



Analysis of population health projects funded by Joint Fund of the National Natural Science Foundation of China between 2015 and 2019

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Background: The National Natural Science Foundation of China (NSFC) is a vital source of support for scientific research in China and abroad. Among the 18 categories programs managed by the NSFC, the Joint Fund, which looks to develop innovation in basic Chinese research, has drawn particular interest from scientists and researchers. This study set out to review the distribution of funding from the Joint Fund in recent years to provide potential applicants with a useful point of reference.

Methods: Guidebooks and annual reports published from 2015 to 2019 were accessed on the NSFC website and the relevant data from the Joint Fund were obtained. The data were analyzed to identify any trends or patterns in funding distribution.

Results: Between 2015 and 2019, the NSFC's Joint Fund awarded a total of 46 million Chinese yuan (CNY) to 354 projects in 29 areas within the field of population health. The funding recipients, who were aged between 30 and 66 years old, came from 47 host institutions. Among the successful applicants, 225 were in senior level positions, 129 were in deputy senior level positions, and 19 were in medium-grade professional positions. Collaboration between institutions was a common feature of funding applications.

Conclusions: By analyzing the distribution of funding from the Joint Fund, we identified a number of common features of successful funding applications, which may help to inform future funding applications.

Keywords: National Natural Science Foundation of China (NSFC); Joint Fund; population health

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Introduction

Managed by the Ministry of Science and Technology of China, the National Natural Science Foundation of China (NSFC) exists to provide vital support for basic scientific research and to promote socioeconomic development.

To achieve this, the NSFC employs a comprehensive and objective merit-based review system (1). The NSFC currently supports 18 categories funding programs. Among these programs, the Joint Fund constitutes an integral part of the science fund funding system.

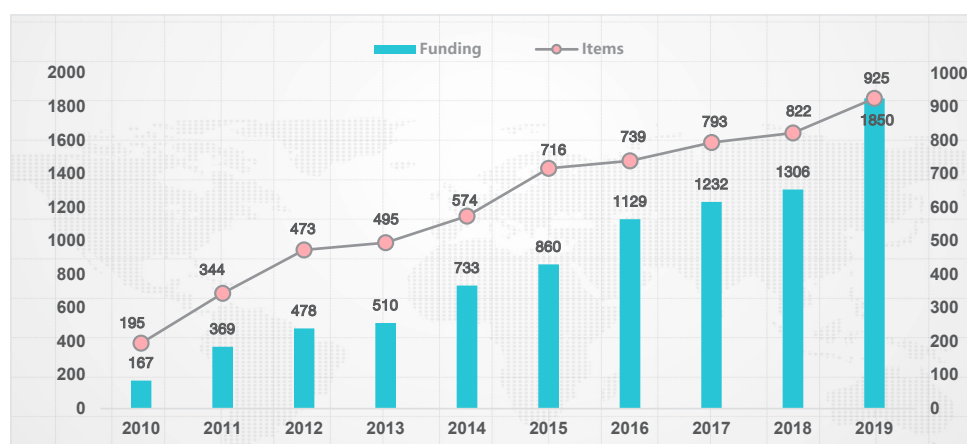


Figure 1 The annual amount of funding distributed from the NSFC Joint Fund between 2010 and 2019 (million CNY). NSFC, National Natural Science Foundation of China; CNY, Chinese yuan.

The Joint Funds set up by NSFC and other relevant government departments, provincial governments and industrial sectors aim at supporting basic research in agreed scientific areas. The joint funds are designed to play a guiding role of the National Natural Science Fund, guide and integrate social resources in basic research, promote cooperation of relevant departments, industries and regions with universities and research institutions, foster scientific and technological talents and enhance China's indigenous innovation capabilities in relevant research areas, industries and regions. At present, the Joint Fund mainly supports projects in the five following areas: Fostering Program projects, Key Program projects, Fostering Local Talents, and Center projects and Integrated projects.

Between 2010 and 2019, the funding allocated through the Joint Fund rose from 167 million CNY to 1.85 billion CNY, with an average annual increase of 187 million; and in the same period, the number of funded projects increased from 195 to 925, with an average annual increase of 81, as illustrated in *Figure 1*.

Given the important role the NSFC plays in funding basic research, it has attracted an increasing amount of attention from scientists and researchers. The field of population health is a highly important area supported by the Joint Fund. Thus, this study set out to analyze and review the population health projects supported by the NSFC's Joint Fund between 2015 and 2019.

Methods

Guidebooks (2) and annual reports (3) published between

2015 and 2019 were obtained from the NSFC website and the relevant data were collected. Further analysis was performed to identify any regularities or trends.

Statistical analysis

All the original data were put into the excel table and analyzed. Each group of data was used graphpad 7.0 software to draw, and integrated the icons through Adobe Illustrator CC 2017 software. Statistical analysis was undertaken using SPSS 23.0. Comparisons were done with the Chi-square test and Fisher's exact test for categorical parameters, while with Student's *t*-test or analysis of variance (ANOVA) test for continuous variables. A 2-sided $P < 0.05$ was considered to be statistically significant.

Results

Overall funding distribution

The Joint Fund was set up by NSFC and local governments, and scientific research organizations and enterprises to solve key scientific problems in the development of regions, industries, and enterprises. The Joint Fund exemplify the role of the National Natural Science Fund in guiding and integrating social resources with basic research and promoting cooperation between relevant departments, industries, and regions and universities and research organizations. Furthermore, the joint fund fosters scientific and technological talent and support the development of Chinese innovation in relevant research areas, industries,

Table 1 Funding applications supported by the Joint Funds from 2015–2019

Year	No. of applications	No. of awards	Average funding amount (thousand CNY)	Success rate (%)
2015	4,218	716	1,201	17.3
2016	4,869	739	1,527	15.2
2017	4,451	793	1,554	17.8
2018	5,044	822	1,710	16.3
2019	5,729	925	2,000	16.1
Total	24,221	3,995	1,621	16.5

CNY, Chinese yuan.

Table 2 Funding applications supported by the Joint Funds in the field of population and health between 2015–2019

Year	No. of applications	No. of awards	Average funding amount (thousand CNY)	Success rate (%)
2015	359	65	1,091	18.1
2016	828	86	1,303	10.4
2017	470	48	1,157	10.2
2018	649	68	1,625	10.5
2019	871	87	1,299	10.0
Total	3,197	354	1,307	11.1

CNY, Chinese yuan.

and regions. From 2015 to 2019, from 24,221 applications received by the NSFC, 3,995 projects were supported from the Joint Funds. *Table 1* details the funding information for 2015 to 2019. Obviously, the numbers of application were increasing rapidly, however, the success rate was decreasing (16.1% *vs.* 17.3%, $P=0.283$) from 2015 to 2019. Moreover, the average funding rate of joint fund projects was a little lower than that of the other general science funds. The detailed information could be seen in our published paper (4).

From 2015 to 2019, the NSFC received 3,197 applications and funded 354 population health projects from the Joint Funds. *Table 2* shows the detailed information from each year. As shown in *Figure 2*, NSFC supported 201 Fostering Program projects, 145 Key Program projects, 6 Foster Local Talent projects, 1 Center project, and 1 Integrated project.

Areas distribution

A total of 354 funded projects in 29 different fields of population health were distributed between 2015 and 2019. A breakdown of the projects supported according to area is given in *Table 3*.

As listed in *Table 4*, from 2015 to 2019, 354 projects

in the field of population health received funding from 8 NSFC Joint funds.

Applicants' host institutions

The successful applicants were based at 47 host institutions. The top 10 institutions supported through the Key Program and the Fostering Program are detailed in *Figures 3* and *4*, respectively.

Distribution of funding according to geographic region

As shown in *Figure 5*, applicants in 20 provinces and municipalities received funding between 2015 and 2019. The researchers in the Henan Province obtained the most number of funding in the field of population health by the NSFC Joint Funds, which is a little unexpected.

Age of applicants funded

The successful applicants ranged in age from 30 to 67 years old, with those in the 41–45 years age bracket receiving

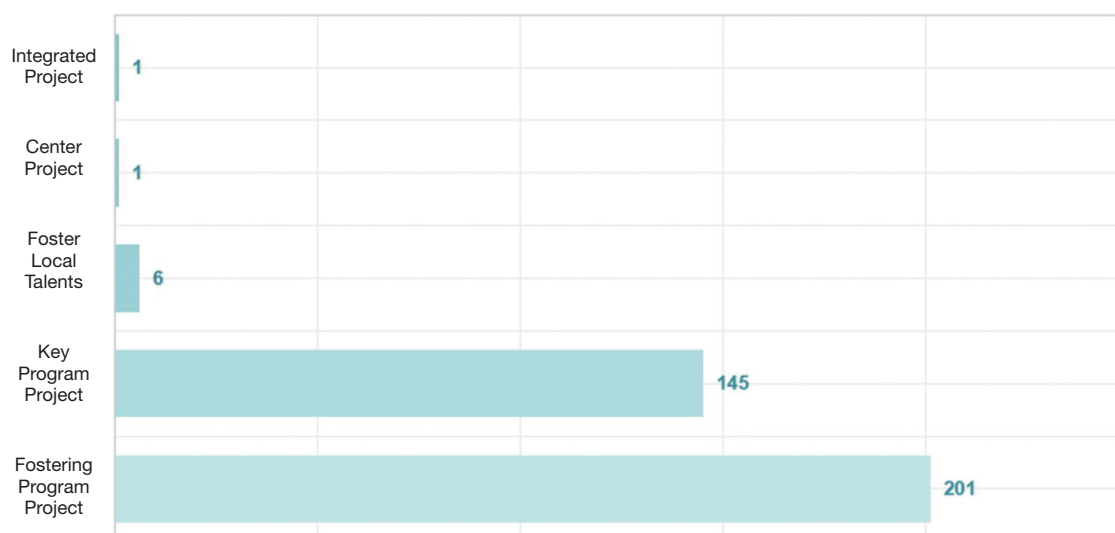


Figure 2 The distribution of funding applications supported by the NSFC Joint Funds in the field of population and health from 2015–2019 according to project type. NSFC, National Natural Science Foundation of China.

Table 3 Projects supported by the NSFC Joint Funds in the field of population and health from 2015–2019 according to scientific area

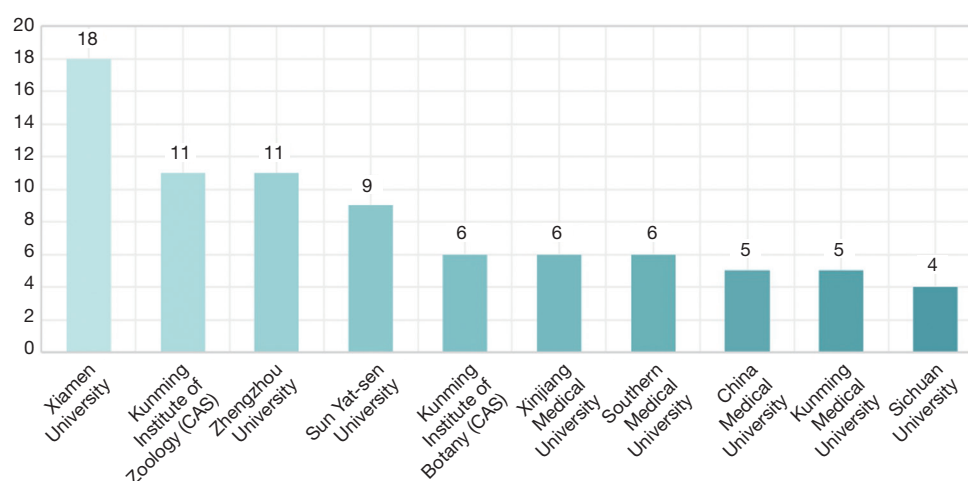
Application code	Areas	Sum	Application code	Areas	Sum
H01	Respiratory system	7	H18	Medical imaging and biomedical engineering	20
H02	Circulatory system	16	H19	Medical pathogenic micro-organisms and infection	14
H03	Digestive system	10	H20	Laboratory medicine	1
H04	Reproductive system; perinatology/ neonatology	6	H21	Special medicine	1
H05	Urinary system	7	H22	Radiology	1
H06	Motion system	5	H23	Forensic medicine	1
H07	Endocrine system/metabolism & nutrition support	13	H24	Endemic/occupational disease	2
H08	Blood system	10	H25	Geriatric medicine	2
H09	Neurological and psychiatric diseases	34	H26	Preventive medicine	8
H10	Medical immunology	11	H27	Chinese medicine	11
H11	Skin and its appendages	4	H28	Chinese materia medica	32
H12	Ophthalmology	8	H29	Combination of Chinese traditional and Western medicine	6
H14	Oral craniomaxillofacial science	3	H30	Materia medica	31
H15	Acute and severe medicine/trauma/ burn/plastic surgery	5	H31	Pharmacology	17
H16	Oncology	68	Total		354

NSFC, National Natural Science Foundation of China.

Table 4 The number of projects supported by each joint fund (in the field of population and health)

Joint Funds	Numbers of awards
NSFC-Henan Joint Fund	183
NSFC-Xinjiang Joint Fund	58
NSFC-Yunnan Joint Fund	37
Joint Fund to Promote Cross-Straits Scientific and Technological Cooperation	28
NSFC-Guangdong Joint Fund	24
National Natural Science Foundation Regional Innovation and Development Joint Fund	13
NSFC-Liaoning Joint Fund	10
NSFC-Guizhou Joint Fund	1
Total	354

NSFC, National Natural Science Foundation of China.

**Figure 3** The top 10 host institutions funded in the field of population and health through the Key Program from 2015–2019.

support most often (*Figure 6*).

Professional qualifications of applicants

Of the applicants who received funding through the Key Program, 141 were in a senior level position (such as professor, researcher, and chief physician) and only 4 were in deputy senior level positions (associate professor and associate chief physician). Among those funded through the Fostering Program, 84 applicants were in a senior level position (such as professor, researcher, and chief physician), 98 were in a deputy senior level position (including associate professor, associate chief physician and associate chief pharmacist), and 19 had a medium-grade professional

title (including lecturer, assistant, physician in charge and pharmacist in charge), as illustrated in *Figure 7*.

Collaboration

Collaboration was a common theme in the applications to the Joint Fund. Among this, 94 successful applications have involved cooperations between two institutions and 24 successful applications have involved cooperations between two institutions (*Figure 8*).

Discussion

After analyzing data obtained from online NSFC resources,

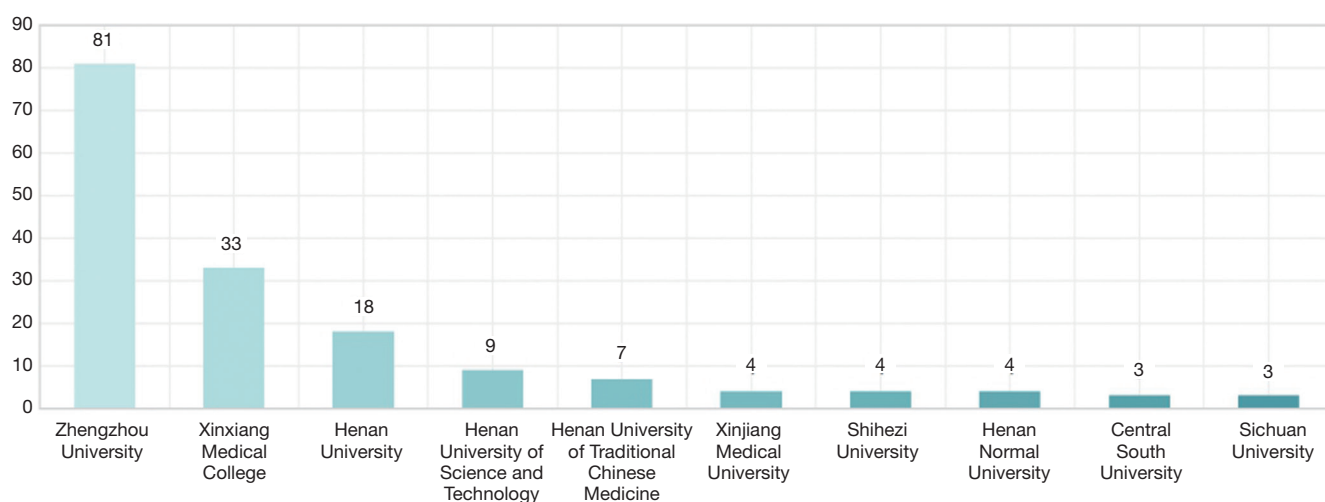


Figure 4 The top 10 host institutions funded in the field of population and health through the Fostering Program from 2015–2019.

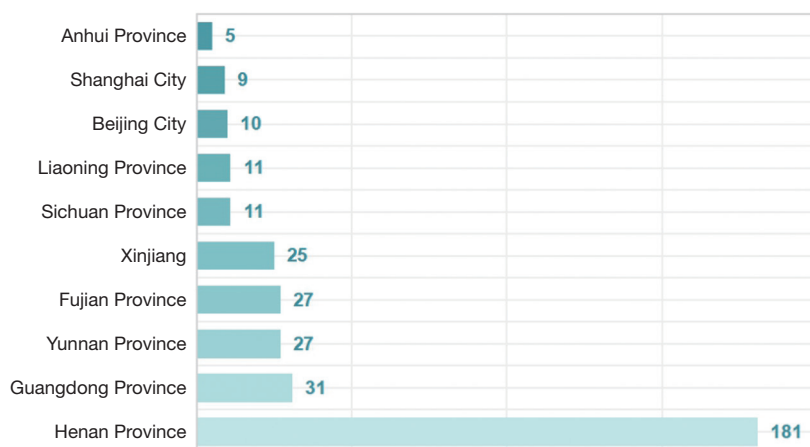


Figure 5 The top 10 regions according to the number of applicants funded in the field of population and health by the NSFC Joint Funds from 2015–2019. NSFC, National Natural Science Foundation of China.

a number of prominent features of funding allocated from the Joint Funds were identified; these may prove to be a useful point of reference for future funding applications. The Joint Fund supports projects in almost every area of health research; however, projects relating to the blood system, oncology, medical imaging, biomedical engineering, medical pathogenic micro-organisms, and infection receive the bulk of the funding. Universities and institutes of the Chinese Academy of Sciences, which are leaders in medical scientific research, account for a significant proportion of projects supported through the NSFC Joint Funds. In addition, collaboration between institutions appeared to be looked on favorably. The applicants of the Joint Fund are

aged between 36–45 (Fostering Program) and 45–60 (Key Program), which points toward the increasing number of PIs who are in their 40s.

In general, eligible applicants are expected to have an excellent academic record, have considerable influence, and possess the ability to work in a team. It is extremely important that, when proposals are written, the guidelines are followed closely. Applicants should focus on key scientific issues with strategic and fundamental significance, concentrate on interdisciplinary scientific targets, and pay attention to coordination and links with other national scientific programs. The research team should have an adequately prepared pilot study, sufficient supporting

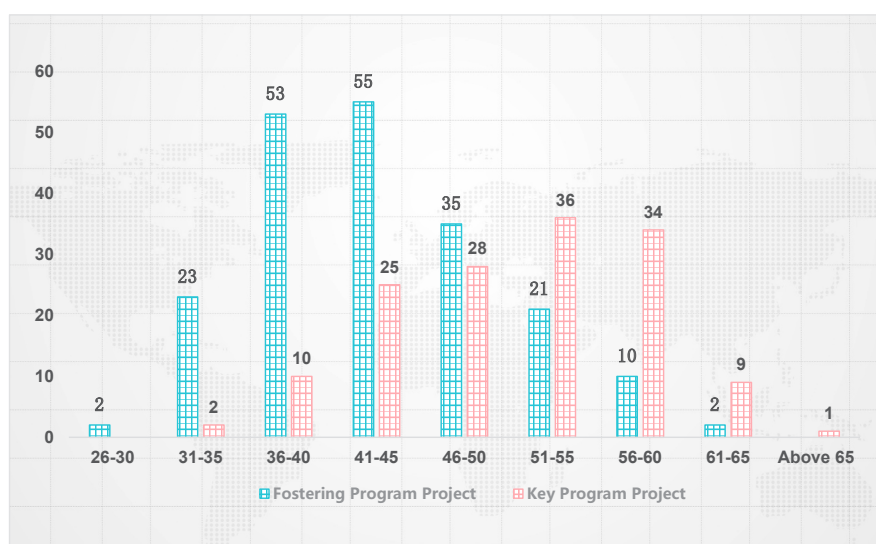


Figure 6 A breakdown of the ages of applicants (in the field of population and health) supported by the NSFC Joint Fund from 2015–2019. NSFC, National Natural Science Foundation of China.

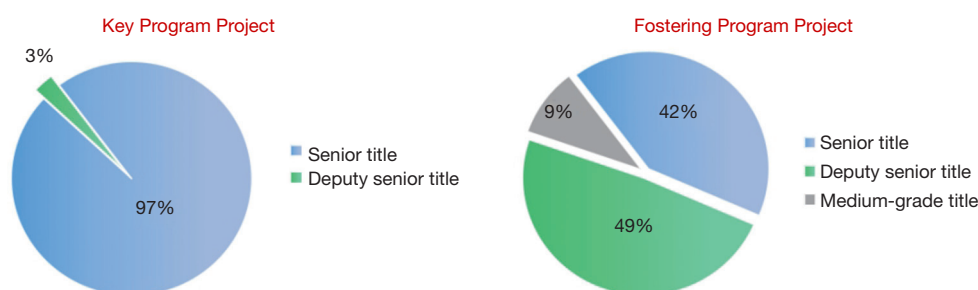


Figure 7 The professional qualifications of applicants in the field of population and health funded by the NSFC Joint Funds from 2015–2019. NSFC, National Natural Science Foundation of China.

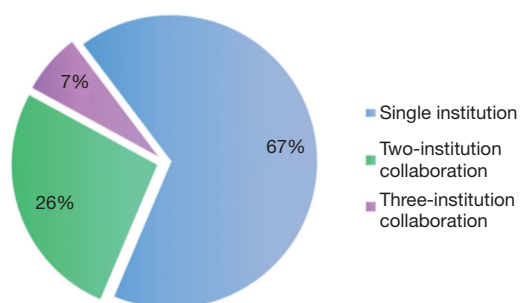


Figure 8 The proportion of collaborative applications supported by the NSFC Joint Funds in the field of population and health from 2015–2019. NSFC, National Natural Science Foundation of China.

conditions, innovative ability, and a number of high-level academic leaders (2).

In 2019, based on the principle of “meeting national demands, introducing diversified investment, encouraging resource sharing, and promoting multi-party cooperation”, NSFC continued to strengthen top-level design, and support forward-looking basic research, with an emphasis on the core scientific problems in key areas and major scientific problems in emerging transdisciplinary areas, to address the urgent needs of regions, industries, and enterprises. NSFC has established National Natural Science Foundation Regional Innovation and Development Joint Fund and National Natural Science Foundation Enterprise

Innovation and Development Joint Fund with cosponsors to gradually formulate the joint funding system for the new era and further improve the efficiency of funding distribution.

In the new period of the joint funding system, the National Natural Science Foundation Regional Innovation and Development Joint Fund has received significant attention and support from local governments. Beside the 4 provinces of Sichuan, Hunan, Anhui, and Jilin, 12 provinces including Guangdong, Zhejiang, Hubei, Qinghai, Liaoning, Ningxia, Heilongjiang, Tibet, Guangxi, Beijing, Chongqing, and Hebei (autonomous regions and municipalities) joined the National Natural Science Foundation Regional Innovation and Development Joint Fund. In all, 16 provinces (autonomous regions and municipalities) plan to invest 4.98 billion yuan over five years, of which 1.66 billion yuan will be matched by the NSFC, amounting to a total of 6.64 billion yuan.

China Aerospace Science and Technology Corporation has joined the National Natural Science Foundation Enterprise Innovation and Development Joint Fund. There are currently four enterprises planning to invest 950 million yuan over five years, of which the NSFC will match 237.5 million yuan, amounting to a total of 1.187 billion yuan. Meanwhile, the NSFC has also steadily expanded its jointly funded work with industry departments, and has cooperated with the China Academy of Engineering Physics, China Civil Aviation, Ministry of Water Resources, China Yangtze River Three Gorges Group Co., Ltd., and China General Technology Research Institute. In the new period, the above four industry sectors have invested 800 million yuan and NSFC matched 350 million yuan, which amount to 1.15 billion yuan to the Joint Fund.

However, our study has limitations. There are many uncertainties in such a retrospective research, which increase the deviation of results.

Conclusions

NSFC plans to power breakthroughs in basic research with social and individual donations, and constantly improves the new model and mechanism of the Science Foundation to facilitate diverse investment in society. Simultaneously, the NSFC will continue to improve the efficiency of funding distribution, strengthen the management and evaluation of joint funding projects, optimize the formation mechanism of guidelines, strengthen the overall arrangement of different types of projects and focus on the summary and discovery of results.

In the past years, NSFC had provided strong support to basic scientific research in all fronts and provided a mechanism for fair competition. In the future, NSFC will stress on the development of the following aspects including all directions of innovative research, talents cultivation, international cooperation and management of excellence. NSFC expects to be a key contributor to the progress and prosperity of the basic research of China, and meanwhile to grow along with it.

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Footnote

Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at <http://dx.doi.org/10.21037/atm-20-6495>). The authors have no conflicts of interest to declare.

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

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