N, Muscogiuri G, Tomaselli M, Sironi S, Parati G, Badano LP. Reference ranges of tricuspid annulus geometry in healthy adults using a dedicated three-dimensional echocardiography software package. *Front Cardiovasc Med*. 2022 Sep 13;9:1011931. doi: 10.3389/fcvm.2022.1011931. PMID: 36176994; PMCID: PMC9513148.

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9513148/pdf/fcvm-09-1011931.pdf>

- Gavazzoni M, Heilbron F, Badano LP, Radu N, Cascella A, Tomaselli M, Perelli F, Caravita S, Baratto C, Parati G, Muraru D. The atrial secondary tricuspid regurgitation is associated to more favorable outcome than the ventricular phenotype. *Front Cardiovasc Med*. 2022 Nov 29;9:1022755. doi: 10.3389/fcvm.2022.1022755.

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9744784/pdf/fcvm-09-1022755.pdf>

Find the full updated list of publications at:

<https://pubmed.ncbi.nlm.nih.gov/?term=muraru+denisa&sort=date>

Scientific Meetings

## **Prof. Denisa Muraru**

- EACVI 2023 – Scientific Program Co-Chair - Echocardiography

<https://www.escardio.org/Congresses-Events/EACVI-Congress/About-the-Congress>

- PCR Madrid Imaging Valves 2023 – Scientific Program Co-Director

<https://www.pcronline.com/Courses/PCR-Imaging-Valves-Madrid>

## **Prof. Luigi Badano**

- Athens Medical Group Cardiovascular Imaging Congress 2023 – Scientific Program Co-Director

<https://medevents.gr/congress/acvi23>

### Research grants

- “In-depth characterization of atrio-genic secondary tricuspid regurgitation due to atrial fibrillation. Prevalence, mechanisms, advanced quantification of regurgitation severity, and relative impact of sinus rhythm” (Bando Ricerca Finalizzata 2021, Ministero della Salute – RF-2021-12374122)

### Awards and international recognitions

- **Prof. Denisa Muraru** is an internationally recognized expert in advanced echocardiography and valvular heart disease.

She ranks as the #1 expert in 3D echocardiography in Europe and #2 worldwide, as well as #8 world expert in Tricuspid regurgitation

<https://expertscape.com/ex/echocardiography%2C+three-dimensional>

She has a H-index is 41 and a record of >200 publications receiving 17500 citations.

Prof. Muraru is the Vice-President of the European Association of Cardiovascular Imaging (EACVI) for Echocardiography Section in the EACVI Board 2022-2024 and Deputy Chair of EACVI Web and Communication Committee. Between 2020 and 2022, she was in charge of the EACVI Research and Innovation Committee. She is Fellow of the European Society of Cardiology (FESC), American College of Cardiology (FACC) and American Society of Echocardiography (FASE). She has served in many writing committees for EACVI and ASE recommendations and consensus papers.

In 2021, she received the distinguished American Society of Echocardiography's 22nd Annual Feigenbaum Lecturer Award in recognition of her significant contribution to research in the field and potential to continue at a high level of achievement. It was for the first time that the American Society of Echocardiography selected a European woman researcher to receive this award.

<https://www.asecho.org/feigenbaum-lecturer/>

- **Prof. Luigi Badano** is the Director of the Cardiovascular Imaging Department at Auxologico and top international expert in cardiovascular imaging and heart valve disease.

He has a H-index is 71 and a record of >400 publications receiving almost 50.000 citations.

Prof. Badano is Past-President of the European Association of Cardiovascular Imaging (EACVI), Fellow of the European Society of Cardiology (FESC), American College of Cardiology (FACC), Honorary fellow of the American Society of Echocardiography (FASE) and British Society of Echocardiography. He has founded the Working Group on Heart Valve Disease of the Italian Society of Cardiology (SIC). He has chaired and served in many writing committees for ESC, EACVI and ASE recommendations and consensus papers.

- **Auxologico HVD Research Center's Publications listed in Top 3 Most Cited Articles in Eur Heart J Cardiovascular Imaging in the Past Two Years**

Muraru D, Addetia K, Guta AC, Ochoa-Jimenez RC, Genovese D, Veronesi F, Basso C, Iliceto S, Badano LP, Lang RM. Right atrial volume is a major determinant of tricuspid annulus area in functional tricuspid regurgitation: a three-dimensional echocardiographic study. *Eur Heart J Cardiovasc Imaging*. 2021 May 10;22(6):660-669. doi: 10.1093/ehjci/jeaa286. Erratum in: *Eur Heart J Cardiovasc Imaging*. 2021 May 10;22(6):669. PMID: 33387441.

Muraru D, Previtiero M, Ochoa-Jimenez RC, Guta AC, Figliozzi S, Gregori D, Bottigliengo D, Parati G, Badano LP. Prognostic validation of partition values for quantitative parameters to grade functional tricuspid regurgitation severity by conventional echocardiography. *Eur Heart J Cardiovasc Imaging*. 2021 Jan 22;22(2):155-165. doi: 10.1093/ehjci/jeaa282. PMID: 33247930.

<https://academic.oup.com/eurheartj/pages/highly-cited-articles#1886730caffbb3e46c3e>

- **Auxologico HVD Research Center's Publications listed in Top 5 Best of Imaging in Eur Heart J Cardiovascular Imaging in 2020 (top Altmetric Scoring articles)**

Skulstad H, Cosyns B, Popescu BA, Galderisi M, Salvo GD, Donal E, Petersen S, Gimelli A, Haugaa KH, Muraru D, Almeida AG, Schulz-Menger J, Dweck MR, Pontone G, Sade LE, Gerber B, Maurovich-Horvat P, Bharucha T, Cameli M, Magne J, Westwood M, Maurer G, Edvardsen T. COVID-19 pandemic and cardiac imaging: EACVI recommendations on precautions, indications, prioritization, and protection for patients and healthcare personnel. *Eur Heart J Cardiovasc Imaging*. 2020 Jun 1;21(6):592-598. doi: 10.1093/ehjci/jeaa072. PMID: 32242891; PMCID: PMC7184341.

Badano LP, Muraru D, Parati G, Haugaa K, Voigt JU. How to do right ventricular strain. *Eur Heart J Cardiovasc Imaging*. 2020 Aug 1;21(8):825-827. doi: 10.1093/ehjci/jeaa126. PMID: 32504092.

[https://academic.oup.com/ehjcmaging/pages/best\\_of](https://academic.oup.com/ehjcmaging/pages/best_of).

- **PhD Students' research received Best Abstract Award at the 83rd and 82nd Congress of the Italian Society of Cardiology (83rd SIC National Congress) in 2022 and 2021**

1. Michele Tomaselli, Luigi Paolo Badano, Francesco Paolo Perelli, Noela Radu, Giorgio Oliverio, Heilbron Francesca, Davide Stucchi, Cinzia Pece, Virginia Camponetti, Andrea Cascella, Sergio Caravita, Claudia Baratto, Francesca Ciambellotti, Gianfranco Parati, Mara Gavazzoni, Denisa Muraru 227 THE PROGNOSTIC VALUE OF RIGHT ATRIAL STRAIN IN PATIENTS WITH SECONDARY TRICUSPID REGURGITATION, *European Heart Journal Supplements*, Volume 24, Issue Supplement\_K, December 2022, suac121. 238, <https://doi.org/10.1093/eurheartjsupp/suac121.238>.

2. Michele Tomaselli, Vincenzo Cannone, Denisa Muraru, Giorgio Oliverio, Mara Gavazzoni, Francesca Heilbron, Noela Radu, Francesco Perelli, Davide Stucchi, Cinzia Pece, Virginia Camponetti, Salvatore Rizzo, Giovanni Battista Perego, Sergio Caravita, Claudia Baratto, Gianfranco Parati, Francesco Brasca, Luigi Paolo Badano, 511 INCREMENTAL VALUE OF RIGHT ATRIAL STRAIN ANALYSIS TO PREDICT ATRIAL FIBRILLATION RECURRENCE AFTER CARDIOVERSION, *European Heart Journal Supplements*, Volume 24, Issue Supplement\_K, December 2022, suac121. 239, <https://doi.org/10.1093/eurheartjsupp/suac121.239>

3. Michele Tomaselli, Emanuele Curti, Noela Radu, Francesco Perelli, Andrea Cascella, Davide Stucchi, Cinzia Pece, Virginia Camponetti, Giorgio Oliverio, Francesca Ciambellotti, Mara Gavazzoni, Francesca Heilbron, Sergio Caravita, Claudia Baratto, Gianfranco Parati, Denisa Muraru, Luigi Paolo Badano, 843 QUANTIFICATION OF VENTRICULAR FUNCTIONAL MITRAL REGURGITATION USING THE VOLUMETRIC METHOD BY 3D-ECHOCARDIOGRAPHY, *European Heart Journal Supplements*, Volume 24, Issue Supplement\_K, December 2022, suac121. 241, <https://doi.org/10.1093/eurheartjsupp/suac121.241>

4. Mara Gavazzoni, Francesca Heilbron, Diana Florescu, Pellegrino Ciampi, Andrada C Guta, Roberto Ochoa, Michele Tomaselli, Valentina Volpato, Giorgio Oliverio, Sergio Caravita, Gianfranco Parati, Denisa Muraru, Luigi Badano, 144 Atrial and ventricular phenotypes in a cohort of patients with functional tricuspid regurgitation: clinical, echocardiographic, and prognostic aspects, *European Heart Journal Supplements*, Volume 23, Issue Supplement\_G, December 2021, suab132. 024, <https://doi.org/10.1093/eurheartj/suab132.024>

## **MAIN COLLABORATIONS IN NATIONAL AND INTERNATIONAL RESEARCH NETWORKS**

- **PCR Tricuspid Focus Group**

<https://www.pcronline.com/Network/Tricuspid-Focus-Group>

[https://www.pcronline.com/Webinars/PCR-Webinars/Valvular-Disease/Tricuspid-Pulmonary\\_Valve/imaging-for-transcatheter-tricuspid-interventions](https://www.pcronline.com/Webinars/PCR-Webinars/Valvular-Disease/Tricuspid-Pulmonary_Valve/imaging-for-transcatheter-tricuspid-interventions)

- **WASE International Multicenter Study of the American Society of Echocardiography**

<https://www.asefoundation.org/wase/>

- **European Society of Cardiology EURObservational Research Program (EORP) EURO-ENDO Registry**

<https://www.escardio.org/Research/Registries-&-surveys/Observational-research-programme/infective-endocarditis-european-registry>

- **EURECA Imaging Registry (<https://doi.org/10.1093/eurheartj/ehac640>)**

<https://www.escardio.org/Research/Registries-&-surveys/Observational-research-programme/eureca-registry>