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RESEARCH ARTICLE

Quality analysis and policy recommendations on the utilization of community basic public health services in urban and suburban Shanghai from 2009 to 2014

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Abstract

Disparities in quality of basic public health services exist between urban and rural populations, but there is no data about these disparities between urban and suburban populations in Shanghai. The study aims to analyze and compare the quality of basic public health service utilization of community health service centers in Shanghai urban and suburban areas between 2009 and 2014. This was a cross-sectional study. Using a two-stage random sampling method, 80 community health service centers were randomly selected from six districts that were also randomly selected from 17 counties in Shanghai. Descriptive statistical analysis, principal component analysis, and forecast analysis were used to compare and analyze basic health services utilization quality between urban and suburban centers. During the 6 years, there has been an increasing trend of the basic public health service effectiveness of prevention services, health care services, rehabilitation services, health education services, and health indexes in Shanghai urban and suburban areas. Prevention services, health care services, health education services, and population health index indicators of urban areas were better than those of the suburbs, while effectiveness indicators of rehabilitation services were lower than that of the suburbs. The urban areas had four principal component scores lower than the suburbs ($P < 0.001$, $P = 0.006$, $P < 0.001$, and $P = 0.015$). During the 6 years, with the strengthening of national support, basic public health service utilization has increased rapidly, and effectiveness of services has improved obviously. Nevertheless, there is an imbalance of basic public health service utilization between urban and suburban areas.

Keywords Community health services · Basic public health service utilization · Quality · Trend prediction · Policy · Shanghai

Lijun Guo and Yong Bao contributed equally to this work.

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Introduction

To carry out public health services and advocate a healthy lifestyle have an important significance in continuously enhancing the awareness of health care for urban and rural residents (Anderson 1913), effectively preventing and controlling the occurrence and prevalence of major infectious diseases and chronic diseases (Mpofu et al. 2016), promoting the equalization of basic public health services in urban and rural areas (Beatty et al. 2010; Yang et al. 2016), and improving residents' health literacy and quality of life (Koop and Ginzburg 1989). There are ten essential public health services in the USA. The National Public Health Performance Standard (NPHPS) was released in 2002 and had been revised in 2007 and 2013. In China, the basic public health service exists since 2009 and includes 10 service contents (Anonymous 2009) and was increased to 11 by 2011 (Anonymous 2011).

Statistics from 1991 to 2015 showed that the neonatal mortality, infant mortality rate, mortality rate of children under

5 years of age, and maternal mortality rate in China gradually decreased over the 25-year period, but that they are still higher in rural areas compared with urban areas. Malignant tumors, heart diseases, and cerebrovascular diseases were the top three causes of death in 2015, and chronic non-communicable diseases became the main factor that influenced the health status and quality of life of urban and rural residents in China (Anonymous 2016). Kroeger et al. (1991) studied the differences in health and disease status between rural and urban/suburban residents of Nuevo León (Mexico) and showed that residents living in urban/suburban areas had certain advantages compared with those living in the countryside. These advantaged included high-level education, lower immigration rate, lower fertility index, lower incidence of serious disease and child mortality, broader coverage of health insurance, better communication between doctors and patients, more frequent use of health services, and greater involvement in prevention programs. The study on the equity of basic public health service utilization in urban and rural areas and the difference among the indicators have been reported in other countries or other provinces in China. Among other, Khan et al. (2013) and Kamal and Sloggett (1996) studied the health care services of reproductive women in Bangladesh and indicated that the gaps between urban/rural and richest/poorest women were still considerable.

In China, Xin (2013) suggested that the overall fairness of basic public health services in urban and rural residents in Jiangxi was good, but that key populations, such as children under age 6, mothers, and psychiatric patients in urban and rural areas had poor fairness, and that their management level needs to be improved. Song et al. (2012)) reached similar conclusions. They considered that the general situation of urban and rural basic public health services in China was good, but that health management, chronic disease management, and psychiatric management were lower in rural areas than in urban communities, while maternal and child health care and senile health care services were better in rural areas than in urban communities. Nevertheless, studies on this subject are lacking for Shanghai. It is worth noting that Shanghai has a high level of urbanization, with the rural population accounting for only 12.4% of the population (Anonymous 2016). Therefore, comparison and analyses between urban and suburban areas are more meaningful for Shanghai than comparing urban and rural populations.

Therefore, the purpose of this study was to analyze and compare the quality of basic public health service utilization of community health service centers in Shanghai urban and suburban areas between 2009 and 2014. The differences of basic public health service effects of prevention, health care, rehabilitation, health education, and health indexes between urban and suburban areas were compared. The present study used single factor evaluation and principal component analysis to forecast the future development trends in order to improve the utilization efficiency of community basic public health services and provide policy recommendations to further promote the equalization of basic public health services for Shanghai urban and suburban residents.

Subjects and methods

Participating centers

This was a cross-sectional study. Using a two-stage random sampling method, 80 community health service centers were randomly selected from six districts that were also randomly selected from 17 counties in Shanghai. These 80 centers were contacted and 73 accepted to participate (91.2%). According to their location, the community health service centers were divided into two groups: the urban group covered Xuhui, Yangpu, and Jing'an Districts, and the suburb group covered Jinshan, Jiading, and Fengxian Districts.

Data collection

Prevalence survey and self-designed questionnaire about routine reports, such as financial statements, human resource reports, and medical statistics reports, were used. The content covered service population, revenue and expenditure, human resource, services, overall satisfaction of residents, two-way referral and information technology, and other areas of indicators (See details in Supplementary material 1). The data were collected by trained investigators who had to go to the appointed institutions to complete the survey.

Research indexes

Evaluation indexes of basic public health service utilization in urban and suburban community health service centers cover prevention index (incidence rate of infectious diseases), health care indexes (maternal systematic management rate, systematic management rate of child under age 6, eye health care rate of people aged > 70, and physical examination rate of kindergartens and students in school), rehabilitation indexes (registration rate and management rate of mental patients and the disabled), health education indexes (regular health education lectures, play recording, and health education prescription), population health index (average life expectancy), and other indicators.

Statistical analysis

Epidata 3.0 (Centers for Disease Control, Atlanta, GA, USA) was used to establish the database and complete the data records and management. Statistical analysis was performed using SPSS 19.0 (IBM, Armonk, NY, USA). The Levene's test was

used to test the normality of the continuous data. Normally distributed data were analyzed with the independent-sample t test or one-way analysis of variance. Non-normally distributed data were analyzed with non-parametric tests. Categorical data were presented as frequency and analyzed with the chi-square test. The variation range of each index was analyzed using the average annual growth rate (AAGR):

$$\mathrm{AAGR} = \left(\sqrt[5]{X_{2014}/X_{2009}} - 1 \right) \times 100\%$$

Eviews 8.0 (IHS Markit, Paris, France) was used to predict each indicator of the next 5 years, and SPSS 19.0 (IBM, Armonk, NY, USA) was used to complete the principal components analysis of basic public health service utilization indicators. Two-sided P values $P < 0.05$ were considered statistically significant.

Quality control

During the study design process, domestic experts were invited to guide the questionnaire and the entire survey program. Preliminary tests were conducted in one community health service center. Availability and operability of the data collection were evaluated. According to the preliminary tests, some adjustments were made to make the questionnaire better reflect the real situation of the institutions investigated, e.g., the format of the tables, the logical relationships between each entry, and the unit of some survey indicators. All personnel involved in the field investigation were trained and tested. After signing the informed consent, unified questionnaires and standards were used to ensure the quality of the survey.

Research ethics

The 73 community health centers voluntarily participated in this study, and ethics was not involved. All data were anonymous.

Results

Comparisons of total population serviced in urban and suburban areas

During the 5 years, the total population of urban and suburban areas had respectively increased from 89,801 to 95,067 and from 62,526 to 75,737 between 2009 and 2013. Therefore, total population of urban services was much higher than that of the suburbs ($P < 0.001$). The AAGR of urban population (1.43%) was lower than that of the suburban population (4.91%) (Table 1). It is estimated that the total serviced population will grow to 85,471 by 2018.

Comparisons of household registered population serviced by urban and suburban areas

During the 5 years, household registered population serviced by urban areas had increased from 78,783 in 2009 to 81,011 in 2013, which was higher than the suburbs (from 33,218 to 34,933) ($P < 0.001$). On the other hand, the AAGR of household registered population serviced by urban areas (0.70%) was lower than that of the suburbs (1.27%) (Table 1). It is estimated that the household registered population will grow to 55,785 by 2018.

Comparisons of people > 60 years of age under the service of urban and suburban areas

During the 5 years, the number of people > 60 years of age under the service of urban areas had increased from 17,971 in 2009 to 21,575 in 2013, with an AAGR of 4.68%, while in the suburbs, they increased from 7226 in 2009 to 9443 in 2013, with an AAGR of 6.92%. The absolute number of people > 60 years of age that urban areas serviced was significantly higher than that of the suburbs ($P < 0.001$), but the AAGR of the suburbs was higher than that of urban areas (Table 1). The number of people > 60 years of age under the service of urban and suburban areas is predicted to grow to 12,788 by 2018.

Comparisons of child < 6 years of age serviced in urban and suburban areas

During the 5 years, the service number of child < 6 years of age in urban areas (increased from 3062 in 2009 to 3815 in 2013) was higher than that in the suburbs (increased from 1877 in 2009 to 2240 in 2013), while AAGRs of urban areas (5.65%) being higher than that of the suburbs (4.52%) ($P < 0.001$) (Table 1). It is predicted that the service number of child < 6 years of age will rise to 5152 by 2018.

Comparisons of the effects of preventive service in urban and suburban areas

During the 5 years, the total incidence of infectious diseases in urban areas (increased from $160.22/10^5$ in 2009 to $190.50/10^5$ in 2013) was lower than that in the suburbs (increased from $236.72/10^5$ to $254.10/10^5$) ($P < 0.001$). The AAGR of total incidence of infectious diseases in urban areas (4.42%) was higher than that in the suburbs (1.79%) (Table 1 and Supplementary Table S1). It is estimated that the total incidence of infectious diseases would

Table 1 Comparisons of average annual growth rate on community health service index in urban and suburban areas of Shanghai from 2009 to 2014

Name	Urban	Suburban	Total
Total population serviced in the community	1.43%	4.91%	3.46%
Household registered population	0.70%	1.27%	0.93%
People > 60 years of age	4.68%	6.92%	5.79%
Child < 6 years of age	5.65%	4.52%	5.22%
Total incidence rate of infectious diseases (/10^5)	4.42%	1.79%	2.71%
Maternal systematic management rate	2.07%	2.15%	2.13%
Systematic management rate of child < 6 years of age	2.20%	0.99%	1.43%
Eye health care rate of people > 70 years of age	1.40%	1.81%	1.52%
Physical examination rate of kindergartens and students in school	1.00%	0.06%	0.46%
Registration rate of mental patients	0.33%	0.08%	0.17%
Management rate of mental patients	0.43%	0.04%	0.18%
Registration rate of the disabled	1.46%	0.58%	1.08%
Management rate of the disabled	− 0.83%	− 0.32%	− 0.10%
Organize propaganda column (quantity)	11.30%	9.49%	9.90%
Regular health education lectures (times)	6.73%	7.74%	7.18%
Play videos (times)	5.71%	14.55%	7.78%
Health education prescription (sheets)	3.66%	10.34%	6.04%
Average life expectancy (year)	0.32%	0.10%	0.10%

reach 237.03/10^5 by 2018, of which 189.24/10^5 in urban areas and 256.13/10^5 in suburbs.

Comparisons of the maternal systematic management rates in urban and suburban areas

During the 6 years, the maternal systematic management rates in urban areas increased from 85.3% in 2009 to 94.5% in 2014, which was higher than that in the suburbs (from 76.1 to 84.6%) ($P < 0.001$). Maternal systematic management rate in urban areas (2.07%) was lower than that in the suburbs (2.15%) (Table 1 and Supplementary Table S2). It is expected that the maternal systematic management rates will increase to 90.23% by 2018, of which 94.45% in urban areas and 86.24% in the suburbs.

Comparisons of the systematic management rates of child < 6 years of age in urban and suburban areas

During the 6 years, the systematic management rates of child < 6 years of age in urban areas increased from 86.0% in 2009 to 95.9% in 2014, which was lower than that in the suburbs (from 93.0 to 97.7%) ($P < 0.001$). The systematic management rate of child < 6 years of age in urban areas with an AAGR of 2.20% was higher than that in the suburbs with 0.99% (Table 1 and Supplementary Table S2). It is estimated that the systematic management rates of child < 6 years of age will increase to 98.45% by 2018, of which 97.68% in urban areas and 98.58% in the suburbs.

Comparisons of the eye health care rates of people > 70 years of age in urban and suburban areas

During the 6 years, the eye health care rates of people > 70 years of age in urban areas increased from 85.3% in 2009 to 91.5% in 2014, which was higher than that in the suburbs (from 72.8 to 79.6%) ($P < 0.001$). The eye health care rate of people > 70 years of age in urban areas with an AAGR of 1.40% was lower than that in the suburbs with 1.81% (Table 1 and Supplementary Table S2). It is estimated that the eye health care rates of people > 70 years of age will be increased to 84.57% by 2018, of which 94.16% in urban areas and 80.46% in the suburbs.

Comparisons of the physical examination rates of kindergartens and students in schools in urban and suburban areas

During the 6 years, the physical examination rates of kindergartens and students in schools in urban areas had increased from 89.4% in 2009 to 93.9% in 2014, which was lower than that in the suburbs (from 99.1 to 99.4%) ($P < 0.001$). The physical examination rate of kindergartens and students in schools in urban areas with an AAGR of 1.00% was higher than that in the suburbs with 0.06% (Table 1 and Supplementary Table S2). It is expected that the physical examination rates of kindergartens and students in school will reach 96.12% by 2018, of which 91.39% in urban areas and 99.51% in the suburbs. See in Table 2 and Supplementary Table S4.

Table 2 Comparisons of the health indexes of residents of community health service centers in urban and suburban areas of Shanghai from 2009 to 2014 (years)

Year	Average life expectancy						*P*
	Urban		Suburban		Total		
	M	SD	M	SD	M	SD	
2009	82.7	0.88	81.6	1.35	82.0	1.30	0.001
2010	83.1	0.75	81.5	1.17	82.1	1.28	< 0.001
2011	83.2	0.91	81.8	0.88	82.3	1.09	< 0.001
2012	83.2	0.58	81.9	1.20	82.4	1.21	< 0.001
2013	83.6	0.87	82.1	1.01	82.7	1.21	< 0.001
2014	84.1	0.22	82.0	1.86	82.4	1.85	0.088
2009–2014	82.7	0.88	81.6	1.35	82.3	1.27	0.001

Comparisons of the registration rates of mental patients in urban and suburban areas

During the 6 years, the registration rates of mental patients in urban areas increased from 84.4% in 2009 to 85.8% in 2014, which was higher than that in the suburbs (from 94.9 to 95.3%) ($P < 0.001$). The registration rates of mental patients in urban areas with an AAGR of 0.33% were higher than that in the suburbs (0.08%) (Table 1 and Supplementary Table S3). It is expected that the registration rates of mental patients will increase to 92.0% by 2018, of which 86.5% in urban areas and 95.3% in the suburbs.

Comparisons of the management rates of mental patients in urban and suburban areas

During the 6 years, the management rates of mental patients in urban areas increased from 89.3% in 2009 to 91.2% in 2014, which was lower than that in the suburbs (from 98.4 to 98.6%) ($P = 0.001$). The management rate of mental patients in urban areas with an AAGR of 0.43% was higher than that in the suburbs (0.04%) (Table 1 and Supplementary Table S3). It is estimated that the management rates of mental patients will increase to 95.8% by 2018, of which 90.9% in urban areas and 98.6% in the suburbs.

Comparisons of the registration rates of the disabled in urban and suburban areas

During the 6 years, the registration rates of the disabled in urban areas increased from 66.0% in 2009 to 71.0% in 2014, which was lower than that in the suburbs (from 87.8 to 90.4%) ($P < 0.001$). The registration rates of the disabled in urban areas with an AAGR of 1.46% were higher than that in the suburbs (0.58%) (Table 1 and Supplementary Table S3). It is estimated that the registration rates of the disabled will be 81.6% by 2018, of which 71.8% in urban areas with 89.3% in the suburbs.

Comparisons of the management rates of the disabled in urban and suburban areas

During the 6 years, the management rates of the disabled in urban areas had decreased from 57.1% in 2009 to 54.8% in 2014, which was lower than that in the suburbs (from 91.2 to 89.7%) ($P < 0.001$). The management rates of the disabled in urban areas with an AAGR of − 0.83% was lower than that in the suburbs (− 0.32%) (Table 1 and Supplementary Table S3). It is estimated that the management rates of the disabled will be 77.1% by 2018, of which 56.4% in urban areas with 90.3% in the suburbs.

Comparisons of the numbers of regular health education lectures in urban and suburban areas

During the 5 years, the numbers of regular health education lectures in urban areas increased from 67 in 2009 to 93 in 2013, which was higher than that in the suburbs (from 32 to 46) ($P < 0.001$). The numbers of regular health education lectures in urban areas with an AAGR of 6.73% were lower than that in the suburbs (7.74%) (Table 1 and Supplementary Table S4). It is estimated that the numbers of regular health education lectures would be 54 by 2018, of which 78 in urban areas and 63 in the suburbs.

Comparisons of the numbers of videos in urban and suburban areas

During the 5 years, the numbers of playing videos in urban areas had increased from 472 in 2009 to 623 in 2013, which was higher than that in the suburbs (from 130 to 256) ($P < 0.001$). The numbers of playing videos in urban areas with an AAGR of 5.71% were lower than that in the suburbs (14.55%) (Table 1 and Supplementary Table S4). It is estimated that the numbers of playing videos will be 329 by 2018, of which 807 in urban areas and 477 in the suburbs.

Comparisons of the numbers of health education prescriptions in urban and suburban areas

During the 5 years, the numbers of health education prescriptions in urban areas had increased from 33,058 in 2009 to 39,567 in 2013, which was higher than that in the suburbs (from 9918 to 16,219) ($P < 0.001$). The numbers of health education prescriptions in urban areas with an AAGR of 3.66% were lower than that in the suburbs (10.30%) (Table 1 and Supplementary Table S4). It is estimated that the numbers of health education prescriptions will increase to 25,284

by 2018, of which 42,243 in urban areas and 17,102 in the suburbs.

Comparisons of the effects of health index service in urban and suburban areas

During the 6 years, the average life expectancy of urban areas had increased from 82.7 in 2009 to 84.1 in 2014, which was higher than that of the suburbs (from 81.6 to 82.0) ($P = 0.001$). The average life expectancy of urban areas with an AAGR of 0.32% was higher than that of the suburbs (0.10%) (Table 2). It is expected that the average life expectancy will increase to 82.54 years by 2018, of which 85.09 in urban areas and 82.00 in the suburbs.

Principal component analysis of basic public health service utilization in urban and suburban areas

To complete the principal component analysis, the study had taken 23 basic public health service utilization indicators as analysis objects. In this study, the appropriate detection value of the KMO sample was 0.5. The chi-square value of the Bartlett's spherical degree test was 920.110, and the degree of freedom was 253, $P < 0.001$. The first eight principal components were obtained by using the variable characteristic value (1) as the standard. Their variance was 4.671, 2.822, 2.363, 1.614, 1.559, 1.293, and 1.246, respectively. Their cumulative contribution rate of the variance was up to 72.304% and could be better to represent the information of the 23 original indicators (Supplementary Table S5).

The composite scores from high to low were incidence rate of infectious diseases, eye health care rate of people over 70 years, and quantity of propaganda column (issue number) (Table 3).

Comparisons of the principal component scores and comprehensive score in urban and suburban areas

The urban areas had six principal component scores less than the suburbs in the proposed eight principal components, and there were statistically significant differences among principal components 2, 3, 5, and 7 ($P < 0.001$, $P = 0.006$, $P < 0.001$, and $P = 0.015$) (Fig. 1). The comprehensive score of the urban areas was also lower than that of the suburbs ($P < 0.001$), but there was no statistically significant between the two.

Discussion

Disparities in quality of basic public health services exist between urban and rural populations (Kamal and Sloggett (1996), Khan et al. 2013, Song et al. 2012, Xin 2013), but there is no data about these disparities between urban and suburban populations in Shanghai. Therefore, the present study aimed to analyze and compare the quality of basic public health service utilization of community health service centers in Shanghai urban and suburban areas between 2009 and 2014. The results showed that during the 6 years, with the strengthening of national support, basic public health service utilization has increased rapidly, and effectiveness of services has improved obviously. Nevertheless, there is an imbalance of basic public health service utilization between urban and suburban areas.

Starting in 1997, China has been implementing a vast health reform and the medical and health service system covering urban and rural areas, which is composed of hospitals, primary health care institutions, and professional public health institutions, has been gradually established. Nevertheless, problems and disparities still exist, such as public health services in suburban areas, are not as good as in urban areas (Xue and Gao 2002), and utilization efficiency is lower than in urban areas (Cui and Xu 2010), seriously affecting the fairness and efficiency of health services (Anonymous 2016). The present study demonstrated unfairness and inequalities in basic public health services in the community health service centers in Shanghai urban and suburban areas; therefore, more strategies and tailored efforts are needed in order to promote the equalization of basic public health services for urban and suburban residents in Shanghai.

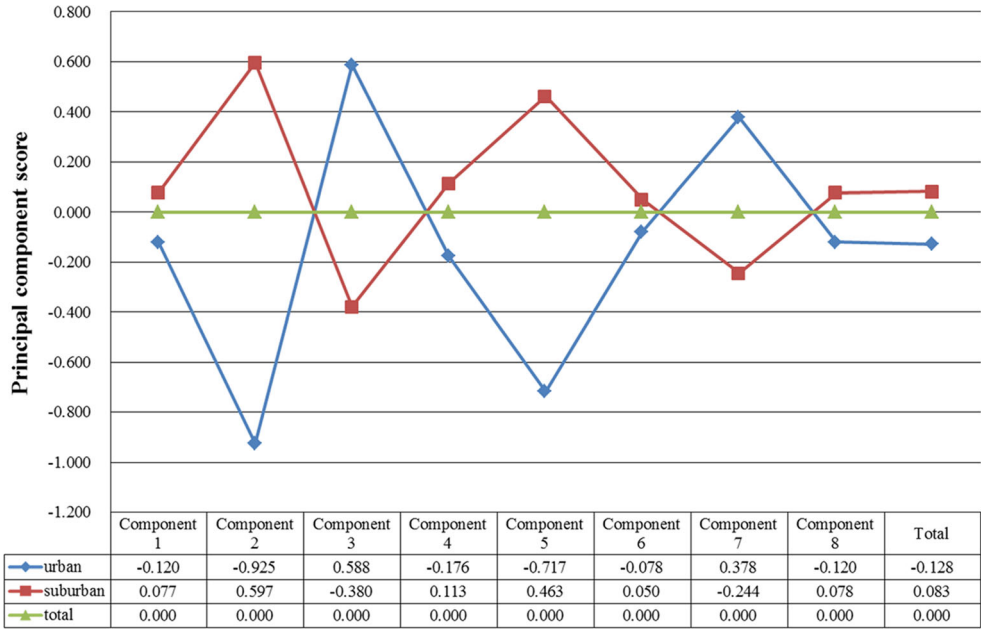
From 2009 to 2013, total population, household registered population, elderly population > 60 years of age, and child < 6 years of age that the community health centers serviced in Shanghai urban areas were higher than in the suburban areas. It is estimated that those trends will keep increasing by 2018. It is suggested that the basic public health service needs of community residents will continue to increase in the future, and the needs of urban areas will to be higher than that of the suburbs. Under the premise of limited resources, research and practice on improving the utilization efficiency of health care are very important (Zhang et al. 2015).

From 2009 to 2013/2014 in Shanghai, the effectiveness indicator of prevention service was lower in urban areas than in the suburbs, while its annual growth rate was higher than in the suburbs. At present, China is facing three major challenges in the prevention and treatment of infectious disease: double pressure of old and new infectious diseases, large-scale flow of population, and changes of environment and lifestyle (Xu and Li 2012). Li et al. (2012)) held the viewpoint that the overall level of health literacy of infectious diseases in China was low and was higher in urban areas than in rural/suburban areas. Therefore, it is necessary to strengthen infectious disease health education of key populations in suburban areas to reduce the incidence of infectious diseases in the suburbs.

Effectiveness indicators of health care services including the maternal systematic management rates and eye health care

Table 3 Components and comprehensive scores of the principal component analysis

No.	Variable	Component 1	Component 2	Component 3	Component 4	Component 5	Component 6	Component 7	Component 8	Total
1	Total incidence rate of infectious diseases (/10^5)	1.487	.526	.295	.255	.330	− .022	− .189	.090	.430
2	Eye health care rate of people aged 70 and above	1.275	.452	.470	− .343	− .493	.243	.143	− .027	.325
3	Organize propaganda column (quantity)	1.653	.034	− .377	.032	.161	.085	− .291	.188	.312
4	Planned immunization coverage rate of floating population (%)	1.102	− .114	.630	− .387	.507	.011	.056	.045	.287
5	Free distribution of propaganda materials (quantity)	.852	.202	.619	.508	.139	− .215	.071	− .232	.287
6	Regular health education lectures (times)	1.526	− .430	.074	− .217	.179	.249	.247	− .156	.282
7	Physical examination rate of nursing home and day-care institutions	1.094	.373	.775	− .454	− .296	− .418	.121	− .016	.278
8	Management rate of the disabled	.210	1.132	− .294	− .005	.524	.213	− .095	.123	.199
9	Registration rate of the disabled	− .022	.833	.540	− .100	− .047	.418	.382	− .014	.187
10	Health management rate of special population	.465	1.117	.057	− .211	− .680	.160	− .055	.052	.185
11	Play recording (times)	1.299	− .912	.045	.071	− .049	.279	.148	− .094	.177
12	Maternal mortality rate (/10^5)	.575	− .066	− .332	.212	− .090	− .135	.405	.740	.132
13	Infant mortality rate (/10^3)	.229	− .168	.636	.831	− .345	.140	− .063	− .142	.124
14	Management rate of mental patients	− .106	1.223	− .074	.357	− .045	− .265	− .311	.098	.116
15	Child mortality rate under age 5 (/10^3)	− .086	− .289	.664	.727	− .222	.288	− .055	.199	.074
16	Health education prescription (sheets)	.882	− 1.082	.141	− .013	− .116	− .058	− .237	.172	.044
17	Systematic management rate of child under age 6	− .519	.012	.950	− .165	.497	.234	− .317	.093	.016
18	Health consultation (times)	− .475	.270	− .335	.144	.350	.702	.107	− .071	− .022
19	Average life expectancy (year)	− .380	.104	− .203	.185	.124	− .069	.762	− .010	− .027
20	Planned immunization coverage rate of permanent residents (%)	− .843	− .138	.639	− .051	.074	.065	.103	.511	− .088
21	Physical examination rate of kindergartens and students in school	− .780	− .230	− .208	− .252	− .572	.465	− .255	.080	− .248
22	Management rate of mental patients	− 1.679	.108	.641	.060	.065	− .177	.201	− .156	− .260
23	Maternal systematic management rate	− 1.370	− .314	.681	− .399	.060	.001	− .122	.151	− .270



	Component 1	Component 2	Component 3	Component 4	Component 5	Component 6	Component 7	Component 8	Total
urban	-0.120	-0.925	0.588	-0.176	-0.717	-0.078	0.378	-0.120	-0.128
suburban	0.077	0.597	-0.380	0.113	0.463	0.050	-0.244	0.078	0.083
total	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Fig. 1 Principal component analysis of basic public health service utilization of community health service centers in urban and suburban areas of Shanghai from 2009 to 2014

rate of people > 70 years of age in urban areas were higher than those in the suburbs, while their annual growth rates were lower than in the suburbs. The systematic management rates of children < 6 years of age and health examination rate were lower in urban areas than in the suburbs, while their annual growth rate was higher than in the suburbs. This is in contradiction with the findings of Feng et al. (2013)) and Song et al. (2012). Indeed, our study suggests that public health services in Shanghai urban and suburban areas are effective and have achieved the purpose of equalization to a certain extent, so the existing policies should be maintained and continuously implemented.

Effectiveness indicators of rehabilitation services were lower in urban areas than in the suburbs. Some authors consider that there is no significant difference in the prevalence of mental disease between urban and rural areas, but it has not yet been related to comparative data in Shanghai (Li et al. 2014). Studies by Yang et al. (2015) and Jiang et al. (2013) support the present study and showed that the registration rates of patients with serious mental disease were lower in Hebei Province, and urban areas were below compared with rural/suburban areas. Standardizing the management of psychiatric patients is helpful to improve their quality of life. Wan (2014) and Zou et al. (2013) pointed that, to some extent, the rehabilitation services for the disabled in China showed a regional differentiation trend affected by the level of economic development. The present study suggests that the implementation of rehabilitation services in Shanghai urban areas was not as good as in the suburbs, in contradiction with a study by Zhang (2007). Nevertheless, this may be related to national and regional policy support in recent years and to a certain extent, it reflects the connotation of equalization of basic public health services. Hence, irrespective of the area (urban or suburbs), we should maintain the policy support, propaganda, and education for patients with psychiatric diseases and disability, improve rehabilitation facilities and conditions, make full use of existing resources to provide rehabilitation services, and improve the participating consciousness and ability for psychiatric patients, disabled persons, and their families and caregivers (Mao 2014).

Effectiveness indicators of health education services were higher in urban areas than in the suburbs. Shi et al. (2012) and Li et al. (2016) showed that health literacy of suburban residents was lower than that of urban areas, and increasing the popularization of health education knowledge in the suburbs could improve consciousness and ability of disease prevention and save medical expenses. Rasu et al. (2015) and other authors in the USA also showed that there was a negative correlation between health literacy and health care utilization. Therefore, public health strategies for improving health education among people with low health literacy may help improve health status and reduce unnecessary medical and health care costs.

The average life expectancy was higher in urban areas than in the suburbs. Since the beginning of the twenty-first century, with the change of disease spectrum and death spectrum of Chinese, chronic non-communicable diseases gradually replaced infectious diseases as the main factors affecting life expectancy of urban and rural/suburban residents. Cai (2012)) pointed out that the urban-rural gap of life expectancy has been gradually narrowing from 1990 to 2005. In China, the growth rate of underdeveloped area was higher than in the developed regions and health inequality was effectively alleviated, which was roughly the same as with the rest of the world. This is closely related to the significant improvement in public health conditions undoubtedly, but there is still a

wide gap between urban and rural areas (Wang and Li 2008). Therefore, the suburbs should pay more attention to prevention and control of chronic non-communicable diseases and advocating a healthy lifestyle and good behavior to narrow the gap of life expectancy between urban and suburban residents.

In this study, the accumulated variance contribution rates of the first eight principal components reached 72.304% in the principal component analysis. Urban areas had four principal component scores significantly lower than in the suburbs. It has also been suggested that by geographical location, economic income, and other factors, community service center as the first hospital was more popular in suburban residents due to convenient medical treatment, lower cost, and other advantages (Shi et al. 2012; Wang et al. 2013). These statistical results were consistent with the National Bureau of statistics of China (Anonymous 2016).Our study demonstrated that the effects of basic public health services in urban and suburban of Shanghai have gradually emerged; suburban residents gradually enjoy equal basic public health services with people in the urban area, achieving the goal of equalization to a certain extent and improving service accessibility and utilization efficiency; so, the existing policies should be maintained for continuous implementation and ultimately to achieve the goal of primary health care for everyone (General Office of the State Council, PRC 2015).

The present study has limitations. It is worth noting that we only analyzed quality status of the basic public health service utilization in urban and suburban areas according to the variables in the community health service center databases, and further discussion should be taken on other factors outside the database that may affect the quality of basic public health service utilization. Due to the limitation of space, the paper that related to health resource allocation and basic medical service utilization in the study will be submitted separately. In the discussion of resource allocation, relationship between community health service quantity, and the number of practicing physicians in urban and suburban areas, accounting for number of practicing physicians and diagnosis and treatment visits would be not mentioned in this article.

In conclusion, prevention service, health care service, health education service, and population health index indicators of urban areas were better than those of the suburbs, and effectiveness indicator of rehabilitation service in urban areas was lower than that of the suburbs. There is an imbalance of basic public health service utilization between urban and suburban areas. The health administrative department should solve the problem of unbalanced development between urban and suburban institutions, in order to promote and realize the goal of equalization of basic public health service utilization between urban and suburban areas. The current health promotion strategies are effective since indexes improved over time, but some improvements could be done regarding specific aspects.

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Compliance with ethical standards

Competing interests All authors declare that they have no competing interests.

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