Development Characteristics and Laws of Aging Studies

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Abstract. Aging studies involve multiple demography-dominated disciplines, such as economics, politics, geography, insurance. In this paper, a statistical analysis of aging studies on China National Knowledge Infrastructure (CNKI) from 1990 to 2015 was carried out based on bibliometric method. Research results are as follows: (1) the number of aging studies increased continuously in the fluctuation manner. (2) Journal studies still remained the major contributor. (3) The number of funded aging studies increased continuously, but the total proportion was still low (only 5.31%). (4) There were 40 authors who had published more than 5 articles. (5) The number of citations and the highest citations of single article changed in the same way. Specifically, Peng Du, Cangping Wu, Guangzong Mu and Xiangqun Jiang took the leading roles in the number and citations of articles.

1. Introduction
Currently, China has stepped into the aging society. It is expected that the aged population of over 60 years old in China will reach 300 million, and China will become a country of super-aging population. As the interdisciplinary research field of social science and natural science, aging of population covers multiple disciplines, such as demography, politics, sociology, statistics, insurance, economics, and medicine. It has attracted wide attentions from scholars at home and abroad. Chinese studies on aging of population started in 1980s, and involved many social problems and economic problems, such as aging situations, aging industry, economic development, family planning, endowment mode, and retirement pension system. The government has been paying great attentions to aging. In 2006, the National Office for Aging issued the Prediction Report on Development Trend of Aging in China, which introduced current situations, pressure, development trend, characteristics, problems and policy suggestions of aging in China [1]. More and more academic studies on aging problems are being published. They analysed, commented, reflected and expected characteristics of aging studies from different levels and disciplines.

Recently, population economy emphasizes on negative impacts of aging on economic development. For example, Yang [2] discussed the macroscopic impacts of aging on China’s economy and society from perspectives of reducing effective labor supply, relieving growth of labor productivity, influencing industrial restructuring, decreasing savings ratio, changing consumption level, and increasing burdens on pension security. Wang [3-4], Cai [5], Tian [6], Peng [7] and Guo [8] further discussed impacts of aging on economy from saving contributions, labor supply, total factor productivity, social insurance, public policy, and public security. Wu and Xie [9] believed that China possessed the late-mover advantage in coping with aging issues. With the economic and social development, technological
progresses and prolonging of average lifetime, China has the opportunities and ability to overcome the pessimistic concept of aging. Aging is not so “horrible” as long as updating the concept, understanding and assessing value of the aged population accurately, and formulating countermeasures positively.

Due to the special national situations, China still has a certain gap with developed countries in pension market, pension security system, childbearing policy, urban-rural differences, and so on. These factors may further influence adjustment of individual behaviours in the aging process. Therefore, aging studies in accordance with national situations in China shall be made. So far, rare scholars have discussed the development characteristics and laws of aging in China under long span. In this paper, aging studies on CNKI from January 1st, 1990 to December 31st, 2015 were searched by “Literature” and title containing “aging” through Bibliometrics. Development characteristics and laws of aging studies were analysed, aiming to making beneficial supplementations.

2. Publishing years and classification of literatures

2.1 Publishing years
The number of aging studies increased from 1990 to 2015 in the fluctuation manner. This period generally can be divided into four stages (Fig. 1). The number of aging studies decreased from 35 in 1991 to 24 in 1990. However, it increased from 24 to 171 during 1992-2000, developing the first peak. It kept stable (171~191) during 2000-2004. Later, the number of aging studies increased from 291 to 526 during 2005-2007, developing the second peak. However, it decreased to 388 in 2008 from 526 in 2007, which was the first valley. Next, a stable growth was achieved during 2008-2011. It increased from 388 in 2008 to 744 in 2011, showing a small peak. The number of studying ages in 2012 decreased slightly to 695. In 2013, it soared up to 2,052 and kept stable at about 1,000 during 2013-2015. To sum up, the number of aging studies increased in the fluctuation manner in the past 25 years.

![Fig. 1 Number and growth rates of aging studies during 1990-2015](image)

2.2 Classification
A total of 8,929 studies with titles containing “aging” were searched on CNKI during 1990-2015. Among them, there were 5,359 (60.01%) journal studies, including 5,289 (59.23%) studies on academic journals and 70 (0.78%) studies on education journals. Besides, there were 734 (8.22%) master and doctoral dissertations, including 50 (0.56%) doctoral dissertations and 684 (7.66%) of master dissertations. There were 578 (6.47%) conference studies, including 479 (5.36%) domestic ones and 99 (1.11%) international ones. The rest 2,258 studies were newspaper studies, accounting for 25.29%.

Among all aging studies, journal studies accounted for 60.01% and ranked the top with absolute advantages. In fact, journal studies were the major contributor in both number and quality of aging studies. Newspaper studies (25.29%) ranked the second, indicating the high attention of Chinese citizens.
to aging problems. Master and doctoral dissertation ranked the third, and most of them were master dissertations (93.19%). As for dissertations, higher level had fewer aging studies. Conference studies ranked the fourth and 82.87% of them were domestic conference studies. In view of spatial distribution of conference studies, domestic scholars mainly focused on domestic communications and rarely made international communications.

3. Disciplines and fund assistance of aging studies

3.1 Disciplines
A statistical analysis on studies with title containing “aging” on CNKI during 1990-2015 was carried out. These studies can be divided into 40 disciplines. The top 10 disciplines were Demography & Family Planning (2907, 26.05%), China Politics & International Politics (2034, 18.23%), Sociology & Statistics (897, 8.04%), Insurance (718, 6.43%), Investment (673, 6.03%), Macroeconomic Management & Sustainable Development (459, 4.11%), Economic System Reform (404, 3.62%), Medical Care Policies and Legal Regulation Study (334, 2.99%), Agricultural Economy (309, 2.77%), and Construction Science & Engineering (285, 2.55%).

It can be seen that aging studies have some basic characteristics. Aging of population is an important branch of population science. Aging studies concerning demography and family planning ranked the top in number and proportion. As the interdisciplinary research field of social science and natural science, aging studies cover multiple disciplines, including demography, politics, sociology & statistics, insurance, investment, economy, and medicine. It has basic attributes of comprehensive disciplines, and belongs to the interdisciplinary research scope.

3.2 Fund assistances
Fund assistance of one discipline can reflect provincial and even national academic attentions to it as well as subsequent practical applications. In the beginning, there’s only one fund assisted aging study in 1992, titled as *Impacts of Panaxoside on Atrial Peptide Gene Expressions in Aging Rats*. In 1994, there’s an aging studying funded by “Natural Science Foundation of China (NSFC)” titled as *Preliminarily Discussion on Urban Living Environment for the Elderly*. The fund assisted aging studies began to increase since 1988. A total of 8,929 aging studies published during 1990-2015, but there were only 474 received fund assistances.

According to statistics on database of CNKI, fund assisted aging studies increased gradually (Fig.2). The proportion of fund assisted aging studies was lower than 13% during 1990-2015. However, it reached the peak (12.02%) in 2014. The highest number (118) of fund assisted aging studies was achieved in 2015, accounting for 10.76%. In a word, the proportion of fund assisted aging studies was very low, which was only 5.31%.

Among them, “National Social Science Foundation” assisted the most aging studies (199), followed by NSFC (122). They accounted 67.72% of fund assisted studies.
Fig. 2 Statistics on aging studies and fund assisted aging studies during 1990-2015

4. Authors of aging studies

Core author of one research field refers to the author who published the most high-quality studies in high-level journals. Studies of core authors are often cited by others. In this paper, a preliminarily statistics on aging studies and authors in the full-text database of CNKI was carried out. It found that there were 40 authors who had published more than 5 aging studies, accounting for 200 studies (2.24%) of the total aging studies. Guangzong Mu published the most studies (21), followed by Cangping Wu (19) and Peng Du (18).

According to the Price’s law, core authors refer to authors who have published at least $N_{min} = 0.749\sqrt{N_{max}}$, (where $N_{max}$ refers to the number of studies of the author who published the most studies in the statistical period) studies in one field. In the statistical period, $N_{max}$ was 21, so $N_{min}$ was 3.43. Based on actual situations, $N_{min}$ was rounded to 4. In other words, authors who have published 4 aging studies during 1990-2015 were viewed as core authors.

| Name          | Institution                | Number (articles) | Name          | Institution                | Number (articles) |
|---------------|----------------------------|-------------------|---------------|----------------------------|-------------------|
| Guangzong Mu  | University of China        | 21                | Xueyuan Tian  | Chinese Academy of Social Sciences | 9                 |
|               | Renmin University of China |                   |               |                            |                   |
| Cangping Wu   | University of China        | 19                | Shengge Lv    | Hangzhou Dianzi University  | 8                 |
|               | Renmin University of China |                   |               |                            |                   |
| Peng Du       | University of China        | 18                | Duolai Zhang  | University of South China  | 8                 |
|               | Renmin University of China |                   | Zurong Xu     | Hangzhou Academy of Social Sciences | 7               |
| Xin Yuan      | Nankai University          | 16                |               |                            |                   |
|               | Renmin University of China |                   |               |                            |                   |
| Xiangqun Jiang| University of China        | 11                | Zhihong Li     | Office of the National Committee on Ageing | 7               |
|               | Renmin University of China |                   |               | Social Welfare Center of Ministry of Civil Affairs |               |
| Yansui Yang   | Tsinghua University        | 10                | Wei Cui       |                            | 7                 |
|               | Dongbei University         |                   |               |                            |                   |
| Sen Wang      | University of              | 9                 |               |                            | 150               |
|               |                            |                   |               |                            |                   |
5. Citations of aging studies

5.1 Basic situations of citations

Basic situations of citations of aging studies during 1990-2015 are shown in Fig.3. The statistics was implemented on September 24th, 2017. The number of citations and the highest citations of single study changed in the basically same way. They both increased gradually from 1990 to 2002, but decreased sharply in 2003 and 2004. They climbed up again quickly in 2005 and fluctuated to the peak during 2005-2011. The number of citations and the highest citations of single study both reached the peaks in 2011, which valued 4,869 and 405, respectively.

![Fig.3 Statistics on citations of aging studies during 1990-2015](image)

On the whole, the sphere of influencing of aging studies was expanding continuously. There were 2 studies cited by more than 400 times, 3 studies cited by over 300 times, and 11 studies cited by over 200 times. In Table2, Development Trend of Aging in China in 100 Years which was published by Du Peng, Zhai Zhenwu and Chen Wei was cited the most (434 times) and ranked the top. Development Trend of Aging in China and Corresponding Strategic Countermeasures published by Mu and Zhang was cited by 405 times and ranked the second. Process, Prospects and Countermeasures of Aging with Chinese Characteristics published by Wu, Wang and Miao was cited by 367 times and ranked the third. The rest 8 aging studies were cited by over 200 times and possessed high attentions and influences in the research field.

| Authors | Title | Year | Number of citations |
|---------|-------|------|---------------------|
| Peng Du, Zhenwu Zhai and Wei Chen | Development Trend of Aging in China in 100 Years | 2005 | 434 |
| Guangzong Mu and Tuan Zhang | Development Trend of Aging in China and Corresponding Strategic Countermeasures | 2011 | 405 |
| Cangping Wu, Lin Wang and Ruifeng Miao | Process, Prospects and Countermeasures of Aging with Chinese Characteristics | 2004 | 367 |
| Zhenghua Jiang | Aging Phenomenon and Countermeasures in China | 2005 | 286 |
| Jinying Wang, Xiubin Fu | Quantitative Analysis on Consumption Function with Consideration to Age Structural Changes in China | 2006 | 252 |
5.2 Authors of cited aging studies

Authors of aging studies with the highest citations of single study during 1990-2015 were divided into three groups. There were 3 authors with over 300 citations of single study, 8 authors with 200-300 citations of single study and 31 authors with 100-200 citations of single study (Many aging studies of Jiang and Wu have been cited). Core authors of aging studies during 1990-2015 are listed in Table 3.

| Number of citations | Number of authors | Name of authors |
|---------------------|-------------------|-----------------|
| >300                | 3                 | Peng Du, Guangzong Mu, Cangping Wu |
| 200-300             | 8                 | Zhenghua Jiang, Jinying Wang, Xizhe Peng, Yonghong Cheng, Qingrui Liu, An Xie, China Women’s Movement, Haiyan Wang, Wanli Zhao, Yi Huang, Lixin Pei, Yi Zeng, Xuejin Zuo, Angang Hu, Guangzong Mu, Xiujian Peng, Xiuyun Fang, Zaisheng Zhang, Zhaopeng Qu, Xiangqun Jiang, Zhibao Wang, Xiaofang Zhao, Yupeng Wang, Peng Du, Xiangqun Jiang2, Cangping Wu, Research Group of China Demography and Development Research Center, Xiaochun Qiao, Cangping Wu2, Min Li, Jianxin Li, Jun Yuan, Xiwen Chen, Benbo Zhang, Xue Yang, Zhanzhao Zhou, Xiangqun Jiang3, Wenfan Zhang and Ribang Li |
| 100-200             | 31                | Qingrui Liu, An Xie |

It can be seen from Table 4 that the aging study of Peng Du was cited by 983 times, maintaining the top. The aging study of Cangping Wu was cited by 816 times and ranked the second. The aging study of Guangzong Mu was cited by 664 times and ranked the third. The aging study of Xiangqun Jiang was cited by 616 times and ranked the fourth. Based on number of cited aging studies, Du Peng had 18 studies cited, followed by Cangping Wu (16), Guangzong Mu (13), Xin Yuan (13) and Xiangqun Jiang (12) successively. To sum up, Peng Du, Cangping Wu, Guangzong Mu and Xiangqun Jiang took the leading role in number and citations of aging studies.

| Author          | Number of citations | Number of cited studies |
|-----------------|---------------------|-------------------------|
| Peng Du         | 983                 | 18                      |
| Guangzong Mu    | 664                 | 13                      |
| Qingrui Liu     | 328                 | 5                       |
| An Xie          | 283                 | 4                       |

| Author          | Number of citations | Number of cited studies |
|-----------------|---------------------|-------------------------|
| Cangping Wu     | 816                 | 16                      |
| Xiangqun Jiang  | 616                 | 12                      |
| Zhenghua Jiang  | 290                 | 2                       |
| Jinying Wang    | 274                 | 3                       |
6. Conclusions
Recently, the aged population in China changed greatly. The new elderly people has significantly different economic incomes, family situations, health conditions and cultural education from the previous ones. New demanding characteristics of the elderly people appeared, resulting in some new social economic characteristics. In this paper, a statistical analysis of aging studies on CNKI during 1990-2015 was carried out by bibliometric method. Development characteristics and laws of aging studies in China were summarized. In future, aging problems will be further intensified in future, accompanied with increasing challenges to social and economic development. Hence, all-round deep discussions on aging in China are still needed.

References
[1] National Office for Aging. Prediction Report on Development Trend of Aging in China [R]. 2006.
[2] Xue Yang, Li Hou. Research on Macroscopic and Microscopic Impacts of Aging on Economy and Society in China [J]. Population Journal, 2011(4):46-53.
[3] Dewen Wang, Fang Cai, Xuehui Zhang. Saving Effect and Growth Effect of Demographic Transitions ------ Discussion on Demographic Factors of Sustainable Growth in China [J]. Population Research, 2004(5):1-14.
[4] Dewen Wang. Supply-demand Changes of Labor in the Low-birth Rate Stage and China’s Economic Growth [J]. Chinese Journal of Population Science, 2007(1):44-52.
[5] Fang Cai, Meiyin Wang. Challenges of “Aging Before Getting Rich” to Sustainable Economic Growth [J]. Macroeconomic Study, 2006(6):6-10.
[6] Xueyuan Tian. Aging from the Perspective of “Middle-income Trap” [J]. Academic Journal of Zhongzhou, 2012(11):83-88.
[7] XizhPeng e, Kan Hu. Aging in China from the Perspective of Public Policy [J]. Social Sciences in China, 2011(3):121-138.
[8] Xibao Guo, Tongpin Li, Bei Yuan. Lasting Impacts of Aging on China’s Economy and Countermeasures [J]. Economic Theory and Economic Management, 2013(2):43-50.
[9] Cangping Wu, Nan Xie. Theoretical Reflection on Aging in China [J]. Social Science of Beijing, 2011(1):4-8.