# Holter electrocardiogram research trends and hotspots: bibliometrics and visual analysis

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**Abstract. – OBJECTIVE:** With the help of metrology, we can identify research hotspots and development trends in dynamic electrocardiography, and thereby provide corresponding reference material to aid further theoretical research.

**MATERIALS AND METHODS:** All research data derived from the core collection of Web of Science, and all searches were completed on the same day (February 6, 2022). The obtained data were stored in plain text format and imported into CiteSpace for subsequent analysis. Citation analysis and visualization technology were used to draw a visual map of the research elements, using factors such as annual literature volume, country, journal, author, abstract, keywords, and citation.

**RESULTS:** After screening, 2,937 papers were obtained. Research on ambulatory electrocardiography is increasing worldwide every year. Using research hotspots, keyword-clustering time-zone maps, and high-frequency emerging words, the research in this field was roughly divided into two stages, with 2017 as the divider. The first stage primarily focuses on areas such as atrial fibrillation, stroke, autonomic nerve function, catheter ablation, and T-wave alternation. The second stage saw the focus shift to wearable devices, sudden cardiac death, obstructive sleep apnea, feature extraction, cryptogenic stroke, and similar topics.

**CONCLUSIONS:** With the development of various wearable technologies, the daily monitoring of healthy people engaged in sporting activities and the development of innovative analysis algorithms providing more accurate data may represent the hotspots and direction of future research.

*Key Words:*
 Electrocardiogram, Holter electrocardiogram, Bibliometrics, Visualization analysis, CiteSpace, VOSviewer.

## Introduction

Since its invention by the American physicist Norman J. Holter, the Holter electrocardiogram, as a long-term, dynamic electrocardiogram (ECG) recording technology, has greatly improved the diagnosis rate of arrhythmia. It is commonly used to assess symptoms that may be associated with intermittent arrhythmias, such as syncope, dizziness, chest pain, palpitations, or shortness of breath[1]. With the advancement of technology, the usage period for a Holter electrocardiogram growing from 6 to 24 hours, and then to seven-day long-term Holter electrocardiograms, implanted recorders can monitor the heart for several years. Holter electrocardiogram technology is also integrated into cardiac pacemakers, implantable cardioverter defibrillators, and other equipment to obtain a higher probability of detecting arrhythmia. Holter electrocardiogram functions extend from arrythmia ECGs to ST segment analysis, QT interval measurement, heart rate variability analysis, and signal-averaged ECGs. In recent years, significant progress has been made in Holter electrocardiogram research, and the invention of various wearable devices has considerably broadened the application of electrocardiography. However, numerous issues remain unresolved. For example, the ECG data obtained by different types of equipment[2-4] and different collection methods and data analysis algorithms[5-7] can create gaps, and the populations to which these methods are applicable can also vary[8].

Although increasing literature related to the Holter electrocardiogram has been published, global research trends and hotspots have not been systematically studied. Accordingly, we

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conducted a bibliometric analysis of nearly 3,000 literature items related to the Holter electrocardiogram published in the last ten years (2012-2021) using Citespace software, thereby providing a broader perspective to promote the research and understanding of all aspects of Holter technology. Bibliometrics is the study of scholarly publishing that uses statistics to describe publishing trends and highlight relationships between published works[9], with applications related to the field of medicine enabling the analysis of large numbers of publications at both macro and micro levels[10]. This makes possible the analysis of hotspots and development trends in these disciplines and the prediction of their development directions. In this study, we used Professor Chen Chaomei's CiteSpace software to perform bibliometric and visual analysis of the literature on the Holter electrocardiogram. We analyzed the annual literature volume, national and institutional cooperation networks, journals, author cooperation relations, hotspots, burst keywords, and research trends through CiteSpace, and discussed the research hotspots and trends related to the Holter electrocardiogram.

## Materials and Methods

### Data Sources

All our research data were from the Web of Science (WoS) core collection. To avoid possible deviations arising from the daily updating of the database, all searches were completed on the same day, February 6, 2022. The retrieval formula was set as TS = (dynamic electrocardiography or amplitude electrocardiographic monitoring or amplitude electrocardiography or Holter electrocardiography or Holter ECG or Holter monitoring or Holter EKG or Holter EKGs) through advanced retrieval. Publication dates were limited to January 1, 2012 - December 31, 2021, resulting in 3,256 publications. Screening and reviewing the items and eliminating duplicated and irrelevant papers resulted in a final sample of 2,937 articles. From these, data related to annual literature volume, countries, journals, authors, abstracts, keywords and citations were extracted, with all data being stored in plain text format and imported into CiteSpace for subsequent analysis. As all the data were downloaded from public databases, no medical ethics issues were involved.

### Analysis Tools and Research Methods

We exported the retrieved articles in plain text format, including complete records and references, into Microsoft Excel 2019 (Microsoft Corporation, Redmond, Washington, USA) for further data processing and graphic development. Data entry, cleaning, and descriptive statistical analysis were performed manually in Microsoft Excel 2019. VOSviewer (Version 1.6.16, Centre for Science and Technology Studies, Leiden University, The Netherlands)[11] and CiteSpace 5.8.R3 (Podia, NY, USA)[12] and the online analysis platform (https://bibliometric.com/) were used for further bibliometric analysis.

In the network visualization map created with VOSviewer, different nodes indicate various parameters, such as organization, author, and keyword, and the size of nodes in the map is proportional to the number of times they appear in the publication. The cooperative relationship between nodes is expressed as line. The total link strength (TLS) is used as a weight attribute to indicate the total strength of the selected node's connection.

CiteSpace has also been used for co-citation analysis of authors and journals, dual map overlay of journals, reference clustering, and burst keywords. Nodes in different maps represent authors, journals, references, or keywords. The size and the color of the node indicate the frequency and the year, respectively, of occurrence or reference. In addition, nodes with purple trim represent high mediation centrality, which is usually recognized as a hotspot or turning point in the field[13].

## Results

### Trends in the Number of Publications

The process described above resulted in a final sample of 2,937 publications from the WoS database dating from 2012 to 2021, comprising 2,810 papers and 127 reviews for further quantitative analysis. Figure 1 shows the trend of the global citations of Holter electrocardiography over the past ten years. The analysis indicates that 2017 was a node. Since 2017, the amount of literature increased every year, reaching the current peak (370 articles) in 2020. It shows the continuous interest of global researchers in Holter electrocardiography. The total number of citations is 39,930 (37,044 without self-citations)
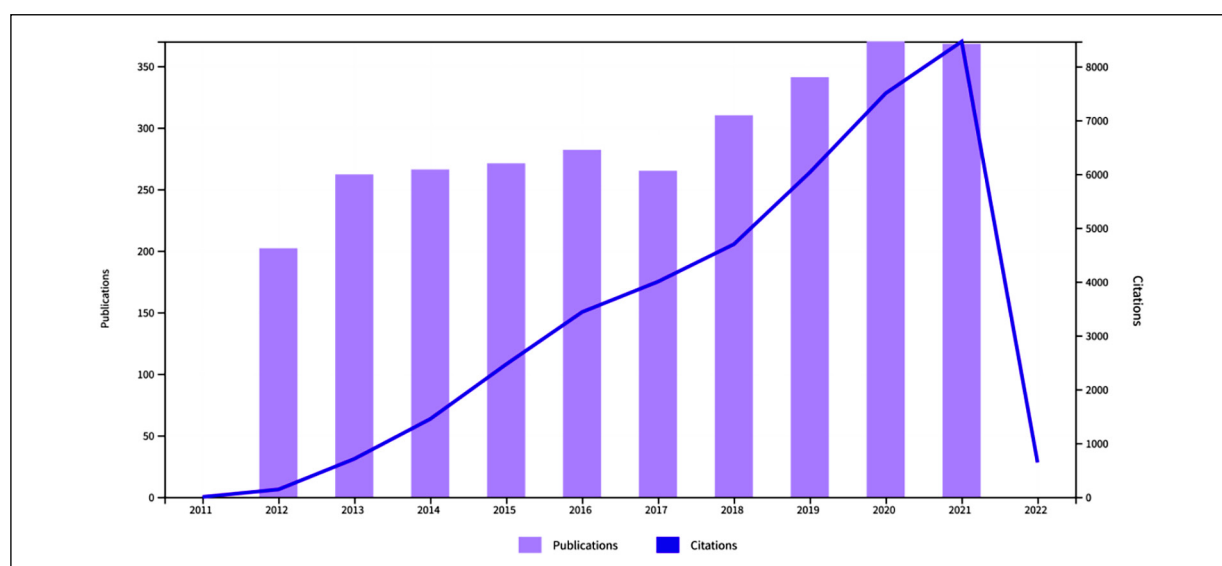
**Figure 1.** The trend of the global and citations of Holter electrocardiography from 2012 to 2021.

(ACI = 13.53).

## Cooperation Between Issuing Countries and Institutions

From 2012 to 2021, 84 countries had published research papers related to Holter electrocardiography. As Table I shows, the United States, with 683 publications, had the highest output, accounting for 23.26% of the total. It was followed by China (362) and Germany (302), representing 12.33 % and 10.28 % of total published articles, respectively. Figure 2A shows the top ten countries from which articles have been published. From the global publication map shown in Figure 2B, an absence of articles on Holter electrocardiography from Africa, Southeast Asia, and South America can be observed, whereas Figure 2C shows the cooperation among countries, with (i) the United States and China, (ii) Germany and Canada, and (iii) Germany, the United States, and the United Kingdom cooperating the most closely. The United States, China, Germany, Canada, and the United Kingdom have been the major contributors in this field. Additionally, academic cooperation between institutions has also had a positive role in promoting academic dissemination and exchanges. Figure 2D presents the 91 institutions that have published more than 13 papers. Among them, Duke University (TLS=84), University of Rochester (TLS=78), Johns Hopkins University (TLS=73), and the University of Washington (TLS=71) have cooperated more with other institutions.

## Authors Distribution and Cooperation Relationship

A total of 16,114 scholars worldwide have

**Table I.** Top 10 countries/regions on the Holter Monitoring field, ranked by the total number of publications (2012-2021).

| Rank | Country | Counts | % of 2,937 | Citations | H-index | ACI |
|------|---------|--------|-----------|-----------|---------|-----|
| 1 | United States of America | 683 | 23.26 | 13,498 | 59 | 19.76 |
| 2 | China | 362 | 12.33 | 3,418 | 28 | 9.44 |
| 3 | Germany | 302 | 10.28 | 7,316 | 40 | 24.23 |
| 4 | Italy | 239 | 8.14 | 3,694 | 34 | 15.46 |
| 5 | United Kingdom | 216 | 7.35 | 4,076 | 31 | 19.88 |
| 6 | Turkey | 196 | 6.67 | 1,832 | 16 | 9.35 |
| 7 | Japan | 192 | 6.54 | 1,426 | 21 | 7.43 |
| 8 | Poland | 164 | 5.58 | 1,552 | 20 | 9.46 |
| 9 | Canada | 152 | 5.18 | 4,045 | 30 | 26.61 |
| 10 | Netherlands | 143 | 4.87 | 2,487 | 26 | 17.39 |

ACI: average citations per item; TLS: Total link strength.
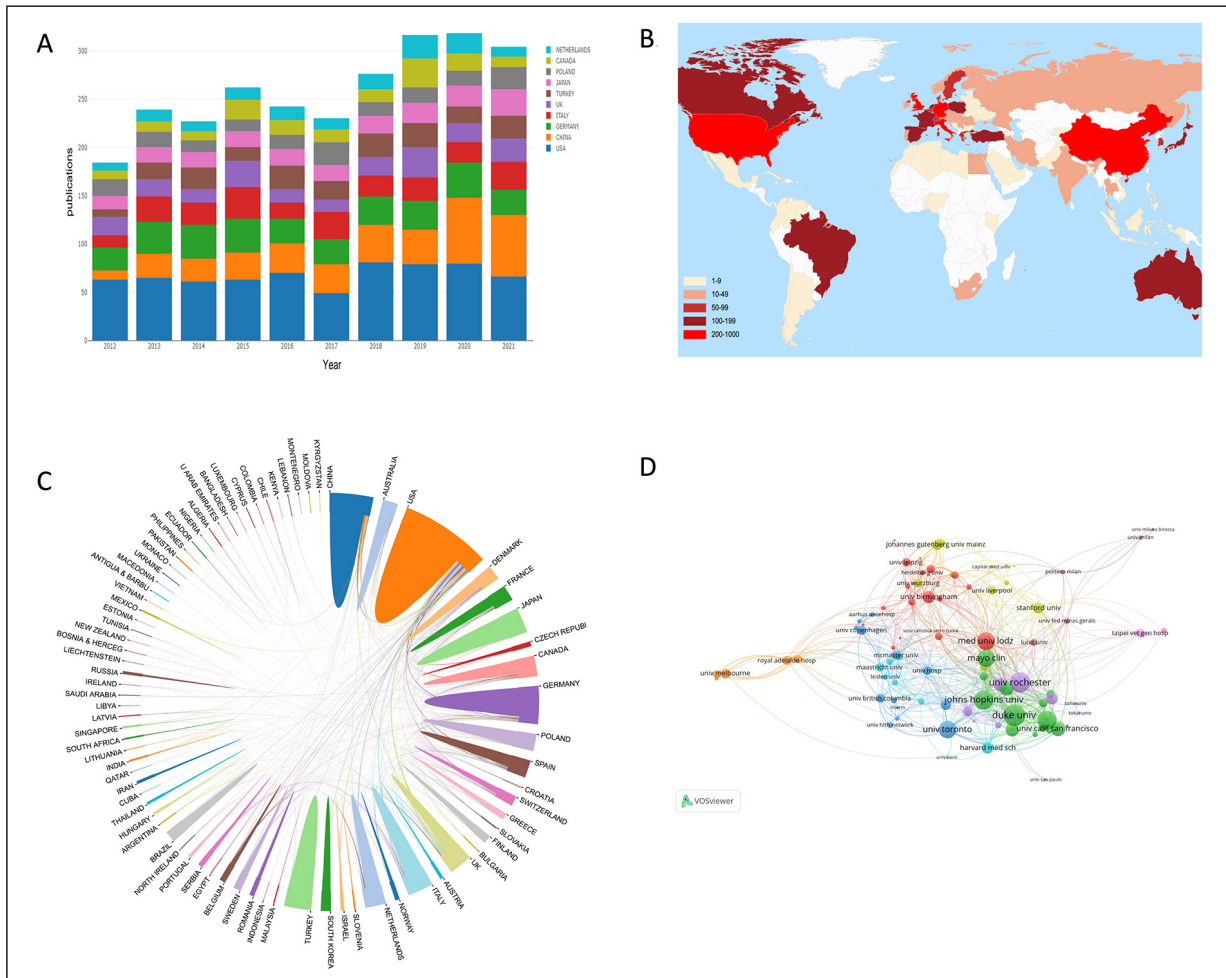
**Figure 2.** Analysis of the contribution of different countries/regions to Holter electrocardiography research publications. **A,** Trends of publications about Holter electrocardiography research of the top 10 countries/regions. **B,** The distribution map of global publications. **C,** Cooperation among countries. **D,** Cooperation map of institutions with 13 or more published articles.

published articles related to the Holter electrocardiography. Table II lists the top 10 most productive authors. Among them, Wojciech Zareba

from the University of Rochester in the United States has had the largest number of published papers, with 27 papers, accounting for 0.92 %

**Table II.** Top 10 most productive authors on the Holter electrocardiography (the superscript denotes the latest article for which the author is the corresponding author).

| Rank | Authors | Countries | Institutions | Counts | % of 2,937 | H-index | ACI |
|------|---------|-----------|--------------|--------|------------|---------|-----|
| 1 | Zareba[14] | USA | University of Rochester | 27 | 0.92 | 13 | 24.15 |
| 2 | Hindricks[15] | Germany | Leipzig University | 25 | 0.85 | 13 | 60.88 |
| 3 | Wachter[16] | Germany | Leipzig University | 20 | 0.68 | 12 | 23.62 |
| 4 | Gröschel[17] | Germany | Johannes Gutenberg University of Mainz | 17 | 0.58 | 11 | 19.72 |
| 5 | Couderc[18] | USA | University of Rochester | 16 | 0.55 | 9 | 23.00 |
| 6 | Bollmann[19] | Germany | Heart Center Leipzig GMBH | 14 | 0.48 | 9 | 15.00 |
| 7 | Cygankiewicz[20] | Poland | Medical University Lodz | 14 | 0.48 | 9 | 19.33 |
| 8 | Kalman[21] | Australia | University of Melbourne | 13 | 0.44 | 9 | 84.38 |
| 9 | Malik[22] | England | Imperial College London | 13 | 0.44 | 6 | 9.23 |
| 10 | Sommer[23] | Germany | Clinic for Electrophysiology | 13 | 0.44 | 7 | 11.31 |
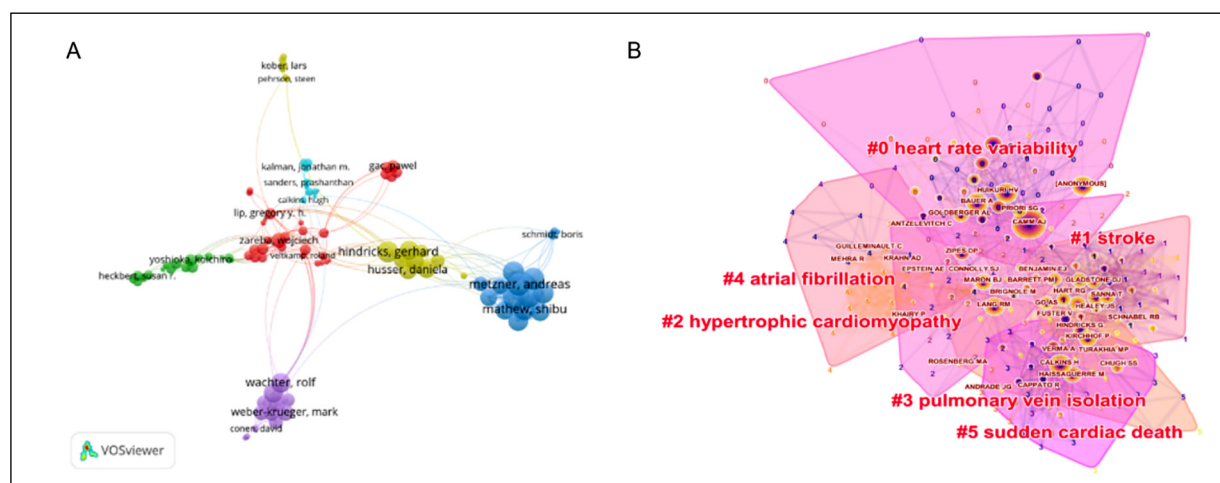
**Figure 3.** Contribution analysis of author publications on Holter electrocardiography. **A,** Authors of at least 6 papers in the field of Holter electrocardiography and their cooperative relations. **B,** The author co-citation graph.

of the total. Jonathan M. Kalman of the University of Melbourne has been the author with the highest Author Contribution Index (ACI=84.38). Figure 3A shows authors who have published at least six articles in this field and their cooperative relationships, and it reveals that the connected items were composed of 100 items. Figure 3B presents the author co-citation graph, which can be divided into six clusters: heart rate variability, stroke, hypertrophic cardiomyopathy, pulmonary vein isolation, atrial fibrillation, and sudden cardiac death.

### Analysis of Published Journals

Since 2012, studies related to Holter electrocardiography have been published in 847 journals, covering 122 categories. Table III lists the top ten journals in the field of Holter electrocardiography:

of these, "Annals of Noninvasive Electrocardiology" has had the highest number of citations with 85 papers, accounting for 2.89% of the total, followed by the "International Journal of Cardiology2 (76) and the "Journal of Electrocardiology" (72), each accounting for 2.59% and 2.45% of the total, respectively. Figure 4A shows that the journals "Circulation" and "IEEE Transactions on Bio-Medical Engineering" have had better betweenness centrality. Among the ten journals, two were classified as Q1 and four as Q2. The influence factors ranged from 1.438 to 6.343, and "Heart Rhythm" has had the highest influence factor.

Figure 4B shows the top 10 WoS discipline categories in this field. The most important was cardiac cardiovascular systems, with 1,252 publications, followed by general internal medicine with 230. In addition, Holter electrocardiography

**Table III.** Top 10 journals on the Holter electrocardiography

| Rank | Journal | Counts | % of 2,937 | H-index | ACI | IFs | JCR partition |
|------|---------|--------|-----------|---------|-----|-----|---------------|
| 1 | Annals of Noninvasive Electrocardiology | 85 | 2.89 | 10 | 4.92 | 1.468 | Q4 |
| 2 | International Journal of Cardiology | 76 | 2.59 | 20 | 17.61 | 4.164 | Q2 |
| 3 | Journal of Electrocardiology | 72 | 2.45 | 11 | 5.57 | 1.438 | Q4 |
| 4 | Europace | 64 | 2.18 | 19 | 18.59 | 5.124 | Q1 |
| 5 | Journal of Cardiovascular Electrophysiology | 64 | 2.18 | 19 | 14.98 | 0 | Q2 |
| 6 | PLoS One | 56 | 1.91 | 16 | 11.23 | 3.24 | Q2 |
| 7 | Pace Pacing and Clinical Electrophysiology | 50 | 1.70 | 10 | 7.08 | 1.976 | Q4 |
| 8 | Heart Rhythm | 44 | 1.50 | 19 | 22.7 | 6.343 | Q1 |
| 9 | American Journal of Cardiology | 38 | 1.29 | 15 | 21.84 | 2.778 | Q2 |
| 10 | Journal of Interventional Cardiac Electrophysiology | 35 | 1.19 | 11 | 9.54 | 1.9 | Q4 |

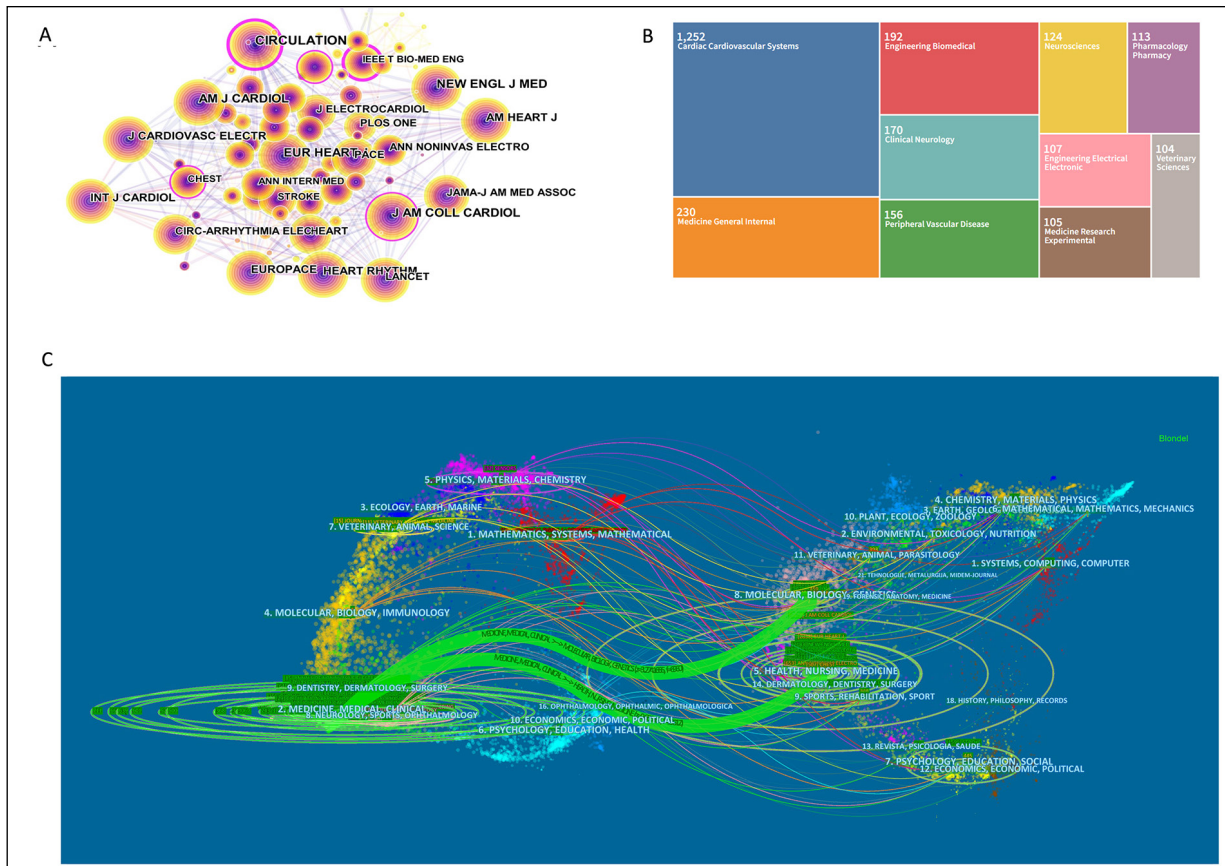ACI: average citations per item.

**Figure 4.** Analysis of core journals in relation to Holter electrocardiography. **A,** Journal co-citation graph. **B,** Tree graphs of the top 10 WoS discipline categories. **C,** Journal double image overlay.

was also used in many fields, such as biomedical engineering, clinical neurology, peripheral vascular disease, and similar fields. Figure 4C is a double image overlay, presenting the flow relationship between the cited documents and the cited documents. On the left, there is a map of citing journals and on the right, there is a map of cited journals. The citation paths are mainly two green ones, showing the flow from citing journal "2. medicine, medical, clinical" to citied journals "8. molecular, biology, genetics" and "5. health, nursing, medicine."

### Reference Co-Citation Analysis

Through literature co-citation analysis, we can find the most cited and influential references (Figure 5A). Table IV shows the top ten references with the highest citation frequency. Figure 5B shows the eight clusters of references in the field of Holter electrocardiography, whereas Figure 5C shows the clustering of references through the time axis, revealing the focus on Holter electrocardiography at different periods. We can observe, for example, that while the previous focuses were primarily on stroke and pulmonary vein isolation, more recent publications have focused on digital health and embolic strokes of undetermined source.

### Keyword Co-Occurrence Analysis

Keywords indicate an article's core content. "Keyword emergence" refers to a significant change in keyword frequency over a short time. It highlights research hotspots in this field and the research directions receiving greater attention within a certain period. Table V lists the top 35 keywords with a citation frequency greater than 28 in the field of Holter electrocardiography. The five keywords occurring most frequently were 'atrial' 'fibrillation', 'electrocardiography', 'heart rate variability', 'Holter ECG', and 'arrhythmia'. Figure 6A shows the heatmap of the top 35 keywords with a citation frequency greater than 28. The more frequently they appear, the yellower the color.

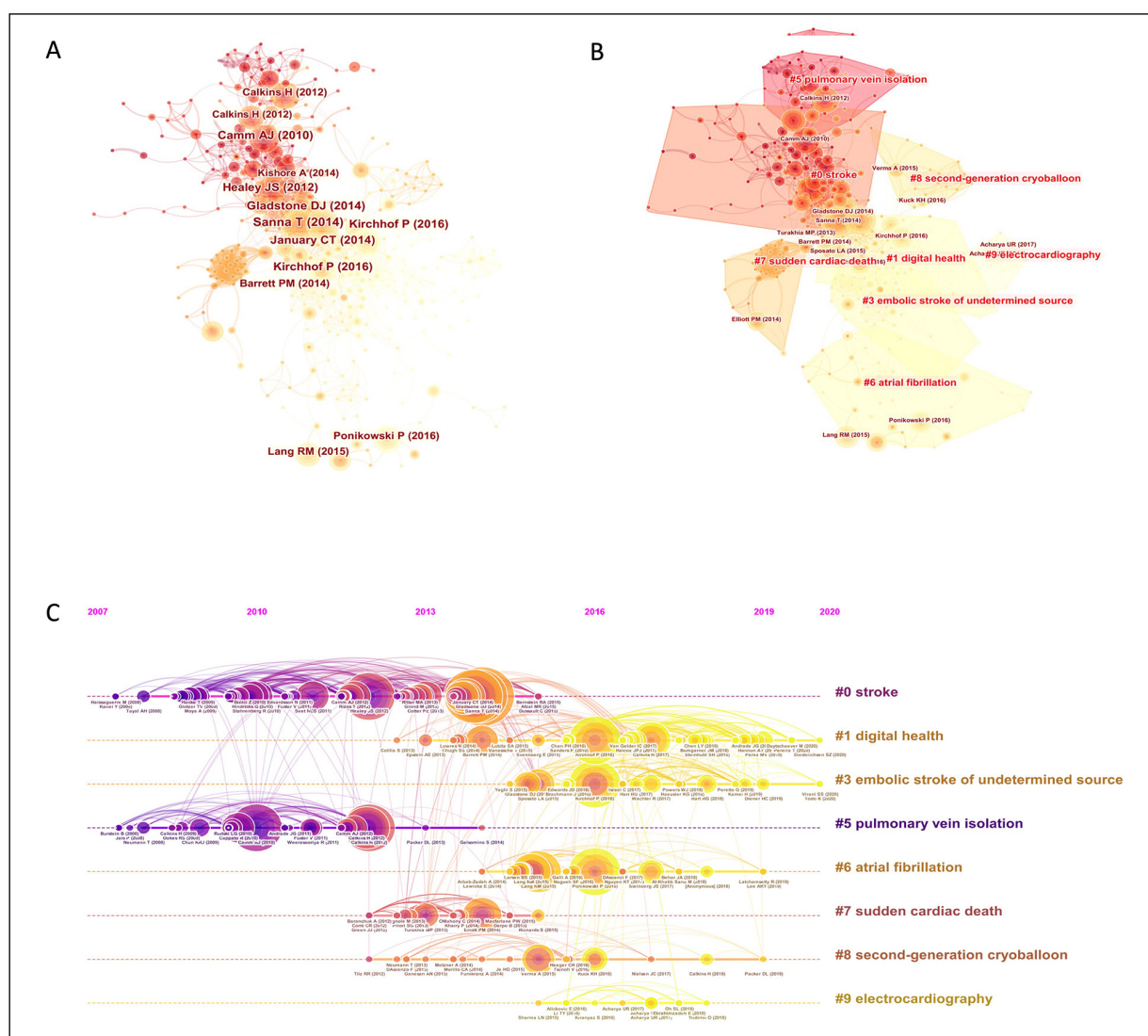CiteSpace burst keywords are considered another important indicator reflecting the research

**Figure 5.** Analysis of references to Holter electrocardiography. **A,** References co-cited. **B,** Eight clusters of references. **C,** Reference Timeline.

frontier and emerging trends in specific fields. Figure 6B shows the top 23 keywords of the strongest citation bursts, reflecting research hotspots and frontiers. The red line represents the duration of the keyword burst; the earliest emerging keyword is 'cardiac autonomic function'. Additionally, 'wearable devices', 'ventricular tachycardia', 'sudden cardiac death', 'obstructive sleep apnea', 'feature extraction', 'congenital heart disease', and 'cryptogenic stroke' are among the research hotspots in recent years.

## Discussion

Using CiteSpace and VoSviewer to analyze research related to Holter electrocardiography in the last ten years can help presenting the research trends in this field in a relatively intuitive way. Consequently, it enables the evaluation of the research status, as well as the tracking and predicting of new research hotspots related to this field.

A variety of important findings arise from this analysis. First, it is clear that the United States are at the core of research, whether in terms of the number of papers or cooperation with other countries. Additionally, since 2017, the number of papers globally published related to Holter electrocardiography has shown a clear trend of annual increase. Researchers from the United States, China, and Germany are the main contributors in this field, and among the top ten countries in terms of published papers (Table I), the top five countries account for 61.36% of the

**Table IV.** Top 10 most cited references on the Holter electrocardiography (2012-2021).

| Rank | Title | Author | Year | Counts | Journal | IF (2020) |
|---|---|---|---|---|---|---|
| 1 | Cryptogenic Stroke and Underlying Atrial Fibrillation | Sanna et al[24] | 2014 | 72 | New Engl J Med | 91.245 |
| 2 | Guidelines for the management of atrial fibrillation The Task Force for the Management of Atrial Fibrillation of the European Society of Cardiology (ESC) | Camm et al[25] | 2010 | 64 | Eur Heart J | 29.983 |
| 3 | Atrial Fibrillation in Patients with Cryptogenic Stroke | Gladstone et al[26] | 2014 | 63 | New Engl J Med | 91.245 |
| 4 | 2016 ESC Guidelines for the management of atrial fibrillation developed in collaboration with EACTS | Kirchhof et al[27] | 2016 | 53 | Eur Heart J | 29.983 |
| 5 | 2014 AHA/ACC/HRS Guideline for the Management of Patients With Atrial Fibrillation: A Report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines and the Heart Rhythm Society | January et al[28] | 2014 | 50 | Circulation | 29.69 |
| 6 | 2016 ESC Guidelines for the management of atrial fibrillation developed in collaboration with EACTS | Kirchhof et al[29] | 2016 | 49 | Europace | 5.214 |
| 7 | Subclinical Atrial Fibrillation and the Risk of Stroke | Healey et al[30] | 2012 | 47 | New Engl J Med | 91.245 |
| 8 | 2016 ESC Guidelines for the diagnosis and treatment of acute and chronic heart failure | Ponikowski et al[31] | 2016 | 39 | Eur Heart J | 29.983 |
| 9 | Comparison of 24-hour Holter Monitoring with 14-day Novel Adhesive Patch Electrocardiographic Monitoring | Barrett et al[32] | 2014 | 36 | Am J Med | 4.965 |
| 10 | 2012 HRS/EHRA/ECAS Expert Consensus Statement on Catheter and Surgical Ablation of Atrial Fibrillation: Recommendations for Patient Selection, Procedural Techniques, Patient Management and Follow-up, Definitions, Endpoints, and Research Trial Design | Calkins et al[33] | 2012 | 35 | Europace | 5.214 |

total. Exchanges and cooperation among various institutions have played a positive role in this process. In Figure 2D, the four organizations with the highest TLS – Duke University, the University of Rochester, Johns Hopkins University, and the University of Washington – are all

**Table V.** Top 35 keywords with frequency higher than 28.

| Rank | Keyword | Occurrence | TLS | Rank | Keyword | Occurrence | TLS |
|---|---|---|---|---|---|---|---|
| 1 | Atrial fibrillation | 482 | 652 | 19 | Ventricular tachycardia | 49 | 77 |
| 2 | Electrocardiography | 468 | 580 | 20 | Hypertrophic cardiomyopathy | 43 | 57 |
| 3 | Heart rate variability | 350 | 323 | 21 | Myocardial infarction | 42 | 95 |
| 4 | Holter ECG | 330 | 506 | 22 | Heart rate turbulence | 40 | 64 |
| 5 | Arrhythmia | 226 | 308 | 23 | Hypertension | 40 | 44 |
| 6 | Heart rate | 99 | 126 | 24 | Cardiac arrhythmias | 39 | 58 |
| 7 | Autonomic nervous system | 97 | 135 | 25 | Syncope | 39 | 79 |
| 8 | Catheter ablation | 96 | 145 | 26 | Ischemic stroke | 37 | 60 |
| 9 | Sudden cardiac death | 80 | 150 | 27 | Risk factors | 35 | 63 |
| 10 | Stroke | 77 | 131 | 28 | Long qt syndrome | 33 | 39 |
| 11 | Ventricular arrhythmias | 71 | 86 | 29 | Paroxysmal atrial fibrillation | 32 | 41 |
| 12 | Ventricular premature complexes | 68 | 104 | 30 | Risk stratification | 32 | 63 |
| 13 | Pulmonary vein isolation | 66 | 118 | 31 | Monitoring | 31 | 48 |
| 14 | Echocardiography | 63 | 86 | 32 | Blood pressure | 29 | 38 |
| 15 | Children | 61 | 64 | 33 | Qt interval | 29 | 22 |
| 16 | Ablation | 58 | 135 | 34 | Cryptogenic stroke | 28 | 46 |
| 17 | Cardiomyopathy | 56 | 84 | 35 | Diabetes | 28 | 39 |
| 18 | Heart failure | 55 | 67 | | | | |

TLS: Total link strength.
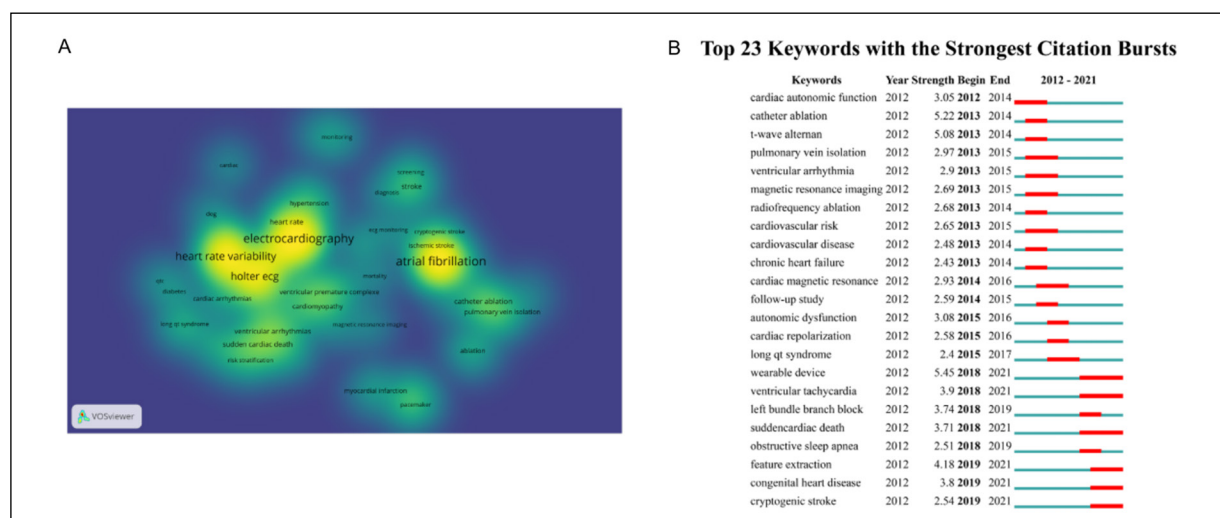
**Figure 6.** Author keywords analysis. **A,** Heatmap of the first 35 keywords with cited frequency greater than 28. **B,** Top 23 keywords with the strongest citation bursts.

from the United States. It shows that they have very close exchanges and cooperation with other institutions, which can reflect the academic level of the industry and the exchange and cooperation projects.

The analysis of the top ten journals shows that those classified as Q1 and Q2 account for 60% (6/10), 20% (2/10) of the impact factors are between 5-10, these journals are "Europace" and "Heart Rhythms". There are 20% (2/10) impact factors between 3 and 5, including the "International Journal of Cardiology" and "PLoS One". The other 60% (6/10) influencing factors were below 3. In summary, research articles related to the field of Holter electrocardiography are mainly published in lower IF journals, indicating that there is relatively little cutting-edge research and few new technological breakthroughs in this field.

Clustering analysis of published papers shows that Holter monitoring is mainly used in cardiovascular system, nervous system, respiratory system, and exercise health monitoring. Taking 2017 as the boundary, researchers' interest in the field of ambulatory electrocardiogram has significantly changed, which can be roughly divided into two stages (Table IV and Figure 6C). The first stage is mainly applied in the field of cardiovascular system and nervous system before 2017, focusing on areas such as atrial fibrillation, stroke, autonomic nerve function, catheter ablation, and T-wave alternation. Studies[34] have shown that more accurate data can be

obtained by using equipment that can record for longer periods of time. Such as, the detection rate of atrial fibrillation can be improved by using materials such as new patch electrodes and implanted devices to prolong the recording time of Holter monitoring[27,30,32]. Long-term rhythm monitoring can improve the diagnosis rate of intermittent atrial fibrillation in cryptogenic stroke patients and make treatment decisions more rational[35,36]. Simultaneously, increasing the recording time is also helpful for the assessment of heart rate variability, which reflects the body's regulation of autonomic nervous function in multiple systems such as the heart, brain, and blood vessels, and predicting the occurrence of arrhythmia events[37,38].

In the second stage, it can be observed that research into dynamic electrocardiography extended to more fields after 2017. The research hotspots are mainly wearable devices, sudden cardiac death, obstructive sleep apnea, feature extraction, and cryptogenic stroke. Studies have shown that a variety of wearable devices using dynamic electrocardiography, including armbands, wristbands, mobile phones and clothes, are used for daily exercise health monitoring[3,39,40]. Feature extraction for a large number of ECG data has become a research hotspot. For example, using convolutional neural network, and other methods to analyze ECG data and automatically classify heartbeat types[40-44], so as to obtain more accurate ECG data analysis results. In addition, cluster analysis showed that in the aspect of sleep

apnea, researchers used Holter electrocardiogram and heart rate periodic score (CVHRS) to screen patients with sleep apnea, which could identify most patients and provide diagnostic support for their treatment strategies[45-47].

### Limitations

This study does have some limitations. The data in this paper are only from the WoS database in the past decade, which cannot represent all the research results in this field around the world. Additionally, only representative hotspots are analyzed, so there may be some deviations in the data content. However, despite these limitations, we feel that the findings in this study represent a significant contribution to our knowledge of research areas and hotspots in this field and their development over time.

## Conclusions

The bibliometric research shows that Holter electrocardiogram can not only be used to monitor specific diseases and provide objective evidence for the study of the pathogenesis of various diseases and the adjustment of treatment plans. With the development of various wearable technologies, the daily monitoring of healthy people engaged in sporting activities and the development of more accurate and innovative analytical algorithms may be the most likely future research hotspots and direction. In addition, Citespace software was used in this study to conduct a bibliometric and visual analysis on the Holter related literature from WoS database, so that the subsequent researchers can have a more intuitive understanding of the research hotspots and trends of Holter electrocardiography, which has a certain reference significance for the research direction.

**Data Availability Statement**
All data generated or analyzed during this study are included in this article.

**Authors' Contribution**
Shanying Lin, Zhongzhi Luo and Zitong Li designed the study. Yide Xu, Shanying Lin, Hong Kang and Zitong Li searched and collected the data. Yide Xu, Mei Lin, Shanying Lin and Zhiyong Xu analyzed the results. Yide Xu, Mei Lin, and Zitong Li drafted the manuscript.

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