Evaluation of YouTube as a reliable source for patient education on aortic valve stenosis

Charl Khalil[1], Michael Megaly[2,3], Catherine Ekladios[1], Amira Ibrahim[1], Wassim Mosleh[4], Mariam Tawadros[5], Yan Yatsynovich[1], Tharmathai Ramanan[1], Mina Youssef[1], Nader Hanna[6], Mofid Khalil[1], Karim M. Al-Azizi[7], Fadi Shamoun[8], Brian Page[1], John Corbelli[1]

[1]Division of Cardiology, State University of New York at Buffalo, Buffalo, NY, USA; [2]Minneapolis Heart Institute at Abbott Northwestern Hospital, Minneapolis, MN, USA; [3]Division of Cardiology, Hennepin Healthcare, Minneapolis, MN, USA; [4]Division of Cardiology, University of Connecticut, Farmington, CT, USA; [5]Faculty of Medicine, Ain Shams University Hospitals, Cairo, Egypt; [6]Division of Cardiology, Cleveland Clinic, Weston, FL, USA; [7]Division of Interventional Cardiology and Structural Heart Disease, The Heart Hospital Plano, Baylor Scott & White, Plano, TX, USA; [8]Division of Cardiovascular Diseases, Mayo Clinic, Phoenix, AZ, USA

Contributions: (I) Conception and design: C Khalil, M Megaly; (II) Administrative support: C Khalil, M Megaly; (III) Provision of study material or patients: All authors; (IV) Collection and assembly of data: All authors; (V) Data analysis and interpretation: All authors; (VI) Manuscript writing: All authors; (VII) Final approval of manuscript: All authors.

Correspondence to: John Corbelli, MD. Buffalo VA Medical Center, 3495 Bailey Avenue, Buffalo, NY 14215, USA. Email: johncorbelli@gmail.com.

Background: Aortic stenosis (AS) is a prevalent disease in the elderly population and has been a public health concern for decades. YouTube is currently being used for obtaining healthcare related information. We evaluated the quality of information about AS on YouTube for patient education.

Methods: YouTube was queried for the search phrases "aortic valve stenosis", "aortic valve replacement", "transcatheter aortic valve replacement" and "TAVR". Videos were assessed for their reliability and content with two five-point scales. They were categorized into groups according to usefulness and uploader source. All videos were assessed for audience interaction. Videos were viewed and analyzed by 2 independent investigators. Conflicts were resolved by a third investigator.

Results: Search phrases yielded 69,300 videos, among which, 120 videos were evaluated and 85 videos were included in the final analysis. Of the 85 videos, only 45 videos (53%) were found to be useful while 40 videos (47%) were found to be non-useful. The majority (98%) of the useful videos were uploaded by professional sources. Overall, videos uploaded by non-professional sources had higher number of views (23,553 *vs.* 11,110, P≤0.001) despite of being less useful (14% *vs.* 67%, P<0.001) when compared to videos uploaded by professional sources.

Conclusions: There is a potential to increase public awareness about aortic valve stenosis and the available treatment options by utilizing YouTube. Professional societies are encouraged to provide more useful material that can deliver comprehensive and reliable information in an entertaining and intuitive manner to the public.

Keywords: Aortic stenosis (AS); patient education; social media; transcatheter aortic valve replacement (TAVR); YouTube

Introduction

Calcific aortic valve disease is the most common cause of aortic stenosis (AS) in the elderly population. Its prevalence is age-related and it can be fatal within a few years of symptom onset if left untreated, making it a significant public health concern (1-3). Aortic valve replacement has been the treatment of choice for calcific AS (4-6). Transcatheter aortic valve replacement (TAVR) has been rapidly evolving with an expanding eligible patient population, new valve types, and better delivery methods (7,8). Recently, the yearly incidence of severe AS has been estimated to be 4.4% per year in the general population above 65 years old with an approximate estimate of 58,000 to 115,000 annual candidates for TAVR in North America and Europe, respectively (9). The internet, along with different social media platforms, has become an accessible source of public health information (10). Almost one-third of United States consumers use YouTube, Facebook, and Twitter to obtain medical information (11). YouTube is a widely available video sharing website with more than one billion hours of video watched daily (12). It could be a valuable tool for delivery of healthcare related information. We sought to investigate the quality of information in YouTube videos on AS and its treatment modalities.

Methods

For the evaluation of videos discussing aortic valve stenosis disease, YouTube (www.youtube.com) was queried using the search word "aortic valve stenosis" on February 2nd, 2019. The first 60 videos (the first 3 pages) were included in our study (group A). For the evaluation of videos discussing AS treatment options, YouTube was queried again using search keywords "aortic valve replacement", "transcatheter aortic valve replacement" and "TAVR" on March 3rd, 2019. The first 20 videos (1 page) resulting from each search phrase were included for a total of 60 videos (group B). All videos were organized according to the default filter of relevance.

Our strategy in selecting videos included in our sample group was based on internet search engine research demonstrating that between 62% and 90% of search engine users do not click on results beyond the first and third page of results, respectively (11). Our methods were previously used in multiple studies that assessed YouTube as a source of patient education (13-16).

Exclusion criteria included videos that were in any language other than English, duplicates, videos that were not relevant to the topic, videos with no audio, or videos that could not be accessed. Videos that were found to describe the personal experiences of patients while being diagnosed or treated for AS were classified as "personal experience" videos, and these videos were also excluded.

Videos were assessed for their reliability using a 5-point score developed from the DISCERN reliability tool for assessment of written health information (*Table 1*). Videos were also analyzed for their content and the comprehensiveness of information conveyed to the audience. Two 5-point scales were created to assess the content of the videos included in our study. The content assessed for group A videos included epidemiology, risk factors, symptoms, diagnosis and treatment, while the content assessed for group B videos included procedure explanation, indications, complications, postoperative treatment/rehabilitation and treatment alternatives (*Table 2*). Finally, videos were evaluated for the overall ease of interpretation and flow of information using the global quality scale (GQS) (*Table 3*).

Included videos were classified according to usefulness into 2 categories: (I) useful videos, defined as videos with a combined reliability and content score of ≥5 points; and (II) non-useful videos, defined as videos with a combined reliability and content score of <5 points. All videos were categorized based on whether the uploader was a professional or non-professional source. Professional sources included health care professionals, health care systems, university channels and government/news agencies.

Other information including the total number of views, likes, dislikes, comments, video length and duration since upload on YouTube were collected for each video. All videos were viewed and analyzed by 2 independent investigators. Conflicts were resolved by a third investigator.

Statistical analysis was conducted using EZR (easy R) (Version 1.37. Jichi Medical University Saitama Medical Center, Japan). Descriptive analyses were performed using percentages for categorical variables and medians with interquartile ranges (IQR) for continuous variables. Categorical variables were compared using Chi-square tests, while continuous variables were compared with an independent *t*-test. A P value of ≤0.05 was considered statistically significant.

Results

Analysis of videos discussing AS disease (group A videos)

For group A videos, our primary search using the keyword

Table 1 DISCERN (reliability) score

Item	Questions
1	Are the aims clear and achieved?
2	Are reliable sources of information used? (i.e., publication cited, speaker is specialist in diabetes)
3	Is the information presented both balanced and unbiased?
4	Are additional sources of information listed for patient reference?
5	Are areas of uncertainty mentioned?

Table 2 Five-point content scales for included videos

Aortic valve stenosis videos

  Epidemiology

  Risk factors

  Symptoms

  Diagnosis

  Treatment

Aortic stenosis treatment videos

  Procedure explanation

  Indications

  Complications

  Postoperative treatment/rehabilitation

  Treatment alternatives

"aortic valve stenosis" yielded 35,400 videos from which the first 60 videos (3 pages) were included in the analysis (*Figure 1*). Six videos were found to be a personal experience and were excluded. For the included 54 videos, the median length was 4 minutes and 43 seconds (IQR: 2:19–8:06), with a median of 717,231 views (IQR: 1,728–86,109), 339 (IQR: 5–2044) likes, 2 (IQR: 0–10) dislikes, 1 (IQR: 0–9) comments, median reliability score of 4 (IQR: 2–44), content score of 2 (IQR: 1–33) and GQS of 3 (IQR: 2–42).

Of the 54 videos, 23 videos were found to be useful (43%), among which 21 videos were uploaded by professional sources and 2 videos were uploaded by non-professional sources. Of the 54 videos, 31 videos were found to be non-useful (57%), among which 15 videos were uploaded by professional sources while 16 were uploaded by non-professional sources.

A total of 35 (65%) videos discussed treatment options and only 16 videos (30%) mentioned TAVR as a treatment option. Of those 16 videos, 12 videos (75%) were uploaded by professional entities (*Figure 2*).

Analysis of videos discussing AS treatment options (group B videos)

Our search using the 3 keywords, "aortic valve replacement", "transcatheter aortic valve replacement" and "TAVR" yielded 33,900 videos (*Figure 1*). The first 20 videos (1 page) obtained from each keyword search were reviewed for a total of 60 videos. Among the 60 videos, 24 videos were duplicate videos and were excluded. Five videos were found to be personal experience videos and were also excluded. For the included 31 videos the median length was 12 minutes and 30 seconds (IQR: 4:44–38:12), with a median of 3,758 (IQR: 1,486–41,379) views, 13 (IQR: 4–80) likes, 1 (IQR: 0–51) dislikes, 0 (IQR8: 0–3) comments, median reliability score 4 (IQR: 3–4), content score 3 (IQR: 2–3) and GQS of 3 (IQR: 3–4).

Of the 31 videos, 22 videos were found to be useful, among which 21 videos were uploaded by professional sources and one video was uploaded by a non-professional source. Of the 31 videos, 9 videos were found to be non-useful, among which 6 videos were uploaded by professional sources and 3 videos were uploaded by non-professional sources.

Analysis of all included videos

Characteristics of all the videos included in the study are outlined in *Tables 4* and *5*. Overall, a total of 85 videos were analyzed. Six videos (7%) needed a third investigator to resolve conflicts in analysis between the first 2 independent investigators. Of the 85 videos, 45 videos (53%) were found to be useful while 40 videos (47%) were found to be non-useful. The useful videos had a median length of 5 minutes

Table 3 Five-point global quality score

Item	Questions
1	Poor quality; poor flow of the video; most information missing; not at all useful for patients
2	Generally poor quality and poor flow; some information listed, but many important topics missing; of very limited use to patients
3	Moderate quality; suboptimal flow; some important information adequately discussed, but other information poorly discussed; somewhat useful for patients
4	Good quality and generally good flow; most of the relevant information listed, but some topics not covered; useful for patients
5	Excellent quality and flow; very useful for patients

and 22 seconds (IQR: 3:33–55:04), with a median of 5,004 (IQR: 1,030–42,047) views, 13 (IQR: 3.5–60) likes, 1 (IQR: 0–3.5) dislikes and 0 (IQR: 0–2.5) comments. They had a median reliability score of 4 (IQR: 4–5), median content score of 3 (IQR: 2–4) and a median GQS of 4 (IQR: 3–4). The non-useful videos had a median length of 5 minutes and 59 seconds (IQR: 3:15–33:07), with a median of 24,392 (IQR: 3,597–89,623) views, 76 (IQR: 7.5–290) likes, 3 (IQR: 0.25–11.75) dislikes and 2.5 (IQR: 0–12.5) comments. They had a median reliability score of 3 (IQR: 2–4), content score of 1 (IQR: 1–2) and GQS of 2.5 (IQR: 1–3).

Of the 85 videos, 63 videos were uploaded by professional sources and 22 videos were uploaded by non-professional sources. Videos uploaded by professional sources were more useful compared to those uploaded by non-professional sources (67% *vs.* 14%, P<0.001).

Audience interaction analysis

Videos uploaded by non-professional sources had higher number of views (23,553 *vs.* 11,110, P≤0.001) when compared to videos uploaded by professional sources. They also had numerically higher medians of likes (52.5 *vs.* 17, P=0.14) and dislikes (2 *vs.* 1, P=0.15) without statistical significance.

Discussion

The main outcomes of our study investigating the reliability and usefulness of healthcare information presented by YouTube videos on AS and aortic valve replacement can be summarized as follows: (I) only 53% of videos were useful and 98% of the useful videos were uploaded by professional sources; (II) only 30% of videos about AS discussed TAVR as a treatment option, among which 75% were uploaded

by professional sources; and (III) videos uploaded by non-professional sources were mostly non-useful (86%). However, they had higher audience interaction compared with videos uploaded by professional sources.

Aortic valve stenosis is a prevalent disease in the general population with an increased incidence with age. Morbidity rates in patients above the age of 75 have been shown to range from 2–4% annually (17). AS results in significant physical and emotional consequences which affect quality of life and hinder the capabilities of daily functioning and social interaction in these patients (18). Aortic valve replacement is associated with positive outcomes on quality of life, physical, and mental health in severely symptomatic patients (19-21). However, many patients with severe AS are found to be poor candidates for surgery due to their advanced age, frailty and multiple comorbidities. TAVR is an emerging alternative to the conventional surgical approach and is currently preferred for severely symptomatic AS patients who are at high or intermediate risk for surgery (7,8,22-25). It is currently being investigated as an effective treatment option for low risk patients.

Despite the growing popularity of the TAVR procedure, studies have shown gender and racial disparities in patients receiving the procedure with higher rates in Caucasians compared to non-Caucasians. Several reasons are proposed to explain this including low socio-economic status, cultural differences and lack of awareness (26-28). One of the main methods of bridging the healthcare–patient population TAVR treatment disparity gap is spreading awareness through social media. Social media is currently widely used by both physicians and patients as a mode of sharing and exchanging medical information (29-31). YouTube is a virtual social media platform that allows sharing millions of videos between users worldwide. YouTube has more than one billion users in 91 countries and 80 languages with
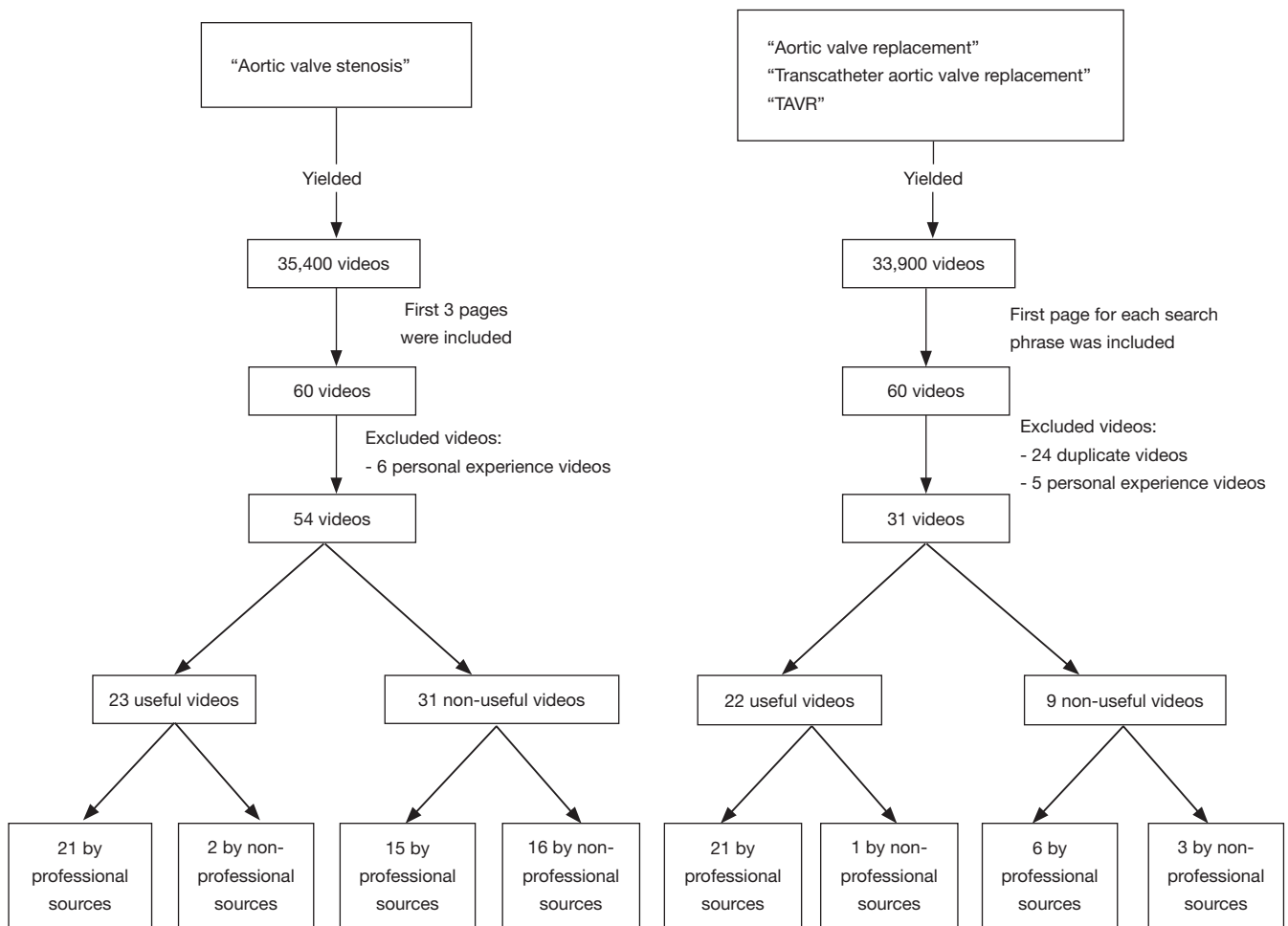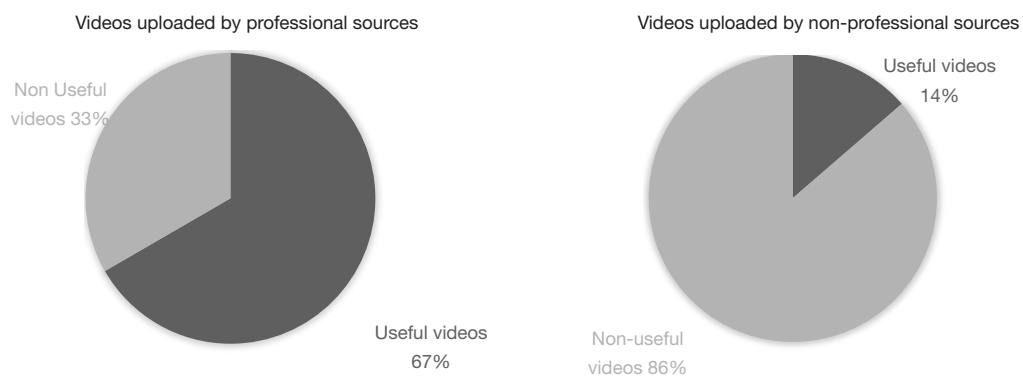
Figure 1 YouTube query flowchart.

Figure 2 Pie chart demonstrating usefulness of professional and non-professional videos.

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Table 4 Characteristics of all included videos according to usefulness

Variable	Useful videos (n=45)		Non-useful videos (n=40)	
	Median	IQR	Median	IQR
Length (min:sec)	5:22	3:33–55:04	5:59	3:15–33:07
Number of views	5,004	1,030–42,047	24,392	3,597–89,623
Number of likes	13	3.5–60	76	7.5–290
Number of dislikes	1	0–3.5	3	0.25–11.75
Number of comments	0	0–2.5	2.5	0–12.5
Reliability score	4	4–5	3	2–4
Content score	3	2–4	1	1–2
GQS	4	3–4	2.5	1–3

GQS, global quality score.

Table 5 Characteristics of included videos according to uploader

Variable	Videos uploaded by professional sources (n=63)		Videos uploaded by non-professional sources (n=22)	
	Median	IQR	Median	IQR
Length (min:sec)	5:27	1:51–63:27	5:41	2:19–37:43
Number of views	11,110	1,496–43,975	23, 553	1,775–114,642
Number of likes	17	5–93	52.5	6–332
Number of dislikes	1	0–8	2	0–11
Number of comments	1	0–4	1	0–25
Reliability score	4	3–4	2	2–3
Content score	2	1–3	2	1–3
GQS	3	2–4	4	3–5

GQS, global quality score.

over one billion videos being watched daily (12). However, the quality and reliability of health-related information on YouTube has been a point of debate. There is a growing body of research to assess the utility of YouTube as a trustworthy mode for delivery of health information. Studies investigating the content of videos addressing food allergies, coeliac disease, CRP, prostate cancer and anorexia, among others, are now available (13,14,16,32).

Our study investigated the reliability of YouTube videos as a source of information on aortic valve stenosis and its treatment options including TAVR. In our study, only 53% of the videos were useful and conveyed valuable information to the audience. This finding demonstrates the substantial

need for improving the quality of delivered information and consequently the great potential to achieve a noticeable rise in awareness levels and better overall outcomes in patients with aortic valve stenosis.

As demonstrated above, the majority (93%) of the useful videos were uploaded by professional sources, indicating the capability of professional health organizations to provide videos of higher content quality, comprehensiveness, and reliability. Moreover, around 65% of group A videos pointed out treatment options for aortic valve stenosis while discussing the disease and 30% mentioned TAVR among the available treatment modalities. Professional sources contributed to 75% of those videos, reinforcing

the importance of these sources in providing up to date evidence-based information to the public.

Another interesting and unexpected finding in our study was the difference in audience interaction depending upon the video source. Videos uploaded by non-professional sources had higher audience interaction with a higher number of views, likes and dislikes compared to those uploaded by professional sources. Also, knowing that almost 86% of the videos uploaded by non-professional sources were found to be non-useful videos would bring to attention the presence of factors influencing audience interaction other than the content quality and usefulness. This could be possibly attributed to higher GQS score and less complexity for videos that were uploaded by non-professional sources compared to those uploaded by professional sources. Intuitive videos with smooth flow, simplified language, and a more interactive and entertaining interfaces are usually more appealing to the public. Hence, professional healthcare organizations should adopt more engaging and easily understood language in their videos to increase viewability and audience interaction.

Limitations of our study include evaluating online content on YouTube only and not including other social media platforms. The tools and methods used in our study focused on evaluating the current available online content without analyzing the impact on the viewers/patients. Also, our study evaluated YouTube videos at a specific time frame. YouTube is a dynamic video sharing platform and content changes every day. Moreover, audience interaction with the videos was evaluated directly on www.YouTube.com and did not include YouTube videos shared on other websites or social media platforms. All included videos were in the English language only. Lastly, all the videos were analyzed by two researchers and a third researcher was involved in cases of discrepancy which could allow for inter- and intra-observer bias.

Further studies to evaluate available online content for aortic valve stenosis on other social media platforms as well as the impact of available current online content on patients' behavioral patterns are warranted. Also, future large prospective studies, after introducing new ideas to improve quality of YouTube videos on aortic valve stenosis, may be enlightening regarding factors that attract an audience to websites with the most credible information.

Conclusions

YouTube is a video sharing platform that is used for

obtaining healthcare related information by the public nowadays. There is a potential to increase public awareness about aortic valve stenosis and the available treatment options by utilizing this tool. Professional societies are encouraged to provide more useful material that can deliver comprehensive and reliable information in an entertaining and intuitive manner to the public.

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Footnote

Conflicts of Interest: The authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

References

1. Eveborn GW, Schirmer H, Heggelund G, et al. The evolving epidemiology of valvular aortic stenosis: the Tromsø study. Heart 2013;99:396-400.
2. Schueler R, Hammerstingl C, Sinning JM, et al. Prognosis of octogenarians with severe aortic valve stenosis at high risk for cardiovascular surgery. Heart 2010;96:1831-6.
3. Nkomo VT, Gardin JM, Skelton TN, et al. Burden of valvular heart diseases: a population-based study. Lancet 2006;368:1005-11.
4. Kang DH, Park SJ, Rim JH, et al. Early surgery versus conventional treatment in asymptomatic very severe aortic stenosis. Circulation 2010;121:1502-9.
5. Murphy ES, Lawson RM, Starr A, et al. Severe aortic stenosis in patients 60 years of age or older: left ventricular function and 10-year survival after valve replacement. Circulation 1981;64:II184-8.
6. Schwarz F, Baumann P, Manthey J, et al. The effect of aortic valve replacement on survival. Circulation 1982;66:1105-10.
7. Leon MB, Smith CR, Mack M, et al. Transcatheter aortic-valve implantation for aortic stenosis in patients who cannot undergo surgery. N Engl J Med 2010;363:1597-607.
8. Reardon MJ, Van Mieghem NM, Popma JJ, et al. Surgical

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or transcatheter aortic-valve replacement in intermediate-risk patients. N Engl J Med 2017;376:1321-31.

9. Durko AP, Osnabrugge RL, Van Mieghem NM, et al. Annual number of candidates for transcatheter aortic valve implantation per country: current estimates and future projections. Eur Heart J 2018;39:2635-42.

10. Vance K, Howe W, Dellavalle RP. Social internet sites as a source of public health information. Dermatol Clin 2009;27:133-6.

11. Social media "likes" healthcare. From marketing to social business. Available online: https://www.pwc.com/us/en/health-industries/health-research-institute/publications/pdf/health-care-social-media-report.pdf

12. YouTube. Available online: https://www.youtube.com/yt/about/press/

13. Megaly M, Khalil C, Tadros B, et al. Evaluation of Educational Value of YouTube Videos for Patients with Coeliac Disease. International Journal of Celiac Disease 2016;4:102-4.

14. Khalil C, Megaly M, Ibrahim A, et al. Reliability of Youtube Videos for Patient Education on Food Allergies. J. Allergy Clin Immunol 2016;137:AB159.

15. Camm CF, Russell E, Xu AJ, et al. Does YouTube provide high-quality resources for patient education on atrial fibrillation ablation? Int J Cardiol 2018;272:189-93.

16. Murugiah K, Vallakati A, Rajput K, et al. YouTube as a source of information on cardiopulmonary resuscitation. Resuscitation 2011;82:332-4.

17. Supino PG, Borer JS, Preibisz J, et al. The epidemiology of valvular heart disease: a growing public health problem. Heart Fail Clin 2006;2:379-93.

18. van Geldorp MW, Heuvelman H, Kappetein AP, et al. Quality of life among patients with severe aortic stenosis. Neth Heart J 2013;21:21-7.

19. van Geldorp MW, Heuvelman H, Kappetein AP, et al. The effect of aortic valve replacement on quality of life in symptomatic patients with severe aortic stenosis. Neth Heart J 2013;21:28-35.

20. Krane M, Deutsch MA, Piazza N, et al. One-year results of health-related quality of life among patients undergoing transcatheter aortic valve implantation. Am J Cardiol 2012;109:1774-81.

21. Stortecky S, Schmid V, Windecker S, et al. Improvement of physical and mental health after transfemoral transcatheter aortic valve implantation. EuroIntervention 2012;8:437-43.

22. Adams DH, Popma JJ, Reardon MJ, et al. Transcatheter aortic-valve replacement with a self-expanding prosthesis. N Engl J Med 2014;370:1790-8.

23. Reardon MJ, Adams DH, Kleiman NS, et al. 2-year outcomes in patients undergoing surgical or self-expanding transcatheter aortic valve replacement. J Am Coll Cardiol 2015;66:113-21.

24. Deeb GM, Reardon MJ, Chetcuti S, et al. 3-year outcomes in high-risk patients who underwent surgical or transcatheter aortic valve replacement. J Am Coll Cardiol 2016;67:2565-74.

25. Piazza N, Kalesan B, van Mieghem N, et al. A 3-center comparison of 1-year mortality outcomes between transcatheter aortic valve implantation and surgical aortic valve replacement on the basis of propensity score matching among intermediate-risk surgical patients. JACC Cardiovasc Interv 2013;6:443-51.

26. Yeung M, Kerrigan J, Sodhi S, et al. Racial differences in rates of aortic valve replacement in patients with severe aortic stenosis. Am J Cardiol 2013;112:991-5.

27. Bob-Manuel T, Sharma A, Nanda A, et al. A review of racial disparities in transcatheter aortic valve replacement (TAVR): accessibility, referrals and implantation. Ann Transl Med 2018;6:10.

28. Chaker Z, Badhwar V, Alqahtani F, et al. Sex differences in the utilization and outcomes of surgical aortic valve replacement for severe aortic stenosis. J Am Heart Assoc 2017;6(9). doi: 10.1161/JAHA.117.006370.

29. McGowan BS, Wasko M, Vartabedian BS, et al. Understanding the factors that influence the adoption and meaningful use of social media by physicians to share medical information. J Med Internet Res 2012;14:e117.

30. De Angelis G, Wells GA, Davies B, et al. The use of social media among health professionals to facilitate chronic disease self-management with their patients: A systematic review. Digit Health 2018;4:2055207618771416.

31. Kaplan AM, Haenlein M. Users of the world, unite! The challenges and opportunities of Social Media. Business Horizons 2010;53:59-68.

32. Steinberg PL, Wason S, Stern JM, et al. YouTube as source of prostate cancer information. Urology 2010;75:619-22.