



Heart Valve Disease Awareness Survey 2017: what did we achieve since 2015?

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Abstract

Aims The 2015 Heart Valve Disease Awareness Survey showed a low knowledge and awareness about heart valve disease in the general population despite its high prevalence and morbidity. The 2017 survey was conducted to re-evaluate concern and knowledge about heart valve disease after 2 years of rapidly increasing patient numbers presenting with heart valve disease.

Methods and results A total of 12,820 people aged 60 years or older in 11 European countries took part in the survey. While the number of people concerned most about heart valve disease increased significantly (2015:1.7% vs. 2017:2.1%; $p < 0.001$), it is still very low compared to cancer (28.8%) or Alzheimer's disease (20.9%). More people claim to be familiar with heart valve disease in general (2015: 17.1% vs. 2017: 20.0%; $p < 0.001$) and the majority claims to know of at least one therapy for heart valve disease (61.9%). Nevertheless, only 3.8% could correctly identify aortic stenosis (AS), which is significantly less than in 2015 (7.2%; $p < 0.001$). As before, the majority of the respondents claimed to rarely or never undergo a stethoscope check from their general practitioner (2015: 54.2% vs. 2017: 50.6%, $p < 0.001$); nevertheless, a positive trend can be seen. People wish heart valve disease to be part of regular checks by the general practitioners.

Conclusion The general population's knowledge of heart valve disease in general slightly increased over the last 2 years. However, detailed understanding of aortic stenosis and its treatment options is still low, as is the level of concern shown for heart valve disease. Nevertheless, the general population cites heart valve disease as a condition they wish to be checked for regularly.

Keywords Heart valve disease · Survey · Knowledge · Awareness · Aortic stenosis

Introduction

Moderate or severe heart valve disease occurs in over 13% of the population aged > 75 years [1, 2]. Aortic stenosis (AS) is the most common acquired valvular heart disease in adults, affecting 2–7% of the population older than 65 years [1]. Due to the relationship between degenerative heart valve disease and increasing life expectancy, the number of patients with severe heart valve disease has been growing steadily over recent years [3] and is likely to grow even further, in light of the aging population. In particular, the incidence of AS has increased exponentially [3].

The severity of heart valve disease has an impact on survival, especially symptomatic severe AS which, if left untreated is associated with a high mortality [4–8]. Heart valve disease can be treated successfully nowadays either with surgery or with a catheter-based approach [9]. In particular, the treatment of AS—via surgical aortic valve

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replacement and transcatheter aortic valve implantation (TAVI)—shows excellent results and a low mortality [10–13]. Therefore, patients with heart valve disease should be diagnosed early and followed closely to minimize mortality rates through timely treatment [9].

The population itself must be aware of heart valve disease to initiate the first step in effective screening—noticing symptoms. In 2015, the first European Heart Valve Disease Survey was conducted to evaluate the general population's awareness and knowledge of heart valve disease. The results showed an alarmingly low awareness amongst the general population regarding heart valve disease, especially AS [14, 15]. To improve general knowledge and awareness of heart valve disease, national and regional media outreach was undertaken in each of the participating countries to generate media coverage of the survey findings and educate people about the condition.

Two years have passed since the initial survey, during this time life expectancy has continued to increase, as have the patient numbers presenting with heart valve disease. This is reflected by an exponentially growing number of heart valve procedures [11].

The 2017 survey was performed to evaluate changes in awareness and knowledge about heart valve disease over this time period.

Methods

Conduction of the survey

The survey was conducted in 11 European countries (United Kingdom, Sweden, Spain, France, Ireland, Italy, Denmark, Finland, Germany, the Netherlands, and Norway).

An online methodology was utilized for all territories. The global online panels were actively managed and recruited for market research purposes. All member panelists went through a double opt-in process and agreed to participate to provide honest opinions for market research studies. For each survey, panelists were sent an invitation to participate via email; invitations were sent on a random basis within the target groups. Each invitation reiterated the terms and conditions for the research, including the potential use by the researchers of the information provided. Participants were reminded that personal identity and other personally identifiable details of the respondents would be protected. The survey adheres to the MRS Code of Conduct in the UK. Within these parameters, guidelines ensure that all research is carried out in a professional and ethical manner. The survey was also fully compliant and in accordance with the Data Protection Act.

The 2017 Heart Valve Disease Awareness Survey was undertaken in November 2017 by Censuswide. Opinion

Matters, who undertook the survey 2015 and Censuswide recently merged some accounts and projects and had the same production team working on the research in 2017 as in 2015. Censuswide abide by and employ members of the Market Research Society which is based on the ESOMAR principles.

Contents of the survey

The survey contained eight questions; six with a single possible response and two with a multiple response possible, the questions are listed in the result section.

After question 5, background information on aortic stenosis was provided before the final question. The background information read as follows: “The heart valve disease, aortic stenosis, is the narrowing of the aortic valve opening, which limits the amount of blood flow from the heart. It is characterized by the accumulation of calcium deposits on the valve leaflets. Symptoms include chest pain, fatigue, shortness of breath, light-headedness and fainting. Once severe symptoms develop, it is life-threatening. The primary treatment is heart valve replacement. This can alleviate symptoms, prolong a patient's life span and improve health and quality of life. Aortic stenosis affects up to 7% of the population over 65”.

Five questions were also part of the 2015 survey (Q1, Q2, Q3, Q5, Q6). Two questions were only part of the country specific questions in 2015: Only participants from the UK were asked Q7 and only participants from Germany were asked Q8 in 2015.

Statistical analysis

The results were compared to the results of the 2015 Heart Valve Disease Awareness Survey, which were previously described [14, 15]. Pearson chi-squared test was performed for categorical variables with nominal scale. The alpha level of statistical significance was 0.05.

Results

In total, 12,820 people aged 60 years or older in 11 European countries participated in the 2017 Heart Valve Disease Awareness Survey. The participants' characteristics showing gender, nationality, and age are listed in Table 1.

Gender, age and location type were recorded, distinguishing between participants from urban, semi-urban, and rural areas (Table 1).

Q1. Which of the following health conditions concerns you most?

Table 1 Participants characteristics

| | <i>n</i> = 12,820 | % |
|----------------------|-------------------|------|
| Country | | |
| UK | 1608 | 12.5 |
| Sweden | 1000 | 7.8 |
| Spain | 1100 | 8.6 |
| France | 1402 | 10.9 |
| Ireland | 1000 | 7.8 |
| Italy | 1301 | 10.1 |
| Denmark | 1002 | 7.8 |
| Finland | 1003 | 7.8 |
| Germany | 1401 | 10.9 |
| Netherlands | 1002 | 7.8 |
| Norway | 1002 | 7.8 |
| Austria | | |
| Age | | |
| 60–64 | 5301 | 41.3 |
| 65–69 | 4014 | 31.3 |
| 70–74 | 2501 | 19.5 |
| 75–79 | 750 | 5.9 |
| ≥ 80 | 264 | 2.1 |
| Location type | | |
| Urban | 4926 | 38.4 |
| Suburban | 4028 | 31.4 |
| Rural | 3866 | 30.2 |
| Gender | | |
| Male | 7115 | 55.5 |
| Female | 5705 | 44.5 |

The disease with the highest level of concern among the participants were—as in 2015—cancer (2017: 28.8% vs. 2015: 27.5%; $p = 0.04$), Alzheimer’s Disease (2017: 20.9% vs. 2015: 24.7%; $p < 0.001$) and stroke (2017: 10.1%

vs. 2015: 12.4%; $p < 0.001$) (Fig. 1). Only 2.1% of the respondents were most concerned about heart valve disease. This number increased slightly yet was statistically significant compared to 2015 (1.7%; $p = 0.04$).

Q2. Which of the following heart conditions are you most familiar with (multiple answers)?

Heart attack was the best-known heart disease. This matches with the results of the 2015 heart valve survey. Changes in familiarity are shown in Table 2. In regards to heart valve disease, familiarity increased significantly by nearly 50% (2015: 6.7% vs. 2017: 10.1%; $p < 0.001$). Taking into account participants who claimed to be familiar with all of the heart conditions, 20% were familiar with heart valve disease in 2017 (vs. 2015: 17.1%; $p < 0.001$). In 2017, an increased number of people stated that they are more familiar with heart valve disease than with congestive heart failure (10.1 vs. 8%; $p < 0.001$). A significantly lower percentage claimed to be unfamiliar with any heart condition (2015: 25.0% vs. 2017: 21.7%; $p < 0.001$).

Q3. When you visit your general practitioner (GP), how often does he/she check your heart with a stethoscope?

More people in 2017 stated that their GP checks their heart at every visit (27.7% vs. 2015: 24.4%; $p < 0.001$). Fewer GPs check their patients only rarely (37.2% vs. 2015: 38.3%; $p < 0.001$) or never (13.4% vs. 2015: 15.9%; $p < 0.001$). So, there is a positive trend with stethoscope checks becoming somewhat more frequent over the last two years. Nevertheless, combined with people who do not have a GP, 54.1% of the participants are not regularly checked with a stethoscope. In 2015 57.9% of the

Fig. 1 Q1. Which of the following health conditions concerns you most?

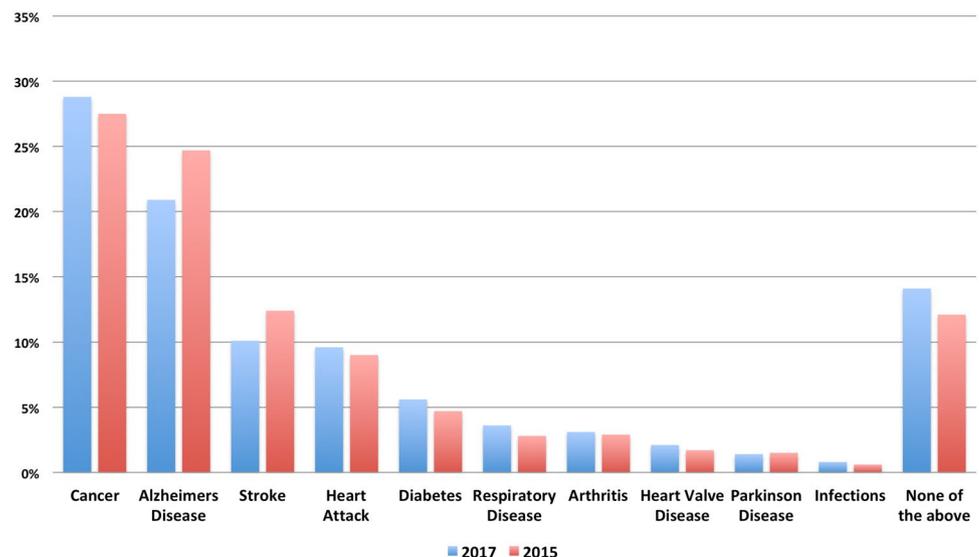


Table 2 Q2: Which of the following heart conditions are you most familiar with?

| | 2017 (%) | 2015 (%) | p value |
|---------------------------------|----------|----------|---------|
| Heart attack | 48.0 | 38.0 | <0.001 |
| Angina | 24.5 | 20.7 | <0.001 |
| Arrhythmia | 20.3 | 22.1 | 0.001 |
| Coronary heart disease | 17.9 | 22.0 | <0.001 |
| Sudden cardiac death | 13.9 | 9.3 | <0.001 |
| Heart valve disease | 10.1 | 6.7 | <0.001 |
| Congestive heart failure | 8.0 | 7.5 | 0.16 |
| Rheumatic heart disease | 1.8 | 1.6 | 0.29 |
| I am familiar with all of these | 9.9 | 10.4 | 0.25 |
| None of the above | 21.7 | 25.0 | <0.001 |

respondents claimed to be checked so infrequently ($p < 0.001$).

Q4. On a scale of 1 to 5 how likely are you to report any of the following symptoms to your GP (1 extremely unlikely; 5 extremely likely)?

Fig. 2 Q4. On a scale of 1–5, how likely are you to report any of the following symptoms to your GP (1 extremely unlikely; 5 extremely likely)?

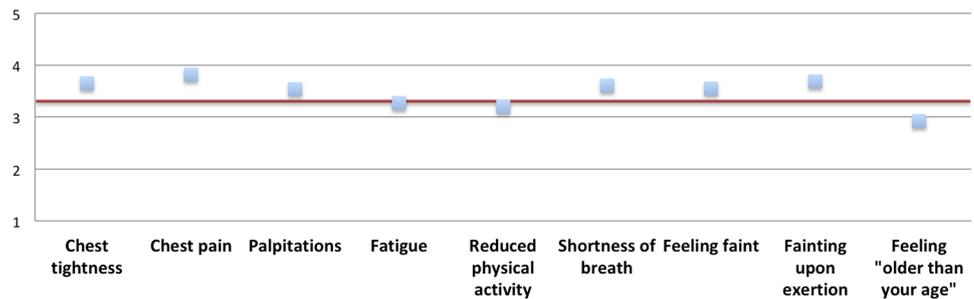
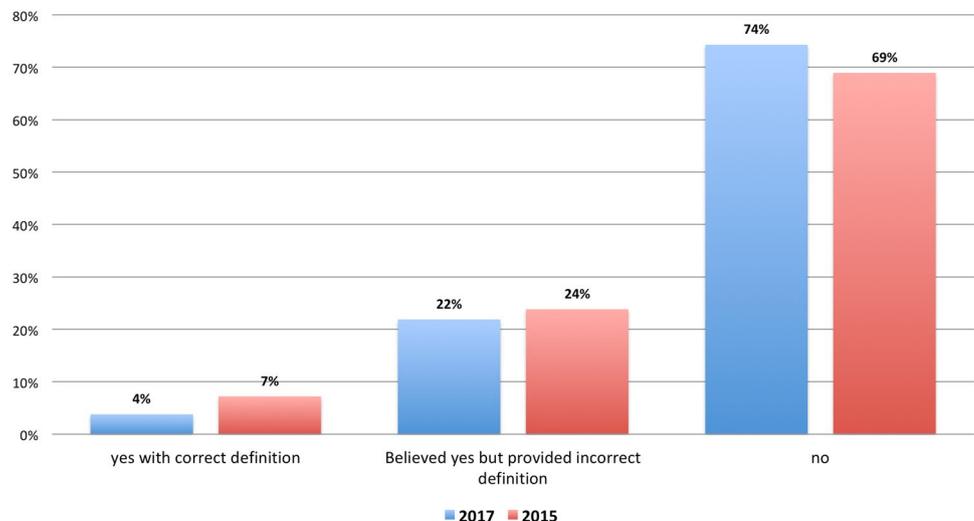


Fig. 3 Q5. Do you know what “aortic stenosis” is?



Respondents are most likely to report chest pain, followed by chest tightness (s. Fig. 2). Interestingly, the most unlikely of the possible answers—“feeling older than your age”—would be reported with the average of 2.9. All other answers ranked between 3.2 and 3.8.

Q5. Do you know what “aortic stenosis” is?

Every fourth (25.7%) participant claimed to know what AS is. However, most of these could not then give the correct description, and therefore the percentage of people who really knew what AS is, was only 3.8%.

Compared to 2015, the number of people who correctly described AS declined significantly (2015: 7.2% vs. 2017: 3.8%; $p < 0.001$). Also the number of people who believed they knew what AS is but were unable to give the right description declined (2015:23.9% vs. 2017: 21.9%; $p < 0.001$). So in 2017 more people do not know and do not even claim to know what aortic stenosis is (2017: 74.5% vs. 2015:68.9%; $p < 0.001$) (Fig. 3).

Q6. Taking into account the above information about aortic stenosis, are you more concerned about the disease and, if so, what will you do as a result?

Table 3 Q6: Taking into account the above information about aortic stenosis, are you more concerned about the disease and, if so, what will you do as a result?

| | 2017 (%) | 2015 (%) | p value |
|--|----------|----------|---------|
| I'm not more concerned | 51.1 | 45.9 | <0.001 |
| I'm more concerned and will seek more information on the subject | 23.3 | 24.2 | 0.12 |
| I'm more concerned, but I have no plans to do anything | 15.3 | 16.9 | 0.002 |
| I'm already aware of aortic stenosis | 6.9 | 9.4 | <0.001 |
| I'm more concerned and I recognize the symptoms in myself | 4.3 | 4.5 | 0.5 |

Table 4 Ranking order of wished for regular health checks

| Ranking | Health condition | Average ranking |
|---------|---------------------|-----------------|
| 1 | Blood pressure | 2.27 |
| 2 | Heart valve disease | 2.9 |
| 3 | Diabetes | 3.22 |
| 4 | Cholesterol | 3.69 |
| 5 | Alzheimer's | 4.2 |
| 6 | Osteoporosis | 4.72 |

Once respondents were given the correct information about AS a greater number showed no more concern about the disease (51.1%) than in 2015 (45.9%; $p < 0.001$). Fewer participants were already aware of aortic stenosis (2017:6.9% vs. 2015:9.4%; $p < 0.001$). The number of participants who recognized the symptoms in themselves afterward stayed stable (2017:4.3% vs. 2015:4.5%; $p = 0.5$). Details are shown in Table 3.

Q7. As part of the regular health checks for over 65s, in your view which of the following should your GP check for. Please rank in order of priority.

Blood pressure was the condition most respondents wanted to be checked for regularly by GPs. Heart valve disease was ranked in the second place followed by diabetes,

cholesterol, and Alzheimer's, with osteoporosis on the last rank. The ranking order is shown in Table 4.

Q8. Which of the following therapies for heart valve disease are you aware of (multiple answers)?

Most participants claimed to know about open heart valve replacement surgery (52%), followed by pharmaceutical drugs (29.0%) and transcatheter aortic valve implantation (TAVI) (18.9%). 38.1% did not know any therapy for heart valve disease (Fig. 4).

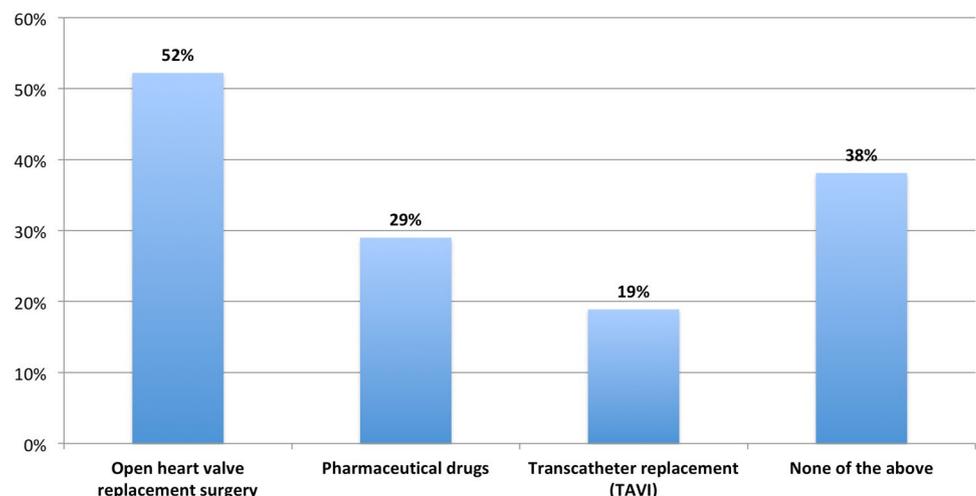
Discussion

The 2017 Heart Valve Disease Awareness Survey demonstrates the development of the awareness and knowledge about different diseases in Europe, with a special focus on heart valve disease—especially aortic stenosis which is the most common heart valve disease.

The results of this survey of 12,820 people from all over Western Europe show the following:

1. People are still most concerned about non-cardiac diseases. Even after describing the poor prognosis of AS, the concern remains low

Fig. 4 Q8. Which of the following therapies for heart valve disease are you aware of (multiple answers)?



2. In 2017 more people claim to be familiar with heart valve disease in general. Nevertheless, a lower number can describe AS correctly despite it being the most common form of heart valve disease
3. The majority of people claim to be aware of at least one therapy option for AS .
4. In 2017 GPs checked their patients slightly more often with a stethoscope, but the number of patients who are not checked regularly remains high. The percentage of people who expressed a wish for a regular check-up for heart valve disease is high

Similar to the 2015 survey, the conditions that concern people the most are still cancer and Alzheimer's disease. Over 2 years the concern about heart valve disease increased significantly, but it remains very low. Even after information on the poor prognosis of the disease was provided, the majority of people were still not more concerned.

Encouragingly, the number of participants familiar with heart conditions increased over the last 2 years, resulting also in a significant increase in familiarity with heart valve disease. Thus, the decrease of people knowing about AS reflected by the answers of Q5 and Q6 is surprising and alarming. With a prevalence of 2–7% of the population older than 65 years [1], the percentage of people who know about the condition is nearly equivalent to the percentage of people being affected. The results of these questions show that only superficial knowledge about heart valve disease has increased, people are still not sufficiently informed in detail about heart valve disease.

Despite low knowledge levels, the majority knew at least one therapy option for heart valve disease. The relatively high knowledge of treatment options compared to the low detailed knowledge on the underlying pathophysiology regarding AS shows a mismatch in information amongst the population. In addition, the low detail knowledge about AS questions the real knowledge about the treatment options. Besides pharmaceutical treatment heart valve disease—especially AS—can and is largely treated either surgically or interventionally with high success and low complications resulting in a low mortality [10, 11, 16–24]. The successful treatment option of heart valve disease compared to the poor prognosis without treatment should encourage to enlighten the population.

In recent years, through awareness campaigns at scientific meetings, and in various scientific journals heart valve disease has been brought to the fore among GPs. The slight increase in stethoscope checks might be a sign of a slight increase of the awareness and understanding of heart valve disease, but it is has not yet been sufficient.

We were able to show through the survey that people tend to report the typical symptoms of heart valve disease like chest pain, chest tightness and shortness of breath to

their GP, but there is a high percentage of asymptomatic patients as well. These asymptomatic patients need to be watched carefully as asymptomatic untreated heart valve disease might also have a high impact on prognosis [7, 9, 25–27]. Missing the diagnosis because of the lack of stethoscope check and thus the treatment might risk a patient's life. In addition, respondents explicitly expressed their wish for regular checks for heart valve disease. Heart valve disease was in second place after blood pressure. (Surprisingly given the very high concern about Alzheimer's disease, the wish for a regular check for this condition is very low.)

Bearing this in mind, a good way to increase regular auscultation to might be to implement regular heart health checks for heart valve disease after a certain age, such as 65. As a result early diagnosis and timely therapy would be guaranteed.

Limitation of the survey

The 2017 Heart Valve Disease Survey was only performed in countries in Western Europe. Respondents were pre-selected based on their agreement to participate in a survey and on the fact that the survey was performed online, which may have resulted in unpredictable bias. Among other factors this might have influenced the age distribution with fewest participants in the age group > 80 years. In the era of smartphones and widespread multimedia content, it appears logical that younger respondents might be better informed. Nonetheless, the large number of respondents may overcome the latter limitations.

Conclusion

Knowledge of heart valve disease increased, but detailed understanding is missing and even declining. Checks by GPs for heart valve disease are wished for and are also performed more often in 2017 than in 2015. Nevertheless, the majority of people aged 60 or older are not checked regularly. Awareness campaigns should be improved to aim for a fully informed population. Regular heart health checks for over 65s might be a good way to guarantee early diagnosis of heart valve disease.

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Compliance with ethical standards

Conflict of interest L. Gaede is a consultant for Abbott vascular and Edwards Lifesciences. H. Möllmann has received speaker's honoraria from Edwards Lifesciences, and proctor and speaker's honoraria from Abbott and Medtronic. G. J. Brandon Bravo Bruinsma is a consultant for Edwards Lifesciences and CEC member for LivaNova. J. Zamo-

rano has received research grants from Edwards Lifesciences. L. Aarberge has been a proctor for Edwards Lifesciences. The other authors have no conflicts of interest to declare.

References

- Nkomo VT, Gardin JM, Skelton TN et al (2006) Burden of valvular heart diseases: a population-based study. *Lancet* 368:1005–1011. [https://doi.org/10.1016/S0140-6736\(06\)69208-8](https://doi.org/10.1016/S0140-6736(06)69208-8)
- Singh JP, Evans JC, Levy D et al (1999) Prevalence and clinical determinants of mitral, tricuspid, and aortic regurgitation (The Framingham Heart Study). *Am J Cardiol* 83:897–902. [https://doi.org/10.1016/S0002-9149\(98\)01064-9](https://doi.org/10.1016/S0002-9149(98)01064-9)
- Berry C, Lloyd SM, Wang Y et al (2013) The changing course of aortic valve disease in Scotland: temporal trends in hospitalizations and mortality and prognostic importance of aortic stenosis. *Eur Heart J* 34:1538–1547. <https://doi.org/10.1093/eurheartj/ehs339>
- Lancellotti P, Troisfontaines P, Toussaint AC, Pierard LA (2003) Prognostic importance of exercise-induced changes in mitral regurgitation in patients with chronic ischemic left ventricular dysfunction. *Circulation* 108:1713–1717. <https://doi.org/10.1161/01.CIR.0000087599.49332.05>
- Nath J, Foster E, Heidenreich PA (2004) Impact of tricuspid regurgitation on long-term survival. *J Am Coll Cardiol* 43:405–409. <https://doi.org/10.1016/j.jacc.2003.09.036>
- ROSS J, BRAUNWALD E (1968) Aortic stenosis. *Circulation* 38:V-61–V-67. <https://doi.org/10.1161/01.CIR.38.1S5.V-61>
- Otto CM, Burwash IG, Legget ME et al (1997) Prospective study of asymptomatic valvular aortic stenosis. *Clin Echocardiogr Exerc Predict Outcome* 95:2262–2270. <https://doi.org/10.1161/01.cir.95.9.2262>
- Rosenhek R, Binder T, Porenta G et al (2001) Predictors of outcome in asymptomatic aortic stenosis. *N Engl J Med* 344:227. <https://doi.org/10.1056/NEJM200101183440312> (author reply 228–229)
- Baumgartner H, Falk V, Bax JJ et al (2017) 2017 ESC/EACTS guidelines for the management of valvular heart disease The Task Force for the Management of Valvular Heart Disease of the European Society of Cardiology (ESC) and the European. *Eur Heart J* 38:2739–2791. <https://doi.org/10.1093/eurheartj/ehx391>
- Gaede L, Kim W-K, Blumenstein J et al (2017) Temporal trends in transcatheter and surgical aortic valve replacement. *Herz* 42:316–324. <https://doi.org/10.1007/s00059-016-4461-1>
- Gaede L, Blumenstein J, Liebetrau C et al (2018) Outcome after transvascular transcatheter aortic valve implantation in 2016. *Eur Heart J* 39:667–. <https://doi.org/10.1093/eurheartj/ehx688>
- Gaede L, Blumenstein J, Kim W-K et al (2017) Trends in aortic valve replacement in Germany in 2015: transcatheter versus isolated surgical aortic valve repair. *Clin Res Cardiol* 106:411–419. <https://doi.org/10.1007/s00392-016-1070-1>
- Möllmann H (2015) In-hospital outcome of transcatheter vs. surgical aortic valve replacement in patients with aortic valve stenosis (AQUA Registry). *Clin Res Cardiol* 104:1934
- Gaede L, Di Bartolomeo R, Van Der Kleij F et al (2016) Aortic valve stenosis: what do people know ? A heart valve disease awareness survey of over 8800 people aged 60 or over. *EuroIntervention* 12:883–889
- Gaede L, Blumenstein J, Liebetrau C et al (2017) Heart valve diseases. How sufficient is the knowledge of the German population? *Herz*. <https://doi.org/10.1007/s00059-017-4632-8> (epub ahead of print)
- Gummert J, Funkat A, Beckmann A et al (2011) Cardiac surgery in Germany during 2010: a report on behalf of the German Society for Thoracic and Cardiovascular Surgery. *Thorac Cardiovasc Surg* 59:259–267. <https://doi.org/10.1055/s-0030-1271191>
- Puls M, Lubos E, Boekstegers P et al (2016) One-year outcomes and predictors of mortality after MitraClip therapy in contemporary clinical practice: results from the German transcatheter mitral valve interventions registry. *Eur Heart J* 37:703–712. <https://doi.org/10.1093/eurheartj/ehv627>
- Kim WK, Blumenstein J, Liebetrau C et al (2017) Comparison of outcomes using balloon-expandable versus self-expanding transcatheter prostheses according to the extent of aortic valve calcification. *Clin Res Cardiol*. <https://doi.org/10.1007/s00392-017-1149-3>
- Frerker C, Bestehorn K, Schlüter M et al (2017) In-hospital mortality in propensity-score matched low-risk patients undergoing routine isolated surgical or transfemoral transcatheter aortic valve replacement in 2014 in Germany. *Clin Res Cardiol* 106:610–617. <https://doi.org/10.1007/s00392-017-1097-y>
- Kim W-K, Liebetrau C, van Linden A et al (2016) Myocardial injury associated with transcatheter aortic valve implantation (TAVI). *Clin Res Cardiol* 105:379–387. <https://doi.org/10.1007/s00392-015-0949-6>
- Möllmann H, Bestehorn K, Bestehorn M et al (2016) In-hospital outcome of transcatheter vs. surgical aortic valve replacement in patients with aortic valve stenosis—complete dataset of patients treated in 2013 in Germany. *Clin Res Cardiol* 105:553–559
- Gaede L, Kim WK, Liebetrau C et al (2018) Pacemaker implantation after TAVI: predictors of AV block persistence. *Clin Res Cardiol* 107:60–69. <https://doi.org/10.1007/s00392-017-1158-2>
- Gaede L, Blumenstein J, Kim W-K et al (2017) Trends in aortic valve replacement in Germany in 2015: transcatheter versus isolated surgical aortic valve repair. *Clin Res Cardiol*. <https://doi.org/10.1007/s00392-016-1070-1>
- Bleiziffer S, Bosmans J, Brecker S et al (2017) Erratum to: Insights on mid-term TAVR performance: 3-year clinical and echocardiographic results from the CoreValve ADVANCE study (*Clin Res Cardiol*, 10.1007/s00392-017-1120-3). *Clin Res Cardiol* 106:849. <https://doi.org/10.1007/s00392-017-1124-z>
- Coglianese EE, Davidoff R (2009) Predicting outcome in patients with asymptomatic aortic stenosis. *Circulation* 120:9–11. <https://doi.org/10.1161/circulationaha.109.875591>
- Pellikka PA, Sarano M, Nishimura R et al (2005) Outcome of 622 adults with asymptomatic, hemodynamically significant aortic stenosis during prolonged follow-up. *Circulation* 111:3290–3295. <https://doi.org/10.1161/CIRCULATIONAHA.104.495903>
- Monin JL, Lancellotti P, Monchi M et al (2009) Risk score for predicting outcome in patients with asymptomatic aortic stenosis. *Circulation* 120:69–75. <https://doi.org/10.1161/CIRCULATIONAHA.108.808857>