Modern researches on Blood Stasis syndrome 1989–2015
A bibliometric analysis
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Abstract
Background: Blood Stasis syndrome (BSS) is one of the major syndromes in Traditional East Asia medicine (TEAM). Modern research of BSS began in the late 1980s.

Methods: We searched in PubMed for BSS-related articles published between 1989 and 2015. The publication information, study contents, and bibliometric indicators were documented and analyzed.

Results: Most of the BSS-related studies were conducted by Chinese researchers in China. The number of publications on BSS-related increased rapidly in recent years, so did the quality of them. The disease diversity of BSS-related studies increased along with the number of publications. Yet the academic influence of them remained on average low; further, the diagnostic criteria of BSS were not uniform.

Conclusions: BSS-related studies have increased in quantity and quality, but there are limitations to them which require improvement in research productivity and academic influence.

Abbreviations: BSS = blood Stasis syndrome, CAM = complementary and alternative medicine, CHD = coronary heart disease, CNKI = China national knowledge infrastructure, IF = impact factors, RCT = randomized clinical trial, TCM = Traditional Chinese medicine, TEAM = Traditional East Asia medicine, WOS = web of Science.

Keywords: bibliometric analysis, blood stasis syndrome, h-index, traditional East Asia medicine

1. Introduction
Blood stasis syndrome (BSS, also known as Xueyu Zheng in Chinese or Oketsu in Japanese) is one of the major syndromes in Traditional East Asia medicine (TEAM). BSS is the compound of various manifestations including pain that occurs in a fixed location, dark-purple face or tongue, bleeding, blood spots under the skin, and an astringent pulse among other features.[1] There are common characteristics and manifestations of BSS in different diseases. In the theory of TEAM, BSS is usually caused by internal or external factors and leads to disturbance of blood circulation.[2] BSS has an important role in TEAM, since it is related to blood, one of the basic elements that nourishes and maintains the body’s physiologic functions. Also, it is seen in almost all chronic internal diseases and external injuries.

The first descriptions of BSS can be traced back to over 2000 years ago, where it is found in the Inner Canon of Huangdi (about 200 B.C. in China). Throughout the practice of TEAM in eastern Asia, the understanding of BSS evolved gradually. But due to the lack of standard diagnosis criteria, it was difficult to summarize and communicate between different studies. Not just in scientific studies, a uniformed and objective diagnostic method for BSS is essential for clinical diagnosis and treatment.[2] BSS is commonly seen in chronic internal diseases and external injuries; hence, the accurate identification and evaluation of BSS and the application of activating blood circulation to dissipate blood stasis are vital to the treatment via TEAM.[1,3] The key to achieving this relies on standardized diagnosis criteria which truly reflects the nature of BSS. In the 1980s, standard diagnostic criteria for BSS were officially established by formal academic committees. In 1982, Tentative diagnostic criterion for BSS was first established by Specialized Committee of “activating blood circulation” (ABC) in China.[4] In Japan, Diagnostic criteria for Oketsu (blood-stasis) syndrome was published by Terasawa et al.[5] in 1983. After years of applications and analyses, revised and relatively more standard diagnostic criteria were established in the late 1980s. In China, the “diagnostic criteria of Blood-stasis symptom-complex” was determined and established in the Chinese Association of Traditional Chinese Medicine, by the committee of “promoting blood circulation to remove blood
stasis" in 1988.[6] The next year in Japan, similar diagnostic criteria were established by Terasawa.[7] Research on BSS has improved since 1989, with the establishment of the standard diagnosis criteria for BSS. It is reported that BSS is correlated to several pathogeneses including abnormal coagulation function,[8] inflammation,[9] and accelerated red blood cell senescence.[10] Studies that focus on the treatment of BSS are also increasing. With more applicable diagnostic criteria established and the BSS-related studies increased, the inconsistency of BSS diagnostic criteria is drawing researchers' attention.[11]

Since modern research on BSS has been ongoing for >30 years, a systematic summary of them is warranted. To date, reviews on particular aspects of BSS such as certain diseases, biomarkers, and medications have been published. But there has not been any comprehensive recognition of the publication status and quality of BSS-related articles as a whole. Therefore, in this study, we systematically summarized all the articles related to BSS published from 1989 to 2015 in MEDLINE and in English, which are the most used academic database and language, hoping to gain a broad perspective of modern research of BSS.

### 2. Materials and methods

#### 2.1. Data sources and searches

Since 1989 was the milestone for modern research of BSS, we searched for all articles related to BSS in PubMed from 1st January 1989 to 31th December 2015. The search term was ("blood stasis syndrome" [All Fields]) AND ("1989/01/01"[PDat]: "2015/12/31"[PDat])). The ethical approval was not necessary since all the data we collected were from those published articles, this research did not involve any privacy of any individual, and the research process would not result in any harm or discomfort to anyone.

#### 2.2. Inclusion/exclusion criteria

The articles which were selected should meet all the inclusion criteria as followed:

1. The definition of BSS in the article was within the theory of TEAM.
2. The main content of the article should focus on BSS.
3. The article was written in English.
4. The publication date should be between 1st January 1989 and 31th December 2015.

Those articles not in English or which studied Western medicine-defined blood stasis were not included.

#### 2.3. Data extraction

The publication information and bibliometric indicators were collected from those included articles. The documented indices included:

1. Publication information, including journal, year of publication, article type, country of author's affiliation.
2. Study contents, including diseases, main subjects of study, characteristics of study, the diagnostic criteria of BSS used in research, intervention if applied.
3. Bibliometric indicators, including total cites in Web of Science (WOS), Scopus and Google Scholar respectively, h-index, and the impact factor (IF) of the journal in publication year.

h-index and IF were extracted from WOS and annual Journal Citation Reports (JCR).

Three authors (LD, GC, and JH) participated in articles searching, screening, and data extracting. All of the information extracted were supervised and verified by 1 author (JL). Any discrepancies were discussed among all of the authors for consensus.

#### 2.4. Data analysis

Data analysis and visualization were performed via SPSS 17.0 and Microsoft Excel 2010. Data were presented by counts, percentage, and frequency.

### 3. Results

#### 3.1. Selection of studies

Searching PubMed with the term of "blood stasis," we identified 807 items published between 1st January 1989 and 31th December 2015. By reading the title and abstract, we excluded 544 non-English language articles. By reading the abstract and the whole articles, we excluded 108 articles that did not focus on BSS in the theory of TEAM. Eventually 155 articles were included in this analysis. Figure 1 shows the flowchart of article searching and screening. Table 1 shows the detailed information of all the included articles. Tables 2 and 3 show the diagnostic criteria and modeling methods these articles applied in their researches. The number in Diagnostic criteria/modeling methods column of Table 1 was referred to those in Tables 2 and 3.

#### 3.2. General information of included articles

Among the 155 BSS-related articles, 127 of them (81.94%) were original articles, 22 of them (14.19%) were review (including systematic review and meta-analysis), 6 (3.87%) were others (such as conference abstract, academic opinion). Authors' affiliations were most commonly in China (144 out of 155, 92.9%). Only 11 articles were authored by authors outside of China, including 7 articles from Japan and 4 articles from Korea. One of the second authors was Norwegian.

| Articles identified in Pubmed (n=807) | Articles written in English (n=263) | Articles eventually Included (n=155) |
|--------------------------------------|-----------------------------------|-------------------------------------|
| non-English written articles (n=544) | non-BSS related articles (n=108)  |                                     |

Figure 1. Article searching and screening process. The article inclusion process was under the inclusion established in Materials and Methods section.
### Table 1

General and bibliometric information of included BSS-related articles (sorted by total citation).

| No. | Title                                                                 | Journal                          | Publication year | Article type | WOS citation | Scopus citation | Google Scholar citation | h-index | Diagnostic criteria/ modeling methods | Diseases | Intervention | Subjects of research | Country of authors' affiliation |
|-----|-----------------------------------------------------------------------|----------------------------------|------------------|--------------|--------------|-----------------|------------------------|---------|----------------------------------------|----------|--------------|------------------------|-------------------------------|
| 1   | Ultrasonic/microwave assisted extraction and diagnostic ion filtering strategy by liquid chromatography-quadrupole time-of-flight mass spectrometry for rapid characterization of flavonoids in Spaltholobus suberectus | J Chromatogr A                    | 2011             | Original article | 49           | 46              | 70                     | 7       | Not mentioned                          | Herbal extract | Not specified | Not specified           | China                          |
| 2   | Herbs of activating blood circulation to remove blood stasis          | Clin Hemorheol Microcirc         | 2000             | Review       | 41           | 40              | 55                     | 12      | Not mentioned                          | None      | Not specified | Not specified           | China                          |
| 3   | A Proteomic Approach for the Diagnosis of „Oketsu“ (blood stasis), a Pathophysiology Concept of Japanese Traditional (Kampo) Medicine | Evid Based Complement Alternat Med | 2007             | Original article | 35           | 37              | 59                     | 6       | #5                                     | Not specified | None          | Human                  | Japan                          |
| 4   | Pharmacokinetic comparisons of hydroxyflavonoid yellow A in normal and blood stasis syndrome rats | J Ethnopharmacol                 | 2010             | Original article | 28           | 33              | 42                     | 7       | #28                                    | Herbal extract | Rat           | China                  |                               |
| 5   | Pharmacokinetics of traditional Chinese syndrome and recipe: a hypothesis and its verification (I) | World J Gastroenterol            | 2000             | Original article | 28           | 26              | 39                     | 11      | Not mentioned                          | Herbal formula | Rat           | China                  |                               |
| 6   | Buyang Huanwu decoction ameliorates coronary heart disease with G deficiency and blood stasis syndrome by reducing CRP and CD40 in rats | J Ethnopharmacol                 | 2010             | Original article | 22           | 25              | 30                     | 10      | #30                                    | Coronary heart disease | Herbal formula | Rat                     | China                          |
| 7   | Blood stasis syndrome and its treatment with activating blood circulation to remove blood stasis therapy | Chin J Integr Med                | 2012             | Academic Exploration | 22           | 20              | 29                     | 4       | #24                                    | None      | Not specified | Not specified           | China                          |
| 8   | Chinese herb and formulas for promoting blood circulation and removing blood stasis and antidysplastic therapies | Evid Based Complement Alternat Med | 2012             | Review       | 30           | 20              | 34                     | 5       | Not mentioned                          | None      | Not specified | Not specified           | China                          |
| 9   | Comparative efficacy of Kelishi-bukuryo-gan and pantseraline on RBC deformability in patients with “oketsu” syndrome | Phytomedicine                    | 2003             | Original article | 30           | 18              | 36                     | 7       | #5                                     | Not specified | Herbal formula | Human                  | Japan                          |
| 10  | Traditional Chinese medicine syndrome distribution in chronic hepatitis B populations: a systematic review | Am J Chin Med                    | 2011             | Systematic review | 18           | 19              | 24                     | 8       | #2                                     | Hepatitis B | None          | Not specified           | China                          |

(continued)
| No. | Title                                                                 | Journal                        | Publication year | Article type | WOS citation | Scopus citation | Google Scholar citation | h-index | Diagnostic criteria/ modeling methods | Diseases                  | Intervention | Subjects of research | Country of authors' affiliation |
|-----|------------------------------------------------------------------------|--------------------------------|------------------|-------------|--------------|----------------|-------------------------|---------|----------------------------------------|--------------------------|--------------|----------------------|-------------------------------|
| 11  | Differential gene expression profiles in coronary heart disease patients of blood stasis syndrome in traditional Chinese medicine and clinical role of target gene | Chin J Integr Med             | 2009             | Original article | 17            | 13             | 22                      | 6       | #3                                     | Coronary heart disease      | None          | Human                | China                          |
| 12  | Effects of Monascus-fermented rice extract on malignant cell-associated neovascularization and intravasation determined using the chicken embryo chorioallantoic membrane model | Integr Cancer Ther            | 2010             | Original article | 16            | 20             | 24                      | 4       | Not mentioned                          | Not specified            | Herbal extract | Cell                 | China                          |
| 13  | The effects of Buyang Huanwu Decoction on hemorheological disorders and energy metabolism in rats with coronary heart disease | J Ethnopharmacol              | 2011             | Original article | 15            | 15             | 21                      | 5       | #30                                    | Coronary heart disease      | None          | Rat                  | China                          |
| 14  | Study on the tongue manifestations for the blood-stasis and toxin syndrome in the stable patients of coronary heart disease | Chin J Integr Med             | 2011             | Original article | 15            | 14             | 19                      | 5       | #1                                     | Coronary heart disease      | None          | Human                | China                          |
| 15  | Effect of Xuefu Zhuyu Capsule on the symptoms and signs and health-related quality of life in the unstable angina patients with blood-stasis syndrome after percutaneous coronary intervention: A Randomized controlled trial | Chin J Integr Med             | 2010             | Original article | 15            | 12             | 21                      | 5       | #3                                     | Coronary heart disease      | None          | Human                | China                          |
| 16  | Relationship between platelet activation related factors and polymorphism of related genes in patients with coronary heart disease of blood-stasis syndrome | Chin J Integr Med             | 2008             | Original article | 14            | 10             | 18                      | 5       | #1                                     | Coronary heart disease      | None          | Human                | China                          |
| 17  | Research on the correlation between platelet gelatin and blood-stasis syndrome of coronary heart disease | Chin J Integr Med             | 2011             | Original article | 12            | 10             | 17                      | 5       | #1                                     | Coronary heart disease      | None          | Human                | China                          |
| No. | Title                                                                 | Journal                                      | Publication year | Article type | WOS citation | Scopus citation | Google Scholar citation | h-index | Diagnostic criteria/ modeling methods | Diseases | Intervention | Subjects of research | Country of authors | Country of affiliation |
|-----|-----------------------------------------------------------------------|----------------------------------------------|------------------|--------------|--------------|----------------|------------------------|---------|----------------------------------------|----------|--------------|-----------------------|-------------------|----------------------|
| 18  | Analysis of plasma proteome from cases of the different traditional Chinese medicine syndromes in patients with chronic hepatitis B | J Pharm Biomed Anal                        | 2011             | Original article | 11           | 13             | 18                     | 4       | #10                         | Hepatitis B | None         | Human                 | China              |
| 19  | Antiplatelet effects of Spatholobus suberectus via inhibition of the glycoprotein IIb/IIIa receptor | J Ethnopharmacol                           | 2011             | Original article | 11           | 12             | 14                     | 3       | Not mentioned | Not specified | Herbal extract | Mouse | Korea |
| 20  | Study on syndrome element characteristics and its correlation with coronary angiography in 334 patients with coronary heart disease | Chin J Integr Med                          | 2008             | Original article | 11           | 9              | 17                     | 3       | #11                         | Coronary heart disease | None         | Human | China |
| 21  | Elevated plasma platelet activating factor, platelet activating factor acetylhydrolase levels and risk of coronary heart disease or blood stasis syndrome of coronary heart disease in Chinese: a case control study | Inflammation                                | 2012             | Original article | 9            | 11             | 14                     | 5       | #1                         | Coronary heart disease | None         | Human | China |
| 22  | Tumor Microenvironment Varies under Different TCM ZHENG Models and Correlates with Treatment Response to Herbal Medicine | Evid Based Complement Alternat Med         | 2012             | Original article | 9            | 10             | 20                     | 3       | #28                         | Cancer | None         | Rat       | China              |
| 23  | Effect of Chinese drugs for activating blood circulation and detertiarying on indices of thrombosis, inflammatory reaction, and tissue damage in a rabbit model of tissue-hist and blood stasis syndrome | Chin J Integr Med                          | 2011             | Original article | 8            | 8              | 12                     | 2       | #32                         | Coronary heart disease | Patent medicine | Human | China |
| 24  | Plasma metabolic biomarkers for syndrome of phlegm and blood stasis in hyperlipidemia and atherosclerosis | J Tradit Chin Med                          | 2012             | Original article | 8            | 7              | 10                     | 2       | #14                         | Hyperlipidemia and atherosclerosis | None         | Human | China |

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| No. | Title                                                                 | Journal                           | Publication year | Article type | WOS citation | Scopus citation | Google Scholar citation | h-index | Diagnostic criteria/ modeling methods | Diseases | Intervention | Subjects of research | Country of authors’ affiliation |
|-----|-----------------------------------------------------------------------|-----------------------------------|------------------|--------------|--------------|-----------------|--------------------------|--------|--------------------------------------|----------|--------------|-------------------------------|-------------------------------|
| 25  | Clinical Distribution and Molecular Basis of Traditional Chinese Medicine ZHENG in Cancer | Evid Based Complement Alternat Med | 2012             | Review       | 7            | 9               | 15                       | 1      | Symptom description                  | Cancer    | None          | Not specified                  | China                               |
| 26  | Metabolomics-based study of clinical and animal plasma samples in coronary heart disease with blood stasis syndrome | Evid Based Complement Alternat Med | 2012             | Original article | 7            | 8               | 9                        | 2      | #29 Coronary heart disease           | None      | Chinese miniswines              | China                                    |
| 27  | The diagnostic criteria of blood-stasis syndrome: considerations for standardization of pattern identification | Chin J Integr Med                | 2014             | Original article | 7            | 7               | 12                       | 1      | Symptom description                  | Not specified | None          | Not specified                  | China                               |
| 28  | Biomedical mechanisms of blood stasis syndrome of coronary heart disease by systems biology approaches | Chin J Integr Med                | 2013             | Review       | 7            | 7               | 8                        | 1      | #4 Coronary heart disease           | None      | Not specified              | China                                    |
| 29  | Clinical observation on the effect of Zengse Pill in treating patients with vitiligo of qi-stagnancy and blood stasis syndrome type | Chin J Integr Med                | 2008             | Original article | 7            | 6               | 8                        | 4      | #18 Vitiligo                         | Patent medicine | Human        | China                                   |
| 30  | Effect of Yinian Jingsu Yin on primary hypertension in early stage—a clinical observation on 40 patients | J Tradit Chin Med                | 2010             | Original article | 7            | 5               | 9                        | 2      | #2 Hypertension                      | Herbal formula | Human        | China                                   |
| 31  | Therapeutic effect of Chinese herbal medicine for strengthening qi, nourishing yin, and removing stasis on serum osteopontin and quality of life of patients with primary Sjogren’s syndrome | Chin J Integr Med                | 2011             | Original article | 7            | 5               | 8                        | 1      | Not mentioned                        | Primary Sjogren’s syndrome | Patent medicine | Human                                   |
| 32  | Correlation between FcγRIIa and aortic atherosclerotic plaque destabilization in ApoE Knockout mice and intervention effects of effective components of chuanxiong rhizome and red gynostemma root | Chin J Integr Med                | 2011             | Original article | 7            | 5               | 7                        | 3      | #36 Not specified                     | Herbal extract | Mouse         | China                                   |
| No. | Title                                                                 | Journal                          | Publication year | Article type         | WOS citation | Scopus citation | Google Scholar citation | h-index | Diagnostic criteria/ modelling methods | Diseases | Intervention | Subjects of research | Country of authors affiliation |
|-----|-----------------------------------------------------------------------|----------------------------------|------------------|----------------------|---------------|------------------|------------------------|---------|--------------------------------------|----------|--------------|----------------------|-----------------------------|
| 33  | Application of metabolomics on diagnosis and treatment of patients with psoriasis in traditional Chinese medicine | Biochim Biophys Acta            | 2013             | Original article     | 6             | 9                | 21                     | 2       | symptom description                  | Psoriasis | None         | Human                | China                       |
| 34  | Progress of experimental study on treatment of psoriasis by Chinese medicinal monomer and single or compound recipe in Chinese materia medica | Chin J Integr Med               | 2007             | Review               | 6             | 6                | 17                     | 2       | not mentioned                        | Psoriasis | None         | Not specified         | China                       |
| 35  | Study on clinical effect and mechanism of Jianpi Ginger-Huaya recipe in treating patients with gastric ulcer | Chin J Integr Med               | 2007             | Original article     | 6             | 6                | 8                      | 3       | #2                                   | Gastric ulcer | Herbal formula | Human                | China                       |
| 36  | Study of the relationship between carotid intima-media thickness and traditional Chinese medicine syndrome of dyslipidemia | Chin J Integr Med               | 2009             | Original article     | 6             | 6                | 7                      | 3       | #2                                   | Dyslipidemia | None         | Human                | China                       |
| 37  | Applied research on serum protein fingerprints for prediction of Qi deficiency syndrome and phlegm and blood stasis in patients with non-small cell lung cancer | J Tradit Chin Med               | 2012             | Original article     | 6             | 6                | 7                      | 0       | symptom description                  | Lung cancer | None         | Human                | China                       |
| 38  | Combining ZHENG Theory and High Throughput Expression Data to Predict New Effects of Chinese Herbal Formulae | Evid Based Complement Alternat Med | 2012             | Original article     | 5             | 8                | 15                     | 3       | not mentioned                        | Patent medicine | Not specified | Human                | China                       |
| 39  | Pharmacokinetic comparison of berberine and palmatine in normal and metabolic syndrome rats | J Ethnopharmacol                | 2013             | Original article     | 5             | 8                | 9                      | 1       | #38                                  | Metabolic syndrome | Herbal formula | Rat                  | China                       |
| 40  | The protective effects of the active fraction of Shanzhizhiyu decoction on hydrogen peroxide-induced oxidative injury in vascular smooth muscle cells | Molecules                       | 2010             | Original article     | 5             | 7                | 9                      | 2       | not specified                        | Herbal formula | Rat          | China                | China                       |
| 41  | Clinical and Epidemiological Investigation of TCM Syndromes of Patients with Coronary Heart Disease in China | Evid Based Complement Alternat Med | 2012             | Original article     | 5             | 6                | 10                     | 2       | #1                                   | Coronary heart disease | None         | Human                | China                       |

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| No. | Title                                                                 | Journal                                      | Publication year | Article type     | WOS citation | Scopus citation | Google Scholar citation | h-index | Diagnostic criteria/ modeling methods | Diseases                  | Intervention       | Subjects of research | Country of authors’ affiliation |
|-----|----------------------------------------------------------------------|----------------------------------------------|------------------|------------------|---------------|-----------------|------------------------|---------|-------------------------------------|--------------------------|-------------------|---------------------|-------------------------------|
| 42  | The Effect of Sodium Tanshinone IIA Sulfate and Simvastatin on Elevated Serum Levels of Inflammatory Markers in Patients with Coronary Heart Disease: A Study Protocol for a Randomized Controlled Trial | Evid Based Complement Alternat Med           | 2013             | Original article | 5             | 6               | 10                     | 1       | Coronary heart disease              | Patent medicine           | Human             | China                |                               |
| 43  | A Systems Biology Approach to Characterize Biomarkers for Blood Stasis Syndrome of Unstable Angina Patients by Integrating MicroRNA and Messenger RNA Expression Profiling | Evid Based Complement Alternat Med           | 2013             | Original article | 5             | 5               | 10                     | 1       | Coronary heart disease              | None                      | Human             | China                |                               |
| 44  | Traditional Chinese medicine syndromes of chronic hepatitis B with proenkephalin | World J Gastroenterol                       | 2005             | Original article | 5             | 3               | 10                     | 2       | Hepatitis B                          | None                      | Human             | China                |                               |
| 45  | Energy metabolism disorder and myocardial injury in chronic myocardial ischemia with QI deficiency and blood stasis syndrome based on 2-DE proteomics | Chin J Integr Med                           | 2012             | Original article | 4             | 6               | 10                     | 1       | Coronary heart disease              | None                      | Chinese miniswine | China                |                               |
| 46  | Effects of Quyu Xiaoban capsules on clinical outcomes and platelet activation and aggregation in patients with unstable angina pectoris | J Altern Complement Med                     | 2007             | Original article | 4             | 5               | 10                     | 4       | Symptom description                  | Coronary heart disease    | Patent medicine | Human               | China                        |
| 47  | Water extract of Spatholobus suberectus inhibits osteoclast differentiation and bone resorption | BMC Complement Alternat Med                 | 2013             | Original article | 4             | 5               | 7                      | 1       | Not mentioned                        | Herbal extract            | None              | Herbal              | Korea                       |
| 48  | Comparative pharmacokinetics of rhein and chrysophanol after oral administration of Quyu Qingre granules in normal and acute blood stasis rabbits | J Ethnopharmacol                            | 2014             | Original article | 4             | 5               | 4                      | 1       | Not specified                        | Patent medicine           | Rabbit            | China                |                               |
| 49  | Blood stasis syndrome in Japan and its molecular biological analysis | Chin J Integr Med                           | 2014             | Original article | 4             | 4               | 7                      | 0       | Not specified                        | None                      | Human             | Japan                |                               |
| 50  | A clinical epidemiological study of the quantitative diagnosis scale of blood stasis syndrome | Chin J Integr Med                           | 2011             | Original article | 4             | 4               | 6                      | 3       | Not specified                        | None                      | Not specified      | China                |                               |

(continued)
| No. | Title                                                                 | Journal           | Publication year | Article type | WOS citation | Scopus citation | Google Scholar citation | h-index | Diagnostic criteria/ modeling methods | Diseases | Intervention | Subjects of research | Country of authors | Subjects of authors affiliation |
|-----|----------------------------------------------------------------------|-------------------|------------------|--------------|--------------|-----------------|------------------------|---------|----------------------------------------|-----------|--------------|----------------------|-----------------|-----------------------------|
| 51  | Protective effect of Chinese herbs for supplementing qi, nourishing yin and activating blood circulation on heart function of patients with acute coronary syndrome after percutaneous coronary intervention | Chin J Integr Med | 2012             | Original article | 4            | 4               | 6                      | 2       | Coronary heart disease | Herbal formula | Human         | China                 |                 |                             |
| 52  | The Expression of CD14 (+) CD16 (+) Monocyte Subpopulation in Coronary Heart Disease Patients with Blood Stasis Syndrome | Evid Based Complement Altatt Med  | 2013             | Original article | 4            | 4               | 5                      | 1       | Coronary heart disease | None       | Human         | China                 |                 |                             |
| 53  | Comparative metabolomics analysis on invigorating blood circulation for herb pair Gui-Hong by ultra-high performance liquid chromatography coupled to quadrupole time-of-flight mass spectrometry and pattern recognition approach | J Pharm Biomed Anal | 2015             | Original article | 4            | 4               | 4                      | 1       | Not specified          | Herbal formula | Rat           | China                 |                 |                             |
| 54  | Study on the relationship between blood stasis syndrome and clinical pathology in 327 patients with primary glomerular disease | Chin J Integr Med | 2009             | Original article | 4            | 3               | 6                      | 3       | Primary glomerular disease | None       | Human         | China                 |                 |                             |
| 55  | Exploring molecular mechanism underlying Chinese medicine syndrome: a study on correlation between Chinese medicine syndrome and biomarkers for ischemic stroke | Chin J Integr Med | 2013             | Original article | 4            | 3               | 5                      | 0       | Stroke                  | None       | Human         | China                 |                 |                             |
| 56  | Multifactor dimensionality reduction analysis of the correlation of Chinese medicine syndrome evolution and cardiovascular events in patients with stable coronary heart disease | Chin J Integr Med | 2014             | Original article | 4            | 3               | 5                      | 0       | Coronary heart disease | None       | Human         | China                 |                 |                             |
| No. | Title                                                                 | Journal                        | Publication year | Article type | WOS citation | Scopus citation | Google Scholar citation | h-index | Diagnostic criteria/ modeling methods | Diseases | Intervention | Subjects of research | Country of authors | Affiliation |
|-----|-----------------------------------------------------------------------|--------------------------------|------------------|--------------|---------------|-----------------|-------------------------|---------|-----------------------------------------|----------|--------------|---------------------|------------------|------------|
| 57  | Platelet proteomics and its advanced application for research of blood stasis syndrome and activated blood circulation herbs of Chinese medicine | Sci China Life Sci            | 2013             | Review       | 4             | 3               | 4                      | 1       | #25 Coronal heart disease               | None     | Not specified | China               |
| 58  | Evaluation on quality of life and analysis on its correlation with TCM syndromes in patients of chronic hepatitis B | Chin J Integr Med             | 2009             | Original article | 4             | 1               | 9                      | 1       | #16 Hepatitis B                         | None     | Human        | China               |
| 59  | Use of comparative effectiveness research for similar Chinese patent medicine for angina pectoris of coronary heart disease: a new approach based on patient-important outcomes | Trials                        | 2014             | Original article | 3             | 5               | 5                      | 1       | #2 Coronal heart disease               | Patent medicine | Human        | China               |
| 60  | Fire-heat and Qi deficiency syndromes as predictors of short-term prognosis of acute ischemic stroke | J Altern Complement Med       | 2013             | Original article | 3             | 5               | 5                      | 0       | #19 Stroke                              | None     | Human        | China               |
| 61  | Chinese medicine improves postoperative quality of life in endometriosis patients: a randomized controlled trial | Chin J Integr Med             | 2012             | Original article | 3             | 4               | 12                     | 1       | #8 Endometriosis                        | Herbal formula | Human        | China               |
| 62  | Relationship between Blood Stasis Syndrome Score and Cardioankle Vascular Index in Stroke Patients | Evid Based Complement Alternat Med | 2012             | Original article | 3             | 4               | 9                      | 2       | #5 Stroke                               | None     | Human        | Korea               |
| 63  | Logistic regression analysis of syndrome essential factors in patients with unstable angina pectoris | J Tradit Chin Med             | 2012             | Original article | 3             | 3               | 6                      | 1       | #6 Coronal heart disease               | None     | Human        | China               |
| 64  | Rule of Chinese medicine syndrome differentiation in the patients with thoracic diseases at preoperation stage | Chin J Integr Med             | 2011             | Original article | 3             | 3               | 3                      | 3       | Not mentioned                          | Thoracic diseases | None         | Human               |
| 65  | Phagocytosis of platelet in coronary heart disease patients with blood-stasis syndrome | Chin Med, J                  | 1998             | Original article | 3             | 3               | 3                      | 2       | Not mentioned                          | Coronal heart disease | None         | China               |
| 66  | Chemotherapeutic activities of Carthami Flos and its reversal effect on multi-drug resistance in cancer cells | Afr J Tradit Complement Alternat Med | 2013             | Original article | 3             | 2               | 6                      | 0       | Not mentioned                          | Cancer   | Herbal extract | Cell                | China         |
| 67  | Effect of Liangzhuxia Recipe on hemorheology in rats with blood stasis syndrome | Asian Pac J Trad Med          | 2012             | Original article | 3             | 1               | 6                      | 1       | Not mentioned                          | Not specified | Herbal formula | Rat                 | China          |

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| No. | Title                                                                                                                                                                                                 | Journal                                      | Publication year | Article type      | WOS citation | Scopus citation | Google Scholar citation | h-index | Diagnostic criteria/ modeling methods | Diseases                | Intervention | Subjects of research | Country of authors’ affiliation |
|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------|------------------|-------------------|---------------|-----------------|------------------------|---------|---------------------------------------|-------------------------|--------------|-------------------|-----------------------------|
| 68  | Analysis on traditional Chinese medicine syndrome elements and relevant factors for senile diabetes                                                                                 | J Tradit Chin Med                            | 2013             | Original article  | 3             | 1               | 5                      | 1       | #9                                    | Diabetes                | None         | Human             | China                                      |
| 69  | Associations of platelet-activating factor acetylhydrolase (PAF-AH) gene polymorphisms with circulating PAF-AH levels and risk of coronary heart disease or blood stasis syndrome in the Chinese Han population | Mol Biol Rep                                 | 2014             | Original article  | 3             | 1               | 5                      | 0       | #1                                    | Coronary heart disease | None         | Human             | China                                      |
| 70  | Clinical study of the hypothesis of endogenous collateral wind on acute coronary syndrome: a review                                                                                                   | Afr J Tradit Complement Altern Med           | 2014             | Review            | 3             | 1               | 4                      | 1       | Not mentioned                         | Coronary heart disease | None         | Not specified     | China                                      |
| 71  | The effects of xuefu zhuyu and shengmai on the evolution of syndromes and inflammatory markers in patients with unstable angina pectoris after percutaneous coronary intervention: a randomized controlled clinical trial   | Afr J Tradit Complement Altern Med           | 2013             | Original article  | 2             | 6               | 13                     | 0       | #3                                    | Coronary heart disease | Patent medicine | Human             | China                                      |
| 72  | Network-based biomarkers for cold coagulation blood stasis syndrome and the therapeutic effects of shaxia decoction in rats                                                                   | Evid Based Complement Altern Med             | 2013             | Original article  | 2             | 4               | 5                      | 1       | #28                                   | Not specified           | Herbal formula | Rat               | China                                      |
| 73  | Tongue diagnosis of traditional Chinese medicine for rheumatoid arthritis                                                                                                                          | Afr J Tradit Complement Altern Med           | 2013             | Original article  | 2             | 3               | 6                      | 0       | Symptom description                   | Rheumatoid arthritis    | None         | Human             | China                                      |
| 74  | Huangqi-Honghua combination and its main components ameliorate cerebral infarction with QI deficiency and blood stasis syndrome by antioxidant action in rats                                              | J Ethnopharmacol                             | 2014             | Original article  | 2             | 3               | 5                      | 1       | #31                                   | Stroke                  | None         | Rat               | China                                      |
| 75  | Prof. ZHANG Yi’s experience in treating severe arrhythmia                                                                                                                                           | J Tradit Chin Med                            | 2010             | Case report       | 2             | 3               | 3                      | 1       | Not mentioned                         | Arrhythmia              | None         | Not specified     | China                                      |
| 76  | A New Biomarkers Feature Pattern Consisting of TNF-α, IL-10, and IL-8 for Blood Stasis Syndrome with Myocardial Ischemia                                                                          | Afr J Tradit Complement Altern Med           | 2013             | Original article  | 2             | 3               | 3                      | 1       | #29                                   | Coronary heart disease | None         | Chinese miniswines | China                                      |
| No. | Title                                                                 | Journal                                | Publication year | Article type | WOS citation | Scopus citation | Google Scholar citation | h-index | Diseases          | Intervention | Subjects of research | Country of authors’ affiliation |
|-----|-----------------------------------------------------------------------|----------------------------------------|------------------|--------------|--------------|------------------|-------------------------|---------|-------------------|--------------|---------------------|-----------------------------|
| 77  | Expression of bcl-2 oncogene in gastric precancerous lesions and its correlation with syndromes in traditional Chinese medicine | World J Gastroenterol | 2005             | Original article | 2                | 2               | 10                      | 1       | Gastric cancer   | None         | Human               | China                       |
| 78  | Distribution and development of the TCM syndromes in psoriatic vulgaris | J Tradit Chin Med | 2009             | Original article | 2                | 2               | 7                       | 1       | Symptom description | Psoriasis vulgaris | None               | Human                       |
| 79  | Pathologic analysis on hyperplasia of mammary gland with different syndromes based on infrared radiation temperature of acupoints | J Tradit Chin Med | 2012             | Original article | 2                | 2               | 6                       | 0       | Hyperplasia of mammary gland | Human               | China               |
| 80  | A Metabonomics Profiling Study on Phlegm Syndrome and Blood-Stasis Syndrome in Coronary Heart Disease Patients Using Liquid Chromatography/Quadrupole Time-of-Flight Mass Spectrometry | Evid Based Complement Alternat Med | 2014             | Original article | 2                | 2               | 4                       | 0       | Coronary heart disease | None         | Human               | China                       |
| 81  | Traditional Chinese medicine syndromes for essential hypertension: a literature analysis of 13,272 patients | Evid Based Complement Alternat Med | 2014             | Systematic review | 2                | 2               | 4                       | 0       | Hypertension | None         | Not specified                   | China                       |
| 82  | Innovative Strategy in Treating Angina Pectoris with Chinese Patent Medicines by Promoting Blood Circulation and Removing Blood Stasis: Experience from Combination Therapy in Chinese Medicine | Curr Isac Pharmacol | 2014             | Review          | 2                | 2               | 3                       | 0       | Coronary heart disease | None         | Not specified                   | China                       |
| 83  | Effects and Perspectives of Chinese Patent Medicines for Tonifying Qi and Promoting Blood Circulation on Patients with Cerebral Infarction | Curr Isac Pharmacol | 2014             | Systematic review | 2                | 2               | 2                       | 0       | Stroke          | None         | Not specified                   | China                       |
| 84  | Chinese medicine syndrome distribution of chronic hepatitis B virus carriers in immunotolerant phase | Chin J Integr Med | 2014             | Original article | 2                | 1               | 4                       | 0       | Hepatitis B | None         | Human               | China                       |
| 85  | A one-year evaluation of radiographic progression in patients with rheumatoid arthritis treated by Qingre Huoxue Decoction | Chin J Integr Med | 2011             | Original article | 2                | 1               | 3                       | 0       | Rheumatoid arthritis | Herbal formula | None               | Human                       |

(continued)
| No. | Title                                                                 | Journal                                      | Publication year | Article type | WOS citation | Scopus citation | Google Scholar citation | h-index | Diagnostic criteria/ modeling methods | Diseases                  | Intervention | Subjects of research | Country of authors’ affiliation |
|-----|------------------------------------------------------------------------|----------------------------------------------|------------------|--------------|--------------|------------------|------------------------|---------|--------------------------------------|--------------------------|--------------|----------------------|-----------------------------|
| 86  | Optimizing prescription of Chinese herbal medicine for unstable angina based on partially observable Markov decision process using partially observable Markov decision process | Evid Based Complement Altern Med              | 2013             | Original article | 2             | 1                | 2                      | 0       | Not specified                        | Herbal formula           | Human        | China                |                                            |
| 87  | Efficacy of chuanxiong ding tong herbal formula granule in the treatment and prophylactic of migraine patients: a randomized, double-blind, multicenter, placebo-controlled trial | Evid Based Complement Altern Med              | 2012             | Original article | 1             | 5                | 9                      | 0       | #2                                 | Migraine                 | Patent medicine | Human     | China                |                                            |
| 88  | Relationship between EGF, TGF-α, and EGFR Gene Polymorphisms and Traditional Chinese Medicine ZHENG in Gastric Cancer | Evid Based Complement Altern Med              | 2013             | Original article | 1             | 5                | 6                      | 0       | #27                                | Gastric cancer           | None          | Human    | China                |                                            |
| 89  | Cortex Moutan Induces Bladder Cancer Cell Death via Apoptosis and Retards Tumor Growth in Mouse Bladders | Evid Based Complement Altern Med              | 2013             | Original article | 1             | 4                | 8                      | 1       | Not mentioned                       | Bladder cancer           | Herbal extract | Cell      | China                |                                            |
| 90  | Aspirin resistance and promoting blood circulation and removing blood stasis: current situation and prospective research | Evid Based Complement Altern Med              | 2014             | Review        | 1             | 3                | 6                      | 1       | Not mentioned                       | Not specified            | None         | Not specified         | China                        |                                            |
| 91  | Toxicity and clinical reasonable application of Taurine (Semen Persicae) based on ancient and modern literature research | J Tradit Chin Med                             | 2013             | Review        | 1             | 3                | 4                      | 0       | Not mentioned                       | Not specified            | None         | Not specified         | China                        |                                            |
| 92  | Blood stasis syndrome of coronary heart disease: A perspective of modern medicine | Chin J Integr Med                             | 2013             | Review        | 1             | 2                | 7                      | 0       | #4                                 | Coronary heart disease   | None         | Not specified         | China                        |                                            |
| 93  | Plasma metabolomics study on Chinese medicine syndrome evolution of heart failure rats caused by LAD ligation | BMC Complement Altern Med                     | 2014             | Original article | 1             | 2                | 4                      | 0       | Not mentioned                       | Heart failure            | None         | Rat      | China                |                                            |
| 94  | Circulating levels of inflammatory cytokines in patients with psoriasis vulgaris of different Chinese medicine syndromes | Chin J Integr Med                             | 2015             | Original article | 1             | 2                | 3                      | 1       | #2                                 | Psoriasis vulgaris       | None         | Human    | China                |                                            |
| No. | Title                                                                                                                                  | Journal                          | Publication year | Article type | WOS citation | Scopus citation | Google Scholar citation | h-index | Diagnostic criteria/ modeling methods | Diseases | Intervention | Subjects of research | Country of authors affiliation |
|-----|----------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|------------------|--------------|--------------|-----------------|-------------------------|---------|--------------------------------------|----------|--------------|----------------------|----------------------------------|
| 95  | Study on correspondence between prescription and syndrome and the essence of phlegm and blood stasis syndrome in coronary heart disease based on metabolomics | Chin J Integr Med                | 2012             | Review       | 1            | 2               | 3                       | 0       | Not mentioned                        | Coronary heart disease            | None                      | Not specified                     | China                             |
| 96  | Differential expression of microRNA in endothelial cells incubated with serum of hypertension patients with blood-stasis syndrome | Chin J Integr Med                | 2015             | Original article | 1         | 2               | 2                       | 0       | #3                                   | Hypertension           | None                      | Cell                              | China                             |
| 97  | The Bi-Digital O-Ring Test used in the successful diagnosis & treatment (with antibiotic, anti-viral agents & oriental herbal medicine) of a patient suffering from pain & weakness of an upper extremity and Bamb-Lieu syndrome appearing after whiplash injury: A case report | Acupunct Electrother Res 1997    |                  | Case report   | 1            | 1               | 3                       | 0       | Not mentioned                        | Not specified                     | Patent medicine                   | Not specified                     | Japan                             |
| 98  | Analysis of clinical syndromes in 47 patients with pancreatic cancer at late stage | J Tradit Chin Med                | 2011             | Original article | 1         | 1               | 3                       | 0       | Not mentioned                        | Pancreatic cancer          | None                      | Human                            | China                             |
| 99  | Serum low-density lipoprotein and heart rate related to the effectiveness in the treatment of angina pectoris with two similar Chinese medicine herbal formulae | Chin J Integr Med                | 2011             | Original article | 1         | 1               | 2                       | 1       | #7                                   | Coronary heart disease      | Patent medicine                   | Human                            | China                             |
| 100 | Study on the relationship between Chinese medicine constitutive susceptibility and diversity of syndrome in diabetic nephropathy | Chin J Integr Med                | 2013             | Original article | 1         | 1               | 2                       | 0       | #22                                  | Diabetes              | None                       | Human                            | China                             |
| 101 | Relationship between endogenous hydrogen sulfide and blood stasis syndrome based on the Qi-blood theory of Chinese medicine | Chin J Integr Med                | 2013             | Review        | 1            | 1               | 2                       | 0       | Symptom description                  | Not specified               | None                       | Not specified                     | China                             |
| 102 | Conceptualization and utilization of blood stasis syndrome among doctors of Korean medicine: results of a web-based survey | Am J Transl Res                  | 2015             | Original article | 1         | 1               | 2                       | 0       | Not mentioned                        | Not specified               | None                       | Human                            | Korea, Norway                    |

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| No. | Title                                                                                                                                                                                                 | Journal                        | Publication year | Article type | WOS citation | Scopus citation | Google Scholar citation | h-index | Diagnostic criteria/ modelling methods | Diseases | Intervention | Subjects of research | Country of authors | Country of authors' affiliation |
|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|------------------|--------------|--------------|----------------|-------------------------|---------|----------------------------------------|----------|--------------|-----------------------|------------------|-----------------------------|
| 103 | Relationship between various Chinese medicine types and T-cell subsets in patients with ulcerative colitis                                                                                           | Chin J Integr Med             | 2009             | Original article | 1            | 1              | 1                       | 1        | #17 Ulcerative colitis                | None      | Human        | China                  |                  |                             |
| 104 | Latest Study on the Relationship between Pathological Process of Inflammatory Injury and the Syndrome of Spleen Deficiency and Fluid Retention in Alzheimer’s Disease                                           | Evid Based Complement Alternat Med | 2014             | Review        | 1            | 1              | 1                       | 1        | Not mentioned                        | Alzheimer's Disease | None          | Not specified          | China             |                             |
| 105 | Correlations among persistent viral infection, heart function and Chinese medicine syndromes in dilated cardiomyopathy patients                                                                       | Chin J Integr Med             | 2014             | Original article | 1            | 1              | 1                       | 0        | #3 Dilated cardiomyopathy            | None      | Human        | China                  |                  |                             |
| 106 | Development and validation of a UFLC-MUIME method for the determination of anhydrocaffeoylferulic acid in rat plasma and its application to pharmacokinetic study                                               | J Chromatogr B Analyt Technol Biomed Sci | 2015             | Original article | 1            | 1              | 1                       | 0        | Not mentioned                        | Not specified | Herbal extract | Rat                   | China             |                             |
| 107 | Accelerated RBC senescence as a novel pathologic mechanism of blood stasis syndrome in traditional East Asian medicine                                                                                   | Am J Transl Res               | 2015             | Review        | 1            | 1              | 1                       | 0        | Not mentioned                        | Not specified | None          | Not specified          | Korea             |                             |
| 108 | Association between Glu298Asp/677C-T single nucleotide polymorphism in the eNOS/MTHFR gene and blood stasis syndrome of ischemic stroke                                                                 | Gene                           | 2012             | Original article | 1            | 1              | 0                       | 0        | #2 Stroke                             | None      | Human        | China                  |                  |                             |
| 109 | Relationship between traditional Chinese medicine syndrome differentiation and imaging characterization to the radiosensitivity of nasopharyngeal carcinoma                                              | Chin J Cancer                  | 2010             | Original article | 0            | 10             | 17                      | 0        | Symptom description                   | Nasopharyngeal carcinoma | None          | Human                  | China             |                             |
| 110 | Therapeutic effects of modified Daogou Si Decoction on plasma level of advanced glycation end products in patients with Wagner grade 0 diabetic foot: a randomized controlled trial                           | J Integr Med                  | 2009             | Original article | 0            | 8              | 10                      | 0        | #6 Diabetes                           | Herbal formula | Human        | China                  |                  |                             |
| No. | Title                                                                 | Journal                        | Publication year | Article type | WOS citation | Scopus citation | Google Scholar citation | h-index | Diagnostic criteria/ modeling methods | Diseases | Intervention | Subjects of research | Country of authors’ affiliation |
|-----|----------------------------------------------------------------------|--------------------------------|------------------|--------------|--------------|-----------------|--------------------------|---------|---------------------------------------|----------|--------------|-----------------------------------|----------------------------------|
| 111 | Characteristics of traditional Chinese medicine syndromes in post-stroke depression | J Chin Integr Med              | 2010             | Original article | 0            | 7               | 12                       | 0       | #9 Stroke                               | None            | Human            |                                    | China                                |
| 112 | Relationship between cytochrome P450 2C19*17 genotype distribution, platelet aggregation and bleeding risk in patients with blood stasis syndrome of coronary artery disease treated with clopidogrel | J Chin Integr Med              | 2012             | Original article | 0            | 6               | 10                       | 0       | #3 Coronary heart disease               | None            | Human            |                                    | China                                |
| 113 | Clinical non-inferiority trial on treatment of coronary heart disease angina pectoris of Xin blood stasis syndrome type with lyophilized Sokka salt of lithospermic acid powder for injection | Chin J Integr Med              | 2006             | Original article | 0            | 6               | 8                        | 0       | Not mentioned Coronary heart disease    | Patient medicine | Human            |                                    | China                                |
| 114 | Traditional Chinese medicine for prevention and treatment of hepatocarcinoma: From bench to bedside | World J Hepatol                | 2015             | Academic Exploration | 0           | 5               | 7                        | 0       | Not mentioned Hepatocarcinoma           | None            | Not specified | China                              |                                    |
| 115 | Effects of L. F04, the active fraction of Lycopus lucidus, on erythrocytes rheological property | J Chin Integr Med              | 2005             | Original article | 0            | 4               | 9                        | 0       | #33 Not specified Herbal extract        | Rat               | China           |                                    |                                    |
| 116 | Intermediate and late rheumatoid arthritis treated by tonifying the kidney, resolving phlegm and removing blood stasis | J Tradit Chin Med              | 2000             | Original article | 0            | 4               | 5                        | 0       | Not mentioned Rheumatoid arthritis Patient medicine | Human            | China           |                                    |                                    |
| 117 | Treatment of nonspecific chronic prostatitis with Qian Lie Xian Yan Suppository by suppository in 104 cases | J Tradit Chin Med              | 2001             | Original article | 0            | 3               | 9                        | 0       | #3 Prostatitis Patent medicine           | Human            | China           |                                    |                                    |
| 118 | Effect of Yinweiding decoction on PGE2, TNF-α and IL-8 in patients with psoriasis vulgaris | Asian Pac J Trap Med           | 2014             | Original article | 0            | 3               | 8                        | 0       | Not mentioned Psoriasis vulgaris Herbal formula | Human            | China           |                                    |                                    |
| 119 | A clinical study on the treatment of chronic pelvic inflammation of Qi-stagnation with blood stasis syndrome by Perisang capsule | Chin J Integr Med              | 2005             | Original article | 0            | 3               | 7                        | 0       | Not mentioned Chronic pelvic inflammation | Patent medicine | Human            |                                    | China                                |

(continued)
| No. | Title                                                                 | Journal                                      | Publication year | Article type | WOS citation | Scopus citation | Google Scholar citation | h-index | Diagnostic criteria/ modelling methods | Diseases                      | Intervention | Subjects of research | Country of authors' affiliation |
|-----|-----------------------------------------------------------------------|----------------------------------------------|------------------|--------------|--------------|----------------|------------------------|---------|----------------------------------------|--------------------------------|--------------|----------------------|-----------------------------|
| 120 | Effects of Chinese medicine for promoting blood circulation and removing blood stasis in treating patients with mild to moderate vascular dementia: a randomized, double-blind and parallel-controlled trial | J Chin Integr Med                           | 2012             | Original article | 0             | 3              | 6                      | 0       | Not mentioned                          | Vascular dementia            | Patent medicine | Human                | China                       |
| 121 | Effect of the principle of activating blood circulation to break stasis on GMP-140 and D2 dimer in patients with acute cerebrovascular infarction | Chin J Integr Med                           | 2005             | Original article | 0             | 2              | 15                     | 0       | #7                                     | Stroke                        | Herbal formula | Human                | China                       |
| 122 | Effect of Gui-zhi-fu-ling-wan on hot flashes in young patients: a retrospective case series | J Acupunct Meridian Stud                    | 2011             | Case report    | 0             | 2              | 7                      | 0       | Not mentioned                          | Hot flashes                   | Herbal formula | Human                | China                       |
| 123 | Effects of Chinese medicinal herbs on hemorheology in diabetes        | Proc Chin Acad Med Sci Peking Union Med Coll | 1989             | Original article | 0             | 2              | 3                      | 0       | Not mentioned                          | Diabetes                      | Herbal formula | Human                | China                       |
| 124 | Progress of modern research on tumor blood stasis syndrome and its treatment with the method of promoting blood circulation by removing blood stasis | J Tradit Chin Med                           | 1995             | Review        | 0             | 2              | 2                      | 0       | Not mentioned                          | Cancer                        | None                      | Not specified         | China                       |
| 125 | Clinical efficacy of traditional Chinese medicine on acute myocardial infarction: a prospective cohort study | Chin J Integr Med                           | 2012             | Original article | 0             | 2              | 2                      | 0       | #1                                     | Coronary heart disease        | Herbal formula | Human                | China                       |
| 126 | Expression of T-helper 17 cells and signal transducers in patients with psoriasis vulgaris of blood-heat syndrome and blood-stasis syndrome | Chin J Integr Med                           | 2014             | Original article | 0             | 1              | 3                      | 0       | #2                                     | Psoriasis vulgaris             | None                      | Human                | China                       |
| 127 | 30 cases of intractable renal edema treated by removing blood stasis and promoting diuresis | J Tradit Chin Med                           | 1997             | Original article | 0             | 1              | 1                      | 0       | #15                                    | Renal edema                   | Herbal formula | Human                | China                       |
| 128 | Combined use of Chinese medicine with allogeneic hematopoietic stem cell transplantation for severe aplastic anemia patients | Chin J Integr Med                           | 2014             | Original article | 0             | 1              | 1                      | 0       | Not mentioned                          | Aplastic anemia               | Herbal formula | Human                | China                       |
| No. | Title                                                                 | Journal                        | Publication year | Article type | WOS citation | Scopus citation | Google Scholar citation | h-index | Diagnostic criteria/ modeling methods | Diseases | Intervention | Subjects of research | Country of authors’ affiliation |
|-----|------------------------------------------------------------------------|--------------------------------|------------------|--------------|--------------|-----------------|-------------------------|---------|---------------------------------------|----------|--------------|----------------------|-------------------------------|
| 129 | Circulating MicroRNA Profiles Differ between Qi- Stagnation and Qi-   | Evid Based Complement Alternat | 2015             | Original     | 0            | 1               | 1                       | 0       | Not mentioned                         | Coronary heart disease        | None                      | Human     | China                    |
|     | Deficiency in Coronary Heart Disease Patients with Blood Stasis Syndrome | Med |                  |              |              |                 |                         |         |                                       |                       |                           |                       |                               |
| 130 | Mice Exposed to Chronic Intermittent Hypoxia Simulate Clinical Features | Evid Based Complement Alternat | 2011             | Original     | 0            | 0               | 11                      | 0       | #37                                   | Chronic intermittent Hypoxia | None                      | Mouse    | China                    |
|     | of Deficiency of both Qi and Yin Syndrome in Traditional Chinese Medicine | Med |                  |              |              |                 |                         |         |                                       |                       |                           |                       |                               |
| 131 | Traditional Chinese medicine syndrome patterns and qi-regulating, chest-relaxing and blood-activating therapy on cardiac syndrome X | J Tradit Chin Med | 2013             | Original     | 0            | 0               | 2                       | 0       | Not mentioned                         | Coronary heart disease        | None                      | Human     | China                    |
| 132 | A preliminary study of TCM stage-oriented treatment of atherosclerosis | J Tradit Chin Med | 2009             | Review       | 0            | 0               | 1                       | 0       | Not mentioned                         | Atherosclerosis              | None                      | Not specified | China                   |
| 133 | Exploration of the mechanism of pattern-specific treatments in coronary heart disease with network pharmacology approach | Comput Biol Med | 2014             | Original     | 0            | 0               | 1                       | 0       | Not mentioned                         | Coronary heart disease        | None                      | Not specified | China                   |
| 134 | Constructing protein-protein interaction network of hypertension with blood stasis syndrome via digital gene expression sequencing and database mining | J Integr Med | 2014             | Original     | 0            | 0               | 1                       | 0       | #3                                   | Hypertension                   | None                      | Rat                   | China                    |
| 135 | The association between blood lipid and phlegm turbidity syndrome of angina pectoris: a systematic review and meta-analysis | Complement Ther Med | 2014             | Systematic   | 0            | 0               | 1                       | 0       | Not mentioned                         | Coronary heart disease        | None                      | Not specified | China                   |
| 136 | Complex networks approach for analyzing the correlation of traditional Chinese medicine syndrome evolution and cardiovascular events in patients with stable coronary heart disease | Evid Based Complement Alternat | 2015             | Original     | 0            | 0               | 1                       | 0       | #1                                   | Coronary heart disease        | None                      | Human     | China                    |
| No. | Title                                                                 | Journal                   | Publication year | Article type | WOS citation | Scopus citation | Google Scholar citation | h-index | Diagnostic criteria/modeling methods | Interventions | Subjects of research | Country of authors’ affiliation |
|-----|-----------------------------------------------------------------------|---------------------------|------------------|-------------|--------------|----------------|------------------------|---------|------------------------------------|---------------|---------------------|-----------------------------|
| 137 | A study of the immunofunction in patients of coronary heart disease with the fundamental deficiency and outward excess syndrome | J Tradit Chin Med         | 1989             | Original article | 0            | 0              | 0                      | 0       | Coronary heart disease             | None          | Human               | China                       |
| 138 | Effects of the integrated TCM-WM treatment of nephrotic syndrome on growth and sexual development | J Tradit Chin Med         | 2000             | Original article | 0            | 0              | 0                      | 0       | Nephrotic syndrome                 | Herbal formula | Human               | China                       |
| 139 | Acoustic features for identifying constitutions in traditional Chinese medicine | J Altern Complement Med   | 2012             | Original article | 0            | 0              | 0                      | 0       | Not mentioned                      | None          | Human               | China                       |
| 140 | Variations of energy metabolism and adenosine triphosphate activity in gastric mucosa in chronic atrophic gastritis rats with Qi deficiency and blood stasis syndrome and effect of zhifang capsule | J Tradit Chin Med         | 2013             | Original article | 0            | 0              | 0                      | 0       | Chronic atrophic gastritis         | Patent medicine | Rat                 | China                       |
| 141 | Standardization and future directions in pattern identification research: International brainstorming session | Chin J Integr Med         | 2014             | Conference     | 0            | 0              | 0                      | 0       | Not mentioned                      | None          | Not specified       | Korea                      |
| 142 | Correlation between blood measures related to blood stasis blocking collaterals and gene expression of angiotensin converting enzyme of renal cortex in diabetic rats and effect of stasis removing and collateral dredging | J Tradit Chin Med         | 2014             | Original article | 0            | 0              | 0                      | 0       | Diabetes                           | Patent medicine | Rat                 | China                       |
| 143 | CUPID: a protocol of a randomised controlled trial to identify characteristics of similar Chinese patent medicines | BMJ Open                  | 2014             | Original article | 0            | 0              | 0                      | 0       | Not mentioned                      | Patent medicine | Human               | China                       |
| 144 | Pharmacokinetics and tissue distribution study of tanshinone IIA after oral administration of Bushen Huoxue Qubi granules to rats with blood stasis syndrome | Pharmacogn Mag            | 2014             | Original article | 0            | 0              | 0                      | 0       | Not specified                      | Herbal extract | Rat                 | China                       |
| No. | Title                                                                 | Journal                  | Publication year | Article type  | WOS citation | Scopus citation | Google Scholar citation | h-index | Diagnostic criteria/ modeling methods | Diseases | Intervention | Subjects of research | Country of authors' affiliation |
|-----|------------------------------------------------------------------------|--------------------------|------------------|---------------|--------------|----------------|------------------------|---------|--------------------------------------|----------|--------------|----------------------|-------------------------------|
| 145 | The Effect of Xuefuzhuyu Oral Liquid on Aspirin Resistance and its Association with rs5911, rs5787, and rs3842788 Gene Polymorphisms | Evid Based Complement Alternat Med | 2015             | Original article | 0            | 0             | 0                      | 0       | #1                                   | Coronary heart disease | Patent medicine | Human                 | China                          |
| 146 | Effect of yangxinkang tablets on chronic heart failure: A multi-center randomized double-blind placebo-controlled trial | Chin J Integr Med       | 2015             | Original article | 0            | 0             | 0                      | 0       | #2                                   | Heart failure          | Patent medicine | Human                 | China                          |
| 147 | Pi (Spleen)-deficiency syndrome in tumor microenvironment is the pivotal pathogenesis of colorectal cancer immune escape | Chin J Integr Med       | 2015             | Academic Exploration | 0           | 0             | 0                      | 0       | Not mentioned                       | Colorectal cancer      | None                       | Not specified          | China                          |
| 148 | Evaluating the effects of Danhong injection in treatment of acute ischemic stroke: study protocol for a multicenter randomized controlled trial | Trials                  | 2015             | Original article | 0            | 0             | 0                      | 0       | Not mentioned                       | Stroke               | Patent medicine | Human                 | China                          |
| 149 | Therapeutic effect and apoptosis mechanism of lung-tonifying and expectorant decoction on lung cancer rats with Qi deficiency and blood stasis | Asian Pac J Trad Med    | 2015             | Original article | 0            | 0             | 0                      | 0       | Not mentioned                       | Lung cancer           | Herbal formula | Rat                   | China                          |
| 150 | The Clinical Relevance of Serum NDKA, NMDA, PARP2, and UTP Levels with Rhegm-Heat Syndrome and Treatment Efficacy Evaluation of Traditional Chinese Medicine in Acute Ischemic Stroke | Evid Based Complement Alternat Med | 2015             | Original article | 0            | 0             | 0                      | 0       | Not mentioned                       | Stroke               | None                       | Human                 | China                          |
| 151 | Understanding the molecular aspects of enteral identity pattern differentiation using DNA microarray | J Transl Med            | 2015             | Original article | 0            | 0             | 0                      | 0       | Not mentioned                       | Obesity              | None                       | Human                 | Korea                         |
| 152 | The Mechanism Research of Qilin Nao Formula by Module-Network Analysis | Evid Based Complement Alternat Med | 2015             | Original article | 0            | 0             | 0                      | 0       | Not mentioned                       | Not specified         | None                       | Not specified          | China                          |
| 153 | Relationship between serum estrogen levels and blood stasis syndrome in postmenopausal women with coronary heart disease | Pak J Med Sci          | 2015             | Original article | 0            | 0             | 0                      | 0       | not mentioned                       | Coronary heart disease | None                       | Human                 | China                          |
The year of publication is graphed in Fig. 2. An increase of publication is observed from 2009, with a peak from 2012 to 2014.

### 3.3. Diseases categories

The names of diseases were documented and classified into different categories according to the International Statistical Classification of Diseases and Related Health Problems 10th Revision (ICD-10, version 2016). Among the 155 BSS-related articles, 112 (72.26%) were not specified to particular diseases, 46 (29.68%) articles focused on coronary heart disease (CHD), which was the largest proportion in disease classification. Followed by 13 (8.39%) in different types of cancer/tumor, 8 (5.16%) in stroke, 7 (4.52%) in skin diseases, 5 (3.23%) in diabetes, 4 (2.58%) in hypertension, metabolic diseases, nervous system diseases, and kidney diseases respectively, 3 (1.94%) in heart failure and gastrointestinal diseases, respectively, and 1 (0.65%) in arrhythmia. Cardiovascular diseases were the most common disease categories, especially CHD. Such results coincided with the epidemiology of clinical BSS and reflected the high interest in CHD-BSS in BSS studies.

The number of articles focused on cardiovascular diseases increased rapidly from 2010 (Fig. 3). Although the number of publications gradually increased (Fig. 2), the range of disease categories broadened, and the gaps between different diseases...
were shortened, these results indicate a growth of diversity in BSS studies.

3.4. Research content and Intervention categories

Among the 155 BSS-related articles, there were 90 articles using humans as research subjects in clinical trials. In total, 58 (64.44%) out of the 90 focused on the BSS syndrome, including syndrome characteristics, syndrome distribution in different diseases, and syndrome differentiation. However, 32 (35.56%) out of the 90 articles focused on efficacy evaluation and comparison of different interventions. Also, 18 articles applied the rules of randomized clinical trial (RCT). It is noteworthy that there were 12 RCTs published in the last 5 years. On the other hand, more comprehensive and profound omics technologies were used in recent years. Twenty-four BSS-related articles explored the BSS characteristics or intervention via genomics, transcriptomics, proteomics, and metabolomics, mostly published since 2012. The contents and technologies contained in the articles show the quality and depth of BSS-related researches increased accordingly as more articles were published.

Despite the range of research subjects, there were 63 articles that applied interventions, including 26 (41.27%) of 63 patent medicine (pill, capsule, pounder, injection, so on), 25 (39.68%) herbal formula, 11 (17.46%) herbal extracts, and 1 (1.59%) acupuncture. The variation of intervention-year can be seen in Fig. 4. Though the total amounts of patent medicine and herbal formula are close, the number of studies on patent medicine increased in recent years while the proportion of herbal formula shrank. With the modern exploration of TEAM developing, studies with patent medicines seem to be improving, with results that appear more convincing.[14-16] Herbal medicine is also one of the vital components in TEAM. It is more widely used in clinical practice. With the growth in BSS-related research, it is necessary to improve and expand herbal formula research.

3.5. Academic influence analysis

The total number of citations and the h-index of every BSS-related article were extracted from WOS, Scopus, and Google Scholar. There were 721, 820, and 1343 cites in WOS, Scopus, and Google Scholar for the 155 BSS-related articles respectively, averagely 4.65, 5.29, and 8.66 cites for each article. According to the citation-year analysis (Fig. 5), the annual citation amount was low before 2009 and has increased since 2010. Citation is related to the articles’ quality, publication type, and research content. The significant increase of citation after 2010 might be due to the increase of both numbers of publications and research quality.

A peak in citations in 2000 was contributed by 2 relatively high-quality articles published in influential journals. One of them was a review of herbal products with the function of promoting blood circulation and removing blood stasis. The other was a pharmacokinetics analysis on herbal formula.

The Schubert h-index (h-index) was introduced by András Schubert in 2009.[17] It has been widely used to measure the direct and indirect citation influence of single publications. Normally an article with h-index≥2 is considered influential. The average h-index of 155 BSS-related articles is 1.39. There are 43 (27.74%) articles with h-index≥2. Only 3 articles’ h-index were higher than 10. As can be seen in Fig. 5, the tendency of the h-index coordinated with the total number of citations, but articles with h-index≥2 are seldom, the proportion of influential articles are small, despite the number of publications and study quality increasing.

3.6. Diagnostic criteria diversity

The diagnostic criteria or definition of BSS in the included articles were documented. Though the basic recognitions and definitions of BSS were similar among different countries, regions, and research groups, the diagnostic criteria used in different studies were strikingly inconsistent. Of all the 155 BSS-related articles, 59 articles did not mention the diagnostic criteria or definition of BSS they implied, 38 of which were original articles (29.92% of all the original articles). Among the rest of BSS-related articles, a total of 27 different kinds of diagnostic criteria were applied in human related researches respectively (Table 2), and 11 different methods were used in animal or cell modeling experiments (Table 3).

Among the 27 different diagnostic criteria for BSS, 9 were established by national or state academic committees, 5 were established by ministerial or provincial agencies, 3 were from text books, and the rest of them were published in journals by individual authors. Among these diagnostic criteria, The Criterion of Chinese Medicine Syndrome-differentiation for CHD by Cardiovascular Branch of Chinese Association of Integrative Western & Chinese Medicine (1991),[18] Guiding principle of clinical research on new drugs of TCM by Ministry of Health, China (2002),[19] and The diagnostic criteria of blood stasis syndrome by Special Committee of Promoting Blood...
Table 2

| No. | Diagnostic criteria                                                                 | Year of establishment | Frequency |
|-----|-------------------------------------------------------------------------------------|-----------------------|-----------|
| #1  | The Criterion of CM Syndrome-differentiation for CHD by Cardiovascular Branch of Chinese Association of Integrative Western and Chinese Medicine | 1991                  | 13        |
| #2  | Guiding principle of clinical research on new drugs of TCM by Ministry of Health, P. R. China | 2002                  | 11        |
| #3  | The diagnostic criteria of blood stasis syndrome by Special Committee of Promoting Blood Circulation and Removing Blood Stasis, Chinese Association of Integrative Medicine | 1987                  | 9         |
| #4  | Study on the diagnostic criteria of blood stasis syndrome by Wang J et al.          | 1988                  | 4         |
| #5  | The presentation of diagnostic criteria for “Yueao” (stagnated blood) conformation by Terasawa et al | 1989                  | 3         |
| #6  | Criteria of Diagnosis and Therapeutic Effects of Diseases and Syndromes in Traditional Chinese Medicine by State Administration of Traditional Chinese Medicine | 1994                  | 3         |
| #7  | Research on cardiocerebrovascular diseases by Chen KJ et al                         | 1998                  | 3         |
| #8  | Guidelines for clinical research of new drugs of traditional Chinese medicine by Ministry of Health of the People’s Republic of China | 1993                  | 2         |
| #9  | Internal medicine of Traditional Chinese Medicine by Wang YY                         | 1997                  | 2         |
| #10 | The standards of TCM differential syndromes of viral hepatitis by Internal Medicine   | 1991                  | 2         |
| #11 | Tentative Standard on TCM Syndrome-Differentiation-Based Treatment of Coronary Artery Disease | 1980                  | 1         |
| #12 | Criteria for diagnosis and treatment of diseases by Wang ZH et al                   | 1983                  | 1         |
| #13 | The presentation of diagnostic criteria for “Oketsu” syndrome by Terasawa K          | 1983                  | 1         |
| #14 | Terminology of traditional Chinese medicine clinical diagnosis and treatment. GB/T16751.2-1997 | 1985                  | 1         |
| #15 | Nephropathy forum of Traditional Chinese Medicine in Nanjing                         | 1986                  | 1         |
| #16 | Standard for TCM syndrome differentiation of patients with viral hepatitis by Special Committee of Internal Medicine on Hepatopathy, Chinese Association of Traditional Chinese Medicine | 1992                  | 1         |
| #17 | Standard of integrative medical diagnosis, syndrome differentiation and efficacy evaluation for chronic non-specific ulcerative Colitis by Professional Committee of digestive diseases, Chinese Association of Integrative Chinese and Western Medicine | 1994                  | 1         |
| #18 | Diagnosis, syndrome classification and criteria for efficacy of Baibofeng              | 1994                  | 1         |
| #19 | TCM Syndrome Differentiation Diagnostic Criteria for Apoplexy by Ren ZL et al       | 1994                  | 1         |
| #20 | The eighth meeting of the Professional Committee for Breast Diseases of China TCM Surgery Society | 2002                  | 1         |
| #21 | Traditional Chinese medicine syndromes of chronic hepatitis B with precore mutant by Yang HZ et al | 2005                  | 1         |
| #22 | Exploration of the research method for Chinese medicine syndrome questionnaire of diabetic nephropathy by Mou X et al | 2007                  | 1         |
| #23 | Guidelines of clinical research technology in treatment of angina pectoris with Chinese medicine or natural medicine by China Food and Drug Administration | 2011                  | 1         |
| #24 | The Grading System in Quantifying Blood Stasis Syndrome Diagnosis Standards by Chinese Association of Integrative Medicine | 2012                  | 1         |
| #25 | Study on the diagnostic criteria for coronary heart disease patients of blood stasis syndrome by Fu CG et al | 2012                  | 1         |
| #26 | Ischemic Stroke CM Syndrome Factor Diagnostic Scale by Gao Y et al                  | 2012                  | 1         |
| #27 | Syndrome description of gastric cancer-in terms of TCM syndrome differentiation by Yang YP | 2012                  | 1         |

BSS = blood stasis syndrome.

Circulation and Removing Blood Stasis, Chinese Association of Integrative Western & Chinese Medicine (1987)[20] were used most frequently (in 13, 11, and 9 studies respectively). Though 104 articles stated the BSS diagnostic criteria they used, only 10 articles listed the detailed diagnostic terms or scales, the rest only named the diagnostic criteria with references. Other than this, 8 studies relied on clinical judgment, which is based on the judgment of >1 practitioner.

In the basic animal and cell experimental studies, 11 different techniques were used to simulate the state of BSS, including adrenaline hydrochloride injection and ice-water soak, artificial myocardial infarction or middle cerebral artery occlusion, exhaustive swimming exercising, metabolic syndrome via diet control, hypoxia, H2O2-induced oxidative injury and so forth. Though some of the techniques were used in several studies, there are unresolved questions about the validity of these experimental approaches in BSS research as well as problems in the inconsistency of the research approach applied in different studies.

4. Discussion

This bibliometric analysis summarized modern research on BSS from 1989 to 2015. It contains all of the BSS-related articles in
Our findings also show that despite the concept of BSS being common within the different branches of TEAM, BSS-related articles in these years are mostly authored by Chinese researchers. So far the academic concept and scholarly communication of BSS are mostly under the theory of Traditional Chinese medicine (TCM, one of the main components and origin of TEAM). It is beneficial to explore BSS in unified academic system, but cooperation and communication between countries and groups in different disciplines and diseases are also vital for the development and promotion of the research products.

A wide range of diseases not limited to CHD, hypertension, stroke, different types of cancer, diabetes, arrhythmia, obesity, dyslipidemia, gastric ulcer, hepatitis B, psoriasis, primary glomerular disease, and rheumatoid arthritis were addressed in BSS-related studies. Most of these are chronic internal diseases. In the theory of TEAM, BSS is most commonly seen in chronic illness.[13,21,22] Continuous disturbances of the inner environment can lead to impaired blood circulation and cause BSS. Hence, BSS is the major syndrome of the above chronic diseases.

Though the number of publications and their citations of BSS-related studies increased in recent years, the academic influence of these still remains relatively low. The average citation for each article is 4.65 to the search date of this study. 27.74% of the articles had h-index higher than 2, only 3 articles’ h-index were higher than 10. The proportion of influential articles is small, especially as the number of publications and quality of the studies are increasing. Of all the BSS-related articles contained in PubMed, 97 out of the 155 articles were published in 3 journals (Chinese Journal of Integrative Medicine, Evidence Based Complementary and Alternative Medicine, and Journal of Traditional Chinese Medicine), whose IFs are between 0.5 and 2. The fact that most studies are published in only 3 complementary and alternative medicine (CAM) journals indicates a probable reason for the low impact of the research. Had the studies been published more widely and especially in non-CAM more mainstream journals, they would have gotten a wider audience and received more attention. It is thus important for authors of future studies to plan their studies more carefully with an eye to targeting publication in more mainstream journals with higher impact factors. This, in turn, will require a further raising of standards for research.

We also found that of all the BSS-related articles, one-third did not state the diagnostic criteria of BSS, the authors only claimed the presence of BSS, or gave a simple description of it. For those that stated the criteria they used in their researches, the diagnostic criteria varied with up to 27 different kinds established by different academic committees and agencies. Though some of them are different editions of the same criteria, the inconsistency of the BSS diagnostic criteria is highly problematic. This inconsistency has weakened the comparability and the validity of BSS-related studies. Different inclusion criteria may lead to different research results. In the animal and cell experiments, the different modeling methods similarly weaken the findings and their impact. Those articles without specific diagnostic criteria tend to have lower numbers of citations in WOS, Scopus, and Google Scholar than the average and especially those with developed criteria. Furthermore, the fact that many BSS criteria were established in China may be an indication that there is significant disagreement within China. Such circumstances might be one of the reasons that slow progress of recognition and citation and the low academic interest were achieved in BSS-related researches for the past decades. Thus, of major concern is the notion that while there is clinical agreement about the presence and use of BSS in treatment, the scientific community has not yet identified all its varieties. In that case, a globally applicable concept of BSS and well-reckoned diagnostic criteria are needed to comprehensively cover different diseases, gender, living and working environment, cultural factors, and so on. It is evidently that some biomarkers have been identified and recommended for pattern identification in different diseases, syndromes, and populations.[3] Using unique biomarkers to subsidiarily identify BSS and its subtypes is an objective approach to eliminate these differences.

Modern research on BSS has been conducted over recent decades. In our overview of publications, we see that it is the right time to integrate the resources and enhance the quality and productivity of BSS-related studies. For future studies, we have some recommendations. First, cooperation between different groups in different fields, and countries need to increase to address some of the issues raised by our review. Second, studies to establish a uniform validated standard for diagnosis and evaluation criteria of BSS are needed. More investigation and cooperation is needed to achieve this. Third, once this standard has been developed and validated more objective biomarkers for

| No.  | Animal or cell modeling approach                                                                 | Frequency |
|------|--------------------------------------------------------------------------------------------------|-----------|
| #28  | Adrenaline hydrochloride injection and ice-water soak                                            | 5         |
| #29  | Artificial chronic myocardial infarction                                                         | 3         |
| #30  | Exhaustive swimming exercising                                                                  | 2         |
| #31  | Artificial middle cerebral artery occlusion                                                      | 1         |
| #32  | Bovine serum albumin injection and high-fat diet feed                                            | 1         |
| #33  | Dextran injection via caudal vein                                                               | 1         |
| #34  | H2O2-induced oxidative injury                                                                   | 1         |
| #35  | High molecular dextran injection                                                               | 1         |
| #36  | High-fat diet                                                                                  | 1         |
| #37  | Hypoxia                                                                                         | 1         |
| #38  | Metabolic syndrome via diet control (water with 20% sucrose and food with high sugar, fat, and salt) | 1         |
BSS need to be identified. More objective biomarkers are the key to the modernization of BSS in medical practice. Fourth, clinical and experimental studies on BSS should be more objective, scientific, apply more restricted rules, and advanced technologies. Fifth, studies of BSS should return to clinical practice, do they result in enhanced treatment of BSS? The efficacy and safety evaluation of existing herbal formulae, patent medicines, and extracts, as well as the development of new drugs for BSS are important.

There are some limitations in our study. We only included articles published between 1989 and 2015, since we aimed to focus on the modern researches of BSS under validated diagnosis criteria, which were published in the late 1980s. However, the articles that we have found did not all follow these same criteria and in fact there are wide range of different criteria and inconsistency in how BSS has been identified in the studies. This weakens our findings, but at the same time reveals the need for further studies. Additionally, publication bias was also a limitation in this study. We only included articles written in English, which are more likely read by the researchers worldwide. This is because one of the intentions of this research is to estimate the exploration and the promotion of BSS worldwide, English is the most suitable language to evaluate the outcomes. Thus, we did not include articles published in the China national knowledge infrastructure (CNKI), China, which contain a large quantity of BSS-related articles in Chinese. We plan to perform a comparative search between Medline and CNKI to analysis the BSS-related articles’ variations between English and Chinese in the future.

5. Conclusions
To sum up, the publication of BSS-related articles increased continuously, especially in the last 5 years. Study quality has improved along with the number of publications. The diversity of BSS-related studies increased, whereas CHD-BSS is still the most researched area. Intervention studies of BSS inclined more to patent medicine; more attention should be drawn to herbal formulae as well. The diagnostic criteria for BSS are still not patent medicine; more attention should be drawn to herbal formulae as well. The diagnostic criteria for BSS are still not.

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