The difference in referencing in Web of Science, Scopus, and Google Scholar

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Abstract

Aims How often a medical article is cited is important for many people because it is used to calculate different variables such as the h-index and the journal impact factor. The aim of this analysis was to assess how the citation count varies between Web of Science (WoS), Scopus, and Google Scholar in the current literature.

Methods We included the top 50 cited articles of four journals ESC Heart Failure; Journal of cachexia, sarcopenia and muscle; European Journal of Preventive Cardiology; and European Journal of Heart Failure in our analysis that were published between 1 January 2016 and 10 October 2019. We recorded the number of citations of these articles according to WoS, Scopus, and Google Scholar on 10 October 2019.

Results The top 50 articles in ESC Heart Failure were on average cited 12 (WoS), 13 (Scopus), and 17 times (Google Scholar); in Journal of cachexia, sarcopenia and muscle 37 (WoS), 43 (Scopus), and 60 times (Google Scholar); in European Journal of Preventive Cardiology 41 (WoS), 56 (Scopus), and 67 times (Google Scholar); and in European Journal of Heart Failure 76 (WoS), 108 (Scopus), and 230 times (Google Scholar). On average, the top 50 articles in all four journals were cited 41 (WoS), 52 (Scopus, 26% higher citations count than WoS, range 8–42% in the different journals), and 93 times (Google Scholar, 116% higher citation count than WoS, range 42–203%).

Conclusion Scopus and Google Scholar on average have a higher citation count than WoS, whereas the difference is much larger between Google Scholar and WoS.

Keywords Web of Science; Scopus; Google Scholar

Introduction

Scopus currently lists 38 060 different journals, with 320 journals publishing in the field of ‘Cardiology and Cardiovascular Medicine’. Many different scores worldwide try to rank journals with the help of different algorithms. The most important and renown score in Europe and the USA is the Thomson Scientific impact factor. Each summer, it is published for the previous year. For understanding the Thomson Scientific impact factor, one first has to comprehend how it is calculated. For example, the 2018 impact factor for any given journal was calculated by adding up all citations in 2018 referencing articles published in that journal in 2016 and 2017 and then dividing by the number of original articles and reviews published in 2016 and 2017 in that journal. For counting the number of citations, Thomson Scientific uses the Web of Science (WoS) database. But there are also other sources for citation information available (e.g. Scopus and Google Scholar). Because we noticed that the number of citations for articles is often different in WoS, Scopus, and Google Scholar, we followed a structured approach to compare the number of citations and find possible differences.
| Nr. | First author          | Title                                                                 | Document type | Times cited in Web of Science | Times cited in Scopus | Times cited in Google Scholar Reference |
|-----|-----------------------|----------------------------------------------------------------------|---------------|-------------------------------|-----------------------|-----------------------------------------|
| 1   | Kotseva K             | EUROASPIRE IV: A European Society of Cardiology survey on the lifestyle, risk factor and therapeutic management of coronary patients from 24 European countries | Article       | 353                           | 427                   | 651                                     |
| 2   | Eckel N               | Metabolically healthy obesity and cardiovascular events: a systematic review and meta-analysis | Review        | 76                            | 76                    | 96                                      |
| 3   | Friis-Møller N        | An updated prediction model of the global risk of cardiovascular disease in HIV-positive persons: the data-collection on adverse effects of anti-HIV drugs (D:A:D) study | Article       | 69                            | 70                    | 100                                     |
| 4   | Kotseva K             | Lifestyle and risk factor management in people at high risk of cardiovascular disease. A report from the European Society of Cardiology European Action on Secondary and Primary Prevention by Intervention to Reduce Events (EUROASPIRE) IV cross-sectional survey in 14 European regions | Article       | 66                            | 78                    | 98                                      |
| 5   | Rauch B               | The prognostic effect of cardiac rehabilitation in the era of acute revascularisation and statin therapy: a systematic review and meta-analysis of randomized and non-randomized studies - The Cardiac Rehabilitation Outcome Study (CROS) | Review        | 66                            | 77                    | 101                                     |
| 6   | Price KJ              | A review of guidelines for cardiac rehabilitation exercise programmes: is there an international consensus? | Review        | 61                            | 67                    | 108                                     |
| 7   | Mont L                | Pre-participation cardiovascular evaluation for athletic participants to prevent sudden death: position paper from the EHRA and the EACPR, branches of the ESC. Endorsed by APHRS, HRS, and SOLAEC | Article       | 51                            | 60                    | 122                                     |
| 8   | Vigorito C            | Frailty and cardiac rehabilitation: a call to action from the EAPC Cardiac Rehabilitation Section | Article       | 47                            | 51                    | 60                                      |
| 9   | Bonaccio MF           | Adherence to the traditional Mediterranean diet and mortality in subjects with diabetes. Prospective results from the MOLI-SANI study | Article       | 45                            | 51                    | 65                                      |
| 10  | Roeters van Lennep EJ | Cardiovascular disease risk in women with premature ovarian insufficiency: a systematic review and meta-analysis | Article       | 45                            | 46                    | 78                                      |
| 11  | Cooney MT             | Cardiovascular risk estimation in older persons: SCORE O.P. | Article       | 41                            | 47                    | 53                                      |
| 12  | Hansen D              | The European Association of Preventive Cardiology Exercise Prescription in Everyday Practice and Rehabilitative Training (EXPERT) tool: a digital training and decision support system for optimized exercise prescription in cardiovascular disease. Concept, definitions and construction methodology | Article       | 40                            | 44                    | 51                                      |
| 13  | Chu P                 | The effectiveness of yoga in modifying risk factors for cardiovascular disease and metabolic syndrome: a systematic review and meta-analysis of randomized controlled trials | Review        | 38                            | 45                    | 103                                     |
| 14  | Piepoli MF            | Challenges in secondary prevention after acute myocardial infarction: a call for action | Review        | 37                            | 40                    | 84                                      |
| 15  | Alharbi M             | Validation of Fitbit-Flex as a measure of free-living physical activity in a community-based phase III cardiac rehabilitation population | Article       | 35                            | 40                    | 67                                      |
| 16  | D’Ascenzi F           | Novel echocardiographic techniques for the evaluation of athletes’ heart: a focus on speckle-tracking echocardiography | Review        | 35                            | 37                    | 44                                      |
| 17  | Fukuta H              | Effects of drug and exercise intervention on functional capacity and quality of life in heart failure with preserved ejection fraction: a meta-analysis of randomized controlled trials | Article       | 35                            | 35                    | 60                                      |

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| Nr. | First author | Title | Document type | Times cited in Web of Science | Times cited in Scopus | Times cited in Google Scholar | Reference |
|-----|--------------|-------|---------------|-------------------------------|-----------------------|-------------------------------|-----------|
| 18  | Hobbs FDR    | European Primary Care Cardiovascular Society (EPCCS) consensus guidance on stroke prevention in atrial fibrillation (SPAF) in primary care | Article | 34 | 37 | 47 | 27 |
| 19  | Frederix I   | Effect of comprehensive cardiac telerehabilitation on one-year cardiovascular hospitalization rate, medical costs and quality of life: a cost-effectiveness analysis | Article | 33 | 39 | 47 | 28 |
| 20  | Solberg EE   | Sudden cardiac arrest in sports: need for uniform registration: a position paper from the Sport Cardiology Section of the European Association for Cardiovascular Prevention and Rehabilitation | Article | 33 | 34 | 57 | 29 |
| 21  | Groenewegen KA | Vascular age to determine cardiovascular disease risk: a systematic review of its concepts, definitions, and clinical applications | Review | 32 | 35 | 58 | 30 |
| 22  | Sato T       | Cardiopulmonary exercise testing as prognostic indicators: comparisons among heart failure patients with reduced, mid-range and preserved ejection fraction | Article | 31 | 37 | 32 | 31 |
| 23  | Pedersen SS  | Psychosocial perspectives in cardiovascular disease | Article | 31 | 29 | 35 | 32 |
| 24  | Pallisgaard JL | Risk of atrial fibrillation in diabetes mellitus: a nationwide cohort study | Article | 31 | 26 | 39 | 33 |
| 25  | Uddin J      | Predictors of exercise capacity following exercise-based rehabilitation in patients with coronary heart disease and heart failure: a meta-regression analysis | Article | 30 | 35 | 44 | 34 |
| 26  | Bohm P       | Data from a nationwide registry on sports-related sudden cardiac deaths in Germany | Article | 30 | 36 | 63 | 35 |
| 27  | Hall AJ      | Association between osteoarthritis and cardiovascular disease: systematic review and meta-analysis | Review | 29 | 34 | 47 | 36 |
| 28  | Frederix I   | Cardiac telerehabilitation: a novel cost-efficient care delivery strategy that can induce long-term health benefits | Article | 29 | 34 | 34 | 37 |
| 29  | Heida KY     | Cardiovascular risk management after reproductive and pregnancy-related disorders: a Dutch multidisciplinary evidence-based guideline | Review | 29 | 33 | 53 | 38 |
| 30  | Huang G      | Dose-response relationship of cardiorespiratory fitness adaptation to controlled endurance training in sedentary older adults | Review | 29 | 28 | 49 | 39 |
| 31  | Kraal JJ     | Clinical and cost-effectiveness of home-based cardiac rehabilitation compared to conventional, centre-based cardiac rehabilitation: results of the FIT@Home study | Article | 28 | 33 | 36 | 40 |
| 32  | Taggar JS    | Accuracy of methods for detecting an irregular pulse and suspected atrial fibrillation: a systematic review and meta-analysis | Review | 28 | 33 | 48 | 41 |
| 33  | Pfaeffli Dale L | The effectiveness of mobile-health behaviour change interventions for cardiovascular disease self-management: A systematic review | Review | 27 | 29 | 67 | 42 |
| 34  | Sandri M     | Chronic heart failure and aging effects of exercise training on endothelial function and mechanisms of endothelial regeneration: results from the Leipzig Exercise Intervention in Chronic heart failure and Aging (LEICa) study | Article | 27 | 34 | 50 | 43 |
| 35  | Kotseva K    | Determinants of participation and risk factor control according to attendance in cardiac rehabilitation programs in coronary patients in Europe: EUROASPIRE IV survey | Article | 27 | 31 | 28 | 44 |
| 36  | Gorenek Chair B | European Heart Rhythm Association (EHRA)/European Association of Cardiovascular Prevention and Rehabilitation (EACPR) position paper on how to prevent atrial fibrillation endorsed by the Heart Rhythm Society (HRS) and Asia Pacific Heart Rhythm Society (APHRS) | Article | 27 | 30 | 71 | 45 |
| 37  | Coppetti T   | Accuracy of smartphone apps for heart rate measurement | Article | 26 | 32 | 35 | 46 |

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| Nr. | First author | Title                                                                 | Document type | Times cited in Web of Science | Times cited in Scopus | Times cited in Google Scholar | Reference |
|-----|--------------|----------------------------------------------------------------------|---------------|-------------------------------|-----------------------|-------------------------------|-----------|
| 38  | Joshi PH     | Association of high-density lipoprotein subclasses and incident coronary heart disease: the Jackson Heart and Framingham Offspring Cohort Studies | Article       | 26                            | 27                    | 41                            | 47        |
| 39  | Pogosova N   | Psychosocial risk factors in relation to other cardiovascular risk factors in coronary heart disease: results from the EUROASPIRE IV survey. A registry from the European Society of Cardiology | Article       | 26                            | 26                    | 34                            | 48        |
| 40  | Ruddox V     | Atrial fibrillation and the risk for myocardial infarction, all-cause mortality and heart failure: a systematic review and meta-analysis | Review        | 25                            | 27                    | 34                            | 49        |
| 41  | Tschentscher M | High-intensity interval training is not superior to other forms of endurance training during cardiac rehabilitation | Article       | 25                            | 25                    | 45                            | 50        |
| 42  | Ekblom-Bak E | Isotemporal substitution of sedentary time by physical activity of different intensities and bout lengths, and its associations with metabolic risk | Article       | 24                            | 28                    | 35                            | 51        |
| 43  | Maiorino Mi  | Effect of a Mediterranean diet on endothelial progenitor cells and carotid intima-media thickness in type 2 diabetes: follow-up of a randomized trial | Article       | 24                            | 25                    | 29                            | 52        |
| 44  | Willette P   | Inflammatory markers and extent and progression of early atherosclerosis: meta-analysis of individual-participant-data from 20 prospective studies of the PROG-IMT collaboration | Article       | 23                            | 29                    | 52                            | 53        |
| 45  | Steffler D   | Fruit and vegetable consumption and mortality in Eastern Europe: longitudinal results from the Health, Alcohol and Psychosocial Factors in Eastern Europe study | Article       | 23                            | 28                    | 34                            | 54        |
| 46  | Ribeiro G    | Cardiac rehabilitation programme after transcatheter aortic valve implantation versus surgical aortic valve replacement: systematic review and meta-analysis | Review        | 23                            | 27                    | 28                            | 55        |
| 47  | Kozela M     | The association of depressive symptoms with cardiovascular and all-cause mortality in Central and Eastern Europe: prospective results of the HAPREE study | Article       | 23                            | 26                    | 33                            | 56        |
| 48  | Auer J       | Muscle- and skeletal-related side-effects of statins: tip of the iceberg? | Article       | 23                            | 26                    | 40                            | 57        |
| 49  | Heida KY     | Cardiovascular disease risk in women with a history of spontaneous preterm delivery: a systematic review and meta-analysis | Review        | 23                            | 24                    | 36                            | 58        |
| 50  | Shi Y        | Can acetic acid substitute ethanol for the reduction of cardiovascular disease risks? | Letter        | 23                            | 22                    | 26                            | 59        |
| Nr. | First author       | Title                                                                 | Document type | Times cited in Web of Science | Times cited in Scopus | Times cited in Google Scholar | Reference |
|-----|-------------------|----------------------------------------------------------------------|---------------|-------------------------------|-----------------------|-------------------------------|-----------|
| 1   | von Haehling S    | Ethical guidelines for publishing in the journal of cachexia, sarcopenia and muscle: update 2017 | Editorial Material | 113                          | 168                   | 178                           | 60        |
| 2   | Malmstrom T       | SARC-F: a symptom score to predict persons with sarcopenia at risk for poor functional outcomes | Article       | 104                          | 111                   | 170                           | 61        |
| 3   | Montano-Loza A    | Sarcopenic obesity and myosteatosis are associated with higher mortality in patients with cirrhosis | Article       | 80                           | 90                    | 125                           | 62        |
| 4   | Anker SD          | Welcome to the ICD-10 code for sarcopenia                           | Editorial Material | 73                           | 88                    | 150                           | 63        |
| 5   | Brown JC          | Sarcopenia and mortality among a population-based sample of community-dwelling older adult | Article       | 66                           | 71                    | 100                           | 64        |
| 6   | Kalafateli M      | Malnutrition and sarcopenia predict post-liver transplantation outcomes independently of the Model for End-stage Liver Disease score | Article       | 53                           | 61                    | 89                            | 65        |
| 7   | von Haehling S    | Prevalence and clinical impact of cachexia in chronic illness in Europe, USA, and Japan: facts and numbers update 2016 | Editorial Material | 52                           | 55                    | 87                            | 66        |
| 8   | Rutten IJ         | Loss of skeletal muscle during neoadjuvant chemotherapy is related to decreased survival in ovarian cancer patients. | Article | 52                           | 63                    | 71                            | 67        |
| 9   | Tyrovolas S       | Factors associated with skeletal muscle mass, sarcopenia, and sarcopenic obesity in older adults: a multi-continent study | Article       | 51                           | 59                    | 80                            | 68        |
| 10  | Buckinx F         | Pitfalls in the measurement of muscle mass: a need for a reference standard | Article       | 46                           | 54                    | 73                            | 69        |
| 11  | Solheim TS        | A randomized phase II feasibility trial of a multimodal intervention for the management of cachexia in lung and pancreatic cancer | Article       | 44                           | 50                    | 70                            | 70        |
| 12  | Stewart Coats AJ  | Espindolol for the treatment and prevention of cachexia in patients with stage III/IV non-small cell lung cancer or colorectal cancer: a randomized, double-blind, placebo-controlled, international multicentre phase II study (the ACT-ONE trial) | Article       | 44                           | 60                    | 62                            | 71        |
| 13  | Loncar G          | Cardiac cachexia: hic et nunc                                       | Review        | 42                           | 43                    | 56                            | 72        |
| 14  | van Dijk DP       | Low skeletal muscle radiation attenuation and visceral adiposity are associated with overall survival and surgical site infections in patients with pancreatic cancer | Article | 41                           | 48                    | 58                            | 73        |
| 15  | Leong DP          | Reference ranges of handgrip strength from 125,462 healthy adults in 21 countries: a prospective urban rural epidemiologic (PURE) study | Article | 41                           | 49                    | 71                            | 74        |
| 16  | Sanders KJ        | Cachexia in chronic obstructive pulmonary disease: new insights and therapeutic perspective | Review | 39                           | 38                    | 60                            | 75        |
| 17  | Boengler K        | Mitochondria and ageing: role in heart, skeletal muscle and adipose tissue | Review | 36                           | 38                    | 57                            | 76        |
| 18  | Rutten UG         | Psoas muscle area is not representative of total skeletal muscle area in the assessment of sarcopenia in ovarian cancer | Article       | 31                           | 41                    | 49                            | 77        |
| 19  | Snijders T        | Muscle fibre capillaryization is a critical factor in muscle fibre hypertrophy during resistance exercise training in older men | Article | 30                           | 37                    | 49                            | 78        |
| 20  | Holeczek M        | Beta-hydroxy-beta-methylbutyrate supplementation and skeletal muscle in healthy and muscle-wasting conditions | Review | 30                           | 34                    | 62                            | 79        |
| 21  | Barbosa-Silva T   | Prevalence of sarcopenia among community-dwelling elderly of a medium-sized South American city: results of the COMO VAI? study | Article       | 30                           | 38                    | 74                            | 80        |
| 22  | Foong YC          | Accelerometer-determined physical activity, muscle mass, and leg strength in community-dwelling older adults | Article       | 30                           | 31                    | 41                            | 81        |

(Continues)
| Nr. | First author | Title | Document type | Times cited in Web of Science | Times cited in Scopus | Times cited in Google Scholar | Reference |
|-----|--------------|-------|---------------|-----------------------------|----------------------|-------------------------------|-----------|
| 23  | Sente T      | Adiponectin resistance in skeletal muscle: pathophysiological implications in chronic heart failure | Review          | 30                          | 31                    | 46                            | 82        |
| 24  | van Vugt JL  | A comparative study of software programmes for cross-sectional skeletal muscle and adipose tissue measurements on abdominal computed tomography scans of rectal cancer patients | Article         | 29                          | 36                    | 47                            | 83        |
| 25  | Mochamat     | A systematic review on the role of vitamins, minerals, proteins, and other supplements for the treatment of cachexia in cancer: a European Palliative Care Research Centre cachexia project | Review          | 29                          | 31                    | 42                            | 84        |
| 26  | Sakuma K     | p62/SQSTM1 but not LC3 is accumulated in sarcopenic muscle of mice | Article         | 29                          | 32                    | 42                            | 85        |
| 27  | Batista ML Jr| Cachexia-associated adipose tissue morphological rearrangement in gastrointestinal cancer patients | Article         | 29                          | 31                    | 43                            | 86        |
| 28  | Morley JE    | Anorexia of ageing: a key component in the pathogenesis of both sarcopenia and cachexia | Editorial Material | 28                          | 26                    | 38                            | 87        |
| 29  | Nijholt W    | The reliability and validity of ultrasound to quantify muscles in older adults: a systematic review | Review          | 28                          | 36                    | 53                            | 88        |
| 30  | Brown JL     | Mitochondrial degeneration precedes the development of muscle atrophy in progression of cancer cachexia in tumour-bearing mice | Article         | 27                          | 26                    | 41                            | 89        |
| 31  | Martone AM   | The incidence of sarcopenia among hospitalized older patients: results from the Glisten study | Article         | 26                          | 27                    | 37                            | 90        |
| 32  | St-Jean-Pelletier F | The impact of ageing, physical activity, and pre-frailty on skeletal muscle phenotype, mitochondrial content, and intramyocellular lipids in men | Article         | 26                          | 28                    | 41                            | 91        |
| 33  | Nederveen JP | Skeletal muscle satellite cells are located at a closer proximity to capillaries in healthy young compared with older men | Article         | 26                          | 32                    | 41                            | 92        |
| 34  | Girón MD     | Conversion of leucine to β-hydroxy-β-methylbutyrate by α-ketoisocaprate dioxygenase is required for a potent stimulation of protein synthesis in L6 rat myotubes | Article         | 26                          | 27                    | 34                            | 93        |
| 35  | de Vries NM  | Patient-centred physical therapy is (cost-) effective in increasing physical activity and reducing frailty in older adults with mobility problems: a randomized controlled trial with 6 months follow-up | Article         | 26                          | 29                    | 42                            | 94        |
| 36  | Pinto CL     | Impact of creatine supplementation in combination with resistance training on lean mass in the elderly | Article         | 26                          | 24                    | 44                            | 95        |
| 37  | Nishikawa H  | Elevated serum myostatin level is associated with worse survival in patients with liver cirrhosis | Article         | 25                          | 26                    | 44                            | 96        |
| 38  | Lipina C     | Lipid modulation of skeletal muscle mass and function | Review          | 25                          | 29                    | 34                            | 97        |
| 39  | Klassen O    | Muscle strength in breast cancer patients receiving different treatment regimes | Article         | 25                          | 26                    | 41                            | 98        |
| 40  | Sahebkar A   | Curcumin: an effective adjunct in patients with statin-associated muscle symptoms? | Review          | 25                          | 27                    | 36                            | 99        |
| 41  | Patel MS     | Growth differentiation factor-15 is associated with muscle mass in chronic obstructive pulmonary disease and promotes muscle wasting in vivo | Article         | 25                          | 28                    | 40                            | 100       |
| 42  | Lewis A      | Increased expression of H19/miR-675 is associated with a low fat-free mass index in patients with COPD | Article         | 25                          | 30                    | 41                            | 101       |
| Nr. | First author | Title                                                                 | Document type     | Times cited in Web of Science | Times cited in Scopus | Times cited in Google Scholar | Reference |
|-----|--------------|----------------------------------------------------------------------|-------------------|-------------------------------|-----------------------|-------------------------------|-----------|
| 43  | Go SI        | Prognostic impact of sarcopenia in patients with diffuse large B-cell lymphoma treated with rituximab plus cyclophosphamide, doxorubicin, vincristine, and prednisone | Article           | 25                            | 28                    | 34                            | 102       |
| 44  | Banach M     | Discussion around statin discontinuation in older adults and patients with wasting diseases | Editorial Material | 25                            | 28                    | 39                            | 103       |
| 45  | Tieland M    | Skeletal muscle performance and ageing                                | Review            | 24                            | 26                    | 62                            | 104       |
| 46  | Dos Santos L | Sarcopenia and physical independence in older adults: the independent and synergic role of muscle mass and muscle function | Article           | 24                            | 31                    | 46                            | 105       |
| 47  | Lerner L     | MAP 3K11/GDF15 axis is a critical driver of cancer cachexia           | Article           | 24                            | 27                    | 33                            | 106       |
| 48  | Penna F      | Effect of the specific proteasome inhibitor bortezomib on cancer-related muscle wasting | Article           | 24                            | 26                    | 37                            | 107       |
| 49  | Gonzalez MC  | Bioelectrical impedance analysis for diagnosing sarcopenia and cachexia: what are we really estimating? | Editorial Material | 23                            | 27                    | 40                            | 108       |
| 50  | van de Bool C| A randomized clinical trial investigating the efficacy of targeted nutrition as adjunct to exercise training in COPD | Article           | 23                            | 26                    | 42                            | 109       |
| Nr. | First author | Title                                                                                                                                                                                                 | Document type | Times cited in Web of Science | Times cited in Scopus | Times cited in Google Scholar | Reference |
|-----|--------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|-------------------------------|-----------------------|-------------------------------|------------|
| 1   | Ponikowski P | 2016 ESC Guidelines for the diagnosis and treatment of acute and chronic heart failure: the Task Force for the diagnosis and treatment of acute and chronic heart failure of the European Society of Cardiology (ESC). Developed with the special contribution of the Heart Failure Association (HFA) of the ESC | Article       | 751                           | 1980                  | 7001                          | 110        |
| 2   | Lyon AR      | Current state of knowledge on Takotsubo syndrome: a Position Statement from the Taskforce on Takotsubo Syndrome of the Heart Failure Association of the European Society of Cardiology | Review        | 276                           | 291                   | 431                           | 111        |
| 3   | Crespo-Leiro MG | European Society of Cardiology Heart Failure Long-Term Registry (ESC-HF-LT): 1-year follow-up outcomes and differences across regions                                                                     | Article       | 124                           | 143                   | 170                           | 112        |
| 4   | Harjola VP   | Contemporary management of acute right ventricular failure: a statement from the Heart Failure Association and the Working Group on Pulmonary Circulation and Right Ventricular Function of the European Society of Cardiology | Article       | 110                           | 131                   | 206                           | 113        |
| 5   | van Riet EE  | Epidemiology of heart failure: the prevalence of heart failure and ventricular dysfunction in older adults over time. A systematic review                                                                  | Review        | 108                           | 125                   | 224                           | 114        |
| 6   | Jorsal A     | Effect of liraglutide, a glucagon-like peptide-1 analogue, on left ventricular function in stable chronic heart failure patients with and without diabetes (LIVE)-a multicentre, double-blind, randomised, placebo-controlled trial | Article       | 91                            | 100                   | 121                           | 115        |
| 7   | Ter Maaten JM | Connecting heart failure with preserved ejection fraction and renal dysfunction: the role of endothelial dysfunction and inflammation                                                                        | Review        | 87                            | 93                    | 111                           | 116        |
| 8   | Jankowska EA | Effects of intravenous iron therapy in iron-deficient patients with systolic heart failure: a meta-analysis of randomized controlled trials                                                                   | Review        | 84                            | 110                   | 148                           | 117        |
| 9   | Pappalardo F | Concomitant implantation of Impella® on top of veno-arterial extracorporeal membrane oxygenation may improve survival of patients with cardiogenic shock                                                      | Article       | 83                            | 84                    | 113                           | 118        |
| 10  | Chioncel O   | Epidemiology and one-year outcomes in patients with chronic heart failure and preserved, mid-range and reduced ejection fraction: an analysis of the ESC Heart Failure Long-Term Registry | Article       | 83                            | 114                   | 159                           | 119        |
| 11  | Komajda M    | Effect of ivabradine in patients with heart failure with preserved ejection fraction: the EDIFY randomized placebo-controlled trial                                                                          | Article       | 78                            | 57                    | 59                            | 120        |
| 12  | Vegter EL    | Long-term excess mortality in takotsubo cardiomyopathy: predictors, causes and clinical consequences                                                                                                       | Review        | 78                            | 85                    | 104                           | 121        |
| 13  | Stermaier T  | MicroRNAs in heart failure: from biomarker to target for therapy                                                                                                                                          | Article       | 72                            | 78                    | 101                           | 122        |
| 14  | Vidán MT     | Prevalence and prognostic impact of frailty and its components in non-dependent elderly patients with heart failure                                                                                       | Article       | 66                            | 77                    | 64                            | 123        |
| 15  | Triposkiadis F | Reframing the association and significance of co-morbidities in heart failure                                                                                                                               | Review        | 64                            | 71                    | 101                           | 124        |
| 16  | Tsuji K      | Characterization of heart failure patients with mid-range left ventricular ejection fraction-a report from the CHART-2 Study                                                                                 | Article       | 63                            | 79                    | 107                           | 125        |
| 17  | Gyöngyösi M  | Myocardial fibrosis: biomedical research from bench to bedside                                                                                                                                             | Review        | 61                            | 63                    | 84                            | 126        |
| 18  | Seferovic PM | Type 2 diabetes mellitus and heart failure: a position statement from the Heart Failure Association of the European Society of Cardiology                                                                       | Article       | 60                            | 82                    | 101                           | 127        |

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| Nr. | First author   | Title                                                                                           | Document type | Times cited in Web of Science | Times cited in Scopus | Times cited in Google Scholar | Reference |
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| 19  | Zamorano JL    | 2016 ESC Position Paper on cancer treatments and cardiovascular toxicity developed under the auspices of the ESC Committee for Practice Guidelines: the Task Force for cancer treatments and cardiovascular toxicity of the European Society of Cardiology (ESC) | Article       | 58                            | 71                     | 92                             | 128       |
| 20  | Ovchinnikova ES| Signature of circulating microRNAs in patients with acute heart failure                           | Article       | 58                            | 66                     | 67                             | 129       |
| 21  | Schmidt M      | Thirty-year trends in heart failure hospitalization and mortality rates and the prognostic impact of co-morbidity: a Danish nationwide cohort study | Article       | 57                            | 68                     | 77                             | 130       |
| 22  | Butler J       | The potential role and rationale for treatment of heart failure with sodium-glucose co-transporter 2 inhibitors | Review        | 56                            | 60                     | 76                             | 131       |
| 23  | Senni M        | Initiating sacubitril/valsartan (LCZ696) in heart failure: results of TITRATION, a double-blind, randomized comparison of two uptitration regimens | Article       | 54                            | 61                     | 90                             | 132       |
| 24  | Christ M       | Heart failure epidemiology 2000-2013: insights from the German Federal Health Monitoring System    | Article       | 54                            | 59                     | 67                             | 133       |
| 25  | Vardeny O      | Efficacy of sacubitril/valsartan vs. enalapril at lower than target doses in heart failure with reduced ejection fraction: the PARADIGM-HF trial | Article       | 54                            | 53                     | 67                             | 134       |
| 26  | Gustafsson F   | Left ventricular assist device therapy in advanced heart failure: patient selection and outcomes | Article       | 53                            | 60                     | 78                             | 135       |
| 27  | Teerlink J     | Serelaxin in addition to standard therapy in acute heart failure: rationale and design of the RELAX-AHF-2 study | Review        | 53                            | 58                     | 72                             | 136       |
| 28  | Komajda M      | Physicians’ adherence to guideline-recommended medications in heart failure with reduced ejection fraction: data from the QUALIFY global survey | Article       | 53                            | 60                     | 74                             | 137       |
| 29  | Bauersachs J   | Current management of patients with severe acute peripartum cardiomyopathy: practical guidance from the Heart Failure Association of the European Society of Cardiology Study Group on peripartum cardiomyopathy | Article       | 52                            | 62                     | 85                             | 138       |
| 30  | Thorvaldsen T  | Use of evidence-based therapy and survival in heart failure in Sweden 2003-2012                 | Article       | 50                            | 57                     | 64                             | 139       |
| 31  | Unger ED       | Association of chronic kidney disease with abnormal cardiac mechanics and adverse outcomes in patients with heart failure and preserved ejection fraction | Article       | 48                            | 49                     | 66                             | 140       |
| 32  | Chioncel O     | Clinical phenotypes and outcome of patients hospitalized for acute heart failure: the ESC Heart Failure Long-Term Registry | Article       | 47                            | 57                     | 72                             | 141       |
| 33  | Fitchett D     | Heart failure outcomes in clinical trials of glucose-lowering agents in patients with diabetes   | Review        | 45                            | 51                     | 63                             | 142       |
| 34  | Aschauer S     | The right heart in heart failure with preserved ejection fraction: insights from cardiac magnetic resonance imaging and invasive haemodynamics | Article       | 45                            | 51                     | 62                             | 143       |
| 35  | Anker SD       | Effects of ferric carboxymaltose on hospitalisations and mortality rates in iron-deficient heart failure patients: an individual patient data meta-analysis | Article       | 44                            | 56                     | 89                             | 144       |

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| 37  | Maggioni AP  | The real-world evidence of heart failure: findings from 41 413 patients of the ARNO database | Article       | 43                            | 52                    | 68                            | 146       |
| 38  | Chan MM      | Growth differentiation factor 15 in heart failure with preserved vs. reduced ejection fraction | Article       | 42                            | 49                    | 73                            | 147       |
| 39  | Mann DL      | One-year follow-up results from AUGMENT-HF: a multicentre randomized controlled clinical trial of the efficacy of left ventricular augmentation with Algisyl in the treatment of heart failure | Article       | 42                            | 54                    | 62                            | 148       |
| 40  | Gorter TM    | Right ventricular dysfunction in heart failure with preserved ejection fraction: a systematic review and meta-analysis | Review        | 42                            | 49                    | 61                            | 149       |
| 41  | Jansweijer JA| Truncating titin mutations are associated with a mild and treatable form of dilated cardiomyopathy | Article       | 41                            | 39                    | 54                            | 150       |
| 42  | Targher G    | In-hospital and 1-year mortality associated with diabetes in patients with acute heart failure: results from the ESC-HFA Heart Failure Long-Term Registry | Article       | 41                            | 45                    | 43                            | 151       |
| 43  | Marques FZ   | The transcardiac gradient of cardio-microRNAs in the failing heart | Article       | 41                            | 56                    | 64                            | 152       |
| 44  | Harjola VP   | Organ dysfunction, injury and failure in acute heart failure: from pathophysiology to diagnosis and management. A review on behalf of the Acute Heart Failure Committee of the Heart Failure Association (HFA) of the European Society of Cardiology (ESC) | Review        | 40                            | 44                    | 58                            | 153       |
| 45  | Ghio S       | Different correlates but similar prognostic implications for right ventricular dysfunction in heart failure patients with reduced or preserved ejection fraction | Article       | 40                            | 46                    | 57                            | 154       |
| 46  | Demissei BG  | Optimizing clinical use of biomarkers in high-risk acute heart failure patients | Article       | 40                            | 40                    | 46                            | 155       |
| 47  | Meini P      | Modalities and effects of left ventricle unloading on extracorporeal life support: a review of the current literature | Article       | 39                            | 45                    | 53                            | 156       |
| 48  | Pearse SG    | Sleep-disordered breathing in heart failure | Review        | 39                            | 43                    | 54                            | 157       |
| 49  | Meijers SG   | Variability of biomarkers in patients with chronic heart failure and healthy controls | Article       | 38                            | 39                    | 49                            | 158       |
| 50  | Voors AA     | A systems BIOlogy Study to TAllored Treatment in Chronic Heart Failure: rationale, design, and baseline characteristics of BIOSTAT-CHF | Article       | 38                            | 38                    | 54                            | 159       |
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| 2   | Springer J   | Muscle wasting and sarcopenia in heart failure and beyond: update 2017 | Review | 32 | 38 | 46 |
| 3   | Konishi M    | Heart failure epidemiology and novel treatments in Japan: facts and numbers | Editorial Material | 25 | 26 | 36 |
| 4   | Luedde M     | Heart failure is associated with depletion of core intestinal microbiota | Article | 24 | 27 | 34 |
| 5   | Nagarajan V  | Obesity paradox in heart failure: a heavy matter | Review | 21 | 23 | 37 |
| 6   | Saitoh M     | Anorexia, functional capacity, and clinical outcome in patients with chronic heart failure: results from the Studies Investigating Co-morbidities Aggravating Heart Failure (SICA-HF) | Article | 19 | 19 | 19 |
| 7   | Riley JP     | Palliative care in heart failure: facts and numbers | Editorial Material | 18 | 21 | 27 |
| 8   | Sotiropoulos K | Red cell distribution width and mortality in acute heart failure patients with preserved and reduced ejection fraction | Article | 17 | 18 | 23 |
| 9   | Arrigo M     | Effect of precipitating factors of acute heart failure on readmission and long-term mortality | Article | 16 | 17 | 27 |
| 10  | Nuñez J      | Left ventricular ejection fraction recovery in patients with heart failure treated with intravenous iron: a pilot study | Article | 16 | 18 | 21 |
| 11  | Delepaul B   | Who are patients classified within the new terminology of heart failure from the 2016 ESC guidelines? | Article | 15 | 17 | 20 |
| 12  | Hayashi T    | Subclinical hypothyroidism is an independent predictor of adverse cardiovascular outcomes in patients with acute decompensated heart failure | Article | 14 | 15 | 24 |
| 13  | Barkhudaryan A | Cardiac muscle wasting in individuals with cancer cachexia | Article | 13 | 13 | 17 |
| 14  | Pascaul-Figal D | Rationale and design of TRANSITION: a randomized trial of pre-discharge vs. post-discharge initiation of sacubitril/valsartan | Article | 13 | 14 | 18 |
| 15  | Sato A       | Associations of dipeptidyl peptidase-4 inhibitors with mortality in hospitalized heart failure patients with diabetes mellitus | Article | 12 | 12 | 11 |
| 16  | Martens P    | Insights into implementation of sacubitril/valsartan into clinical practice | Article | 11 | 11 | 16 |
| 17  | Seropian IM  | Neutrophil-to-lymphocyte ratio and platelet-to-lymphocyte ratio as predictors of survival after heart transplantation | Article | 11  | 12 | 16 |
| 18  | Lauritsen J  | Characteristics and long-term prognosis of patients with heart failure and mid-range ejection fraction compared with reduced and preserved ejection fraction: a systematic review and meta-analysis | Review | 10 | 10 | 11 |
| 19  | Cohen-Solal A | Beta blocker dose and markers of sympathetic activation in heart failure patients: interrelationships and prognostic significance | Article | 10 | 13 | 13 |
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| 22  | Morishita T  | Association between matrix metalloproteinase-9 and worsening heart failure events in patients with chronic heart failure | Article | 10 | 13 | 17 |
| 23  | Alma UJ      | Shared biomarkers between female diastolic heart failure and pre-edempsia: a systematic review and meta-analysis | Review | 10 | 13 | 16 |
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| 28  | Theidel U         | Budget impact of intravenous iron therapy with ferric carboxymaltose in patients with chronic heart failure and iron deficiency in Germany | Article            | 9                             | 13                    | 13                            | 187       |
| 29  | Möckel M          | The role of procalcitonin in acute heart failure patients            | Review             | 9                             | 9                     | 13                            | 188       |
| 30  | Searle J          | Acute heart failure facts and numbers: acute heart failure populations | Editorial Material | 9                             | 8                     | 15                            | 189       |
| 31  | Aleksova N        | Barriers to goals of care discussions with hospitalized patients with advanced heart failure: feasibility and performance of a novel questionnaire | Article            | 9                             | 10                    | 11                            | 190       |
| 32  | Hoshida S         | Age- and sex-related differences in diastolic function and cardiac dimensions in a hypertensive population | Article            | 9                             | 9                     | 12                            | 191       |
| 33  | Porto CM          | Association between vitamin D deficiency and heart failure risk in the elderly | Article            | 8                             | 7                     | 16                            | 192       |
| 34  | Pappalardo F      | Full percutaneous biventricular support with two Impella pumps: the Bi-Pella approach | Article            | 8                             | 7                     | 14                            | 193       |
| 35  | Buckley LF        | Low NT-proBNP levels in overweight and obese patients do not rule out a diagnosis of heart failure with preserved ejection fraction | Article            | 8                             | 6                     | 10                            | 194       |
| 36  | Öhman J           | Focused echocardiography and lung ultrasound protocol for guiding treatment in acute heart failure | Article            | 8                             | 9                     | 10                            | 195       |
| 37  | Smedema JP        | Right ventricular involvement and the extent of left ventricular enhancement with magnetic resonance predict adverse outcome in pulmonary sarcoidosis | Article            | 8                             | 9                     | 12                            | 196       |
| 38  | Jaarsma T         | Sexual function of patients with heart failure: facts and numbers | Editorial Material | 8                             | 9                     | 12                            | 197       |
| 39  | Keene D           | Rationale and design of the randomized multicentre His Optimized Pacing Evaluated for Heart Failure (HOPE-HF) trial | Article            | 7                             | 8                     | 11                            | 198       |
| 40  | Pitt B            | Evaluation of an individualized dose titration regimen of patiomer to prevent hyperkalaemia in patients with heart failure and chronic kidney disease | Article            | 7                             | 13                    | 12                            | 199       |
| 41  | Ferreira JP       | Rationale of the RBROTARGETS study designed to identify novel biomarkers of myocardial fibrosis | Article            | 7                             | 8                     | 12                            | 200       |
| 42  | Norberg H         | Eligibility of sacubitril-valsalartan in a real-world heart failure population: a community-based single-centre study | Article            | 7                             | 8                     | 10                            | 201       |
| 43  | Shirakabe A       | Worsening renal function definition is insufficient for evaluating acute renal failure in acute heart failure | Article            | 7                             | 8                     | 10                            | 202       |
| 44  | Lavall D          | Mitral valve interventions in heart failure | Review             | 7                             | 8                     | 14                            | 203       |
| 45  | Cattadori G       | Exercise and heart failure: an update | Review             | 7                             | 10                    | 19                            | 204       |
| 46  | Ancion A          | Serum albumin level and hospital mortality in acute non-ischemic heart failure | Article            | 7                             | 12                    | 14                            | 205       |
| 47  | Lancellotti P     | Protocol update and preliminary results of EACVI/HFA Cardiac Oncology Toxicity (COT) Registry of the European Society of Cardiology | Article            | 7                             | 9                     | 7                             | 206       |
| 48  | Peled Y           | The impact of gender mismatching on early and late outcomes following heart transplantation | Article            | 7                             | 6                     | 10                            | 207       |
| 49  | Ahmed MB          | Higher risk for incident heart failure and cardiovascular mortality among community-dwelling octogenarians without pneumococcal vaccination | Article            | 7                             | 7                     | 9                             | 208       |
| 50  | Thomsen MM        | Varying effects of recommended treatments for heart failure with reduced ejection fraction: meta-analysis of randomized controlled trials in the ESC and ACCF/AHA guidelines | Review             | 7                             | 7                     | 13                            | 209       |
Methods

We included four journals in our analyses that focus on different cardiovascular and non-cardiovascular research topics and have differing impact factors. We included two open access journals: the ‘ESC Heart Failure’ (ESC-HF) and the ‘Journal of cachexia, sarcopenia and muscle’ (JCSM) and two standard subscription journals: the ‘European Journal of Heart Failure’ (EJHF) and the ‘European Journal of Preventive Cardiology’ (EJPC). Each of the journals has a different focus: ESC-HF publishes basic, clinical, and translational research concerning heart failure; EJHF focuses on pathophysiologic research, diagnosis, prevention, and treatment development for cardiovascular diseases, with a main interest in heart failure; EJPC has the aim to share the latest knowledge on preventive and rehabilitative strategies of cardiovascular diseases; and JCSM is focused on better understanding the molecular background of wasting disorders with the purpose to improve the recognition and management of these diseases.

In order to get up-to-date numbers for our comparison, we considered the top 50 cited papers of the four journals according to WoS that were published between 1 January 2016 and 10 October 2019 (Tables 1–4). For each of the 50 papers, we recorded the number of citations according to WoS, Scopus, and Google Scholar on 10 October 2019.

Results

Each of the journals has a different impact factor ranging between 3.407 and 12.129. The change of the impact factors over the last years (2008–18) are shown Figure 1. ESC-HF was founded in 2014 and received its first impact factor in 2018 (3.407), whereas there are no previous impact factors to compare with. EJPC has received its first impact factor in 2011 (2.634) and, since then, steadily increased to 5.640 in 2018. EJHF has been publishing papers since 1999. Since 2008, its impact factor has steadily risen until 3 years ago when it rapidly increased from 5.135 (2015) to 12.129 (2018). JCSM received its first impact factor of 7.413 in 2013 and it increased in the following years to currently 10.754 (2018).

The precise number of citations according to WoS, Scopus, and Google Scholar are shown in Tables 1–4. The top 50 articles in ESC-HF were on average cited 12 (WoS), 13 (Scopus), and 17 times (Google Scholar); in JCSM 37 (WoS), 43 (Scopus), and 60 times (Google Scholar); in EJPC 41 (WoS), 56 (Scopus), and 67 times (Google Scholar); and in EJHF 76 (WoS), 108 (Scopus), and 230 times (Google Scholar). On average, the top 50 cited articles in all four journals were cited 41 (WoS), 52 (Scopus, 26% higher citations count than WoS, range 8–42% in the different journals), and 93 times (Google Scholar, 116% higher citation count than WoS, range 42–203% in the different journals, Figure 2).

Discussion

We have shown here that Scopus and Google Scholar on average have a higher citation count than WoS, whereas the difference is much larger between Google Scholar and WoS. Another systematic comparison of Google Scholar, Scopus, and WoS found that Google Scholar identified >90% of the citations listed in Scopus and WoS. Of the additional citations that Google Scholar identified, about 50% came from non-journal sources: conference papers, books, theses, and unpublished materials. While WoS and Scopus predominantly used English literature for their citation count (>90%), Google Scholar also frequently used non-English literature for their citation count (up to 40% of citations). Therefore, if one wants to find all possible citations of an article, this can only be achieved by combining all three databases. Adriaanse et al. have shown that WoS and Scopus did not count duplicates of papers, while Google Scholar sometimes counted one paper multiple times—additionally explaining why the citation count in Google Scholar is much higher.

Looking at the three analysed journals publishing in the field of cardiovascular research, one can notice a volume effect regarding the ratio between Google Scholar/WoS. The citation count in ESC-HF (average eight citations per article in WoS) is 42% higher for Google Scholar; in EJPC (average 41 citations per article in WoS), the citation count is 63% higher; and in EJHF (average 76 citations per article in WoS), the citation count is 203% higher. We think that one of the main
reasons for this is that very frequently cited articles are read in many parts of the world and then are also often cited in non-English speaking literature and non-journal sources. Such citations can be found more often in Google Scholar. For example, the ‘2016 ESC guidelines for the diagnosis and treatment of acute and chronic heart failure’ by Ponikowski et al. have received 751 citations in WoS, but 7001 citations (+832%) in Google Scholar so far.

Regarding the 26% higher citation count in Scopus compared with WoS, we think that this might be due to the fact that Scopus has a wider database of journals than WoS (20 000 vs. 14 000 journals), and therefore, Scopus has access to more possible citations. Still, it is important to acknowledge that Harzing et al. demonstrated that even though all three databases use different algorithms, each citation count shows a stable and consistent growth over time.

Conflict of interest
None declared.

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