Trends in access to health services and financial protection in China between 2003 and 2011: a cross-sectional study

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Summary

Background In the past decade, the Government of China initiated health-care reforms to achieve universal access to health care by 2020. We assessed trends in health-care access and financial protection between 2003, and 2011, nationwide.

Methods We used data from the 2003, 2008, and 2011 National Health Services Survey (NHSS), which used multistage stratified cluster sampling to select 94 of 2859 counties from China's 31 provinces and municipalities. The 2011 survey was done with a subset of the NHSS sampling frame to monitor key indicators after the national health-care reforms were announced in 2009. Three sets of indicators were chosen to measure trends in access to coverage, health-care activities, and financial protection. Data were disaggregated by urban or rural residence and by three geographical regions: east, central, and west, and by household income. We examined change in equity across and within regions.

Findings The number of households interviewed was 57 023 in 2003, 56 456 in 2008, and 18 822 in 2011. Response rates were 98·3%, 95·0%, and 95·5%, respectively. The number of individuals interviewed was 193 689 in 2003, 177 501 in 2008, and 59 835 in 2011. Between 2003 and 2011, insurance coverage increased from 29·7% (57 526 of 193 689) to 95·7% (57 262 of 59 835, p<0·0001). The average share of inpatient costs reimbursed from insurance increased from 14·4 (13·7–15·1) in 2003 to 46·9 (44·7–49·1) in 2011 (p<0·0001). Hospital delivery rates averaged 95·8% (1219 of 1272) in 2011. Hospital admissions increased 2·5 times to 8·8% (5288 of 59 835, p<0·0001) in 2011 from 3·6% (6981 of 193 689) in 2003. 12·9% of households (2425 of 18 800) had catastrophic health expenses in 2011. Caesarean section rates increased from 19·2% (736 of 3835) to 36·3% (443 of 1221, p<0·0001) between 2003 and 2011.

Interpretation Remarkable increases in insurance coverage and inpatient reimbursement were accompanied by increased use and coverage of health care. Important advances have been made in achieving equal access to services and insurance coverage across and within regions. However, these increases have not been accompanied by reductions in catastrophic health expenses. With the achievement of basic health-services coverage, future challenges include stronger risk protection, and greater efficiency and quality of care.

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Introduction

The changes in China's health system in the past few decades have been remarkable. After 1978, the government's economic liberalisation policies led to rapid economic growth and poverty reduction. However, the performance of the health system did not improve at the same pace as did the economy.[1–3] Local governments were given the responsibility for health care, and user fees were implemented as public funding decreased. Sales of medicines and services became the main source of operational funds for public health facilities. By 2001, 60% of total health expenditures were out-of-pocket.[4] Access to health care became more difficult for those who could not pay. Because of the need to attract private individual spending, the health-service sector expanded in urban areas. Growing inequalities between rural and urban areas in health-care use and health outcomes were reported.[5,6] In response, insurance reforms were initiated between 2003 and 2008 to achieve better access and risk protection. The appendix describes the evolution of the major health-insurance programmes,[7–9] and the changes in coverage.

A comprehensive reform of the health-care system was however recognised to be needed. Pilots were undertaken to study how essential health services could be financed and delivered.[10] After careful consideration, the State Council announced in 2009 a systematic plan to achieve universal coverage by 2020.[11] Between 2009 and 2011, the reforms focused on five areas: service delivery, essential medicines, public health, insurance, and public hospital reform (appendix).[12] By mid-2011, the government announced its intention to increase investments in the 3-year plan to 1·13 trillion CN¥ (US$173·8 billion, 6·5 ¥ per $).[13]

Crucial questions remain about the response to major reforms and the large influx of additional resources. Monitoring systems have been put into place to see how the reforms are progressing. This study provides up-to-date evidence of trends in access to health services and financial protection between 2003 and 2011, and of

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whether inequalities across regions and income groups have decreased with time.

Methods

Study design and data sources

All three rounds (2003, 2008, and 2011) of the National Health Services Survey (NHSS) used in this study were done with a multistage cluster sampling method, stratified by province, in which 94 counties in China's 31 provinces, autonomous regions, and municipalities were selected from 2859 counties. The NHSS has been done at 5-year intervals since 1993; the 2003 survey was done in September and October, and the 2008 and 2011 surveys were both done in June and July. The 2011 survey was done with a subset of the NHSS sampling frame to monitor key indicators after the national health-care reform was announced in early 2009. In every county, five townships were selected within which two villages were selected. In 2003 and 2008, 60 households were selected in each village; and in 2011, 20 households were selected in each village. The institutional review board of the Chinese National Bureau of Statistics provided review and ethics approval of the survey. All respondents were read a statement that explained the purpose of the survey and gave consent to continue.

Procedures

Local medical workers did the interviews, and their supervisors were doctors from township hospitals or higher-level health institutions. If a household was not at home, the team returned to complete the survey up to three times. Additionally, advertising was done to ensure that community members knew when the survey would take place. 5% of the households were revisited. There were eight questions for the re-interview, including household composition, presence of selected household assets, and distance to the nearest health institution. The consistency between survey and re-interview survey was

	2003		2008		2011	
	n	% (95% CI)	n	% (95% CI)	n	% (95% CI)
Households	57 023	..	56 456	..	18 822	..
Individuals interviewed	193 689	..	177 501	..	59 835	..
Response rate	..	98·3%	..	95·0%	..	95·5%
Residence						
Urban	49 698	25·7% (25·3–26·0)	46 510	26·2% (25·8–26·6)	15 949	26·7% (26·0–27·3)
Rural	143 991	74·3% (74·1–74·6)	130 991	73·8% (73·6–74·0)	43 886	73·3% (72·9–73·8)
Region						
East	63 284	32·7% (32·3–33·0)	58 989	33·2% (32·9–33·6)	19 840	33·2% (32·5–33·8)
Central	54 268	28·0% (27·6–28·4)	50 217	28·3% (27·9–28·7)	17 042	28·5% (27·8–29·2)
West	76 137	39·3% (39·0–39·7)	68 295	38·5% (38·1–38·8)	22 953	38·4% (37·7–39·0)
Age, years						
<5	9297	4·8% (4·4–5·2)	9763	5·5% (5·1–6·0)	3589	6·0% (5·2–6·8)
5–14	30 409	15·7% (15·3–16·1)	21 655	12·2% (11·8–12·6)	6408	10·7% (10·0–11·5)
15–64	135 582	70·0% (69·8–70·2)	125 848	70·9% (70·7–71·2)	42 430	70·9% (70·5–71·3)
≥65	18 400	9·5% (9·1–9·9)	20 413	11·5% (11·1–11·9)	7407	12·4% (11·6–13·1)
Education						
None	36 414	18·8% (18·4–19·2)	27 513	15·5% (15·1–15·9)	7769	13·0% (12·2–13·7)
Primary	51 134	26·4% (26·0–26·8)	46 860	26·4% (26·0–26·8)	15 817	26·4% (25·8–27·1)
Junior high	66 242	34·2% (33·8–34·6)	63 013	35·5% (35·1–35·9)	21 946	36·7% (36·0–37·3)
Senior high	28 860	14·9% (14·5–15·3)	28 400	16·0% (15·6–16·4)	9590	16·0% (15·3–16·8)
College	11 040	5·7% (5·3–6·1)	11 715	6·6% (6·2–7·1)	4698	7·9% (7·1–8·6)
Employment						
Unemployed or semi-employed	18 788	9·7% (9·3–10·1)	26 980	15·2% (14·8–15·6)	10 507	17·6% (16·8–18·3)
Retired	14 914	7·7% (7·3–8·2)	17 040	9·6% (9·2–10·0)	6244	10·4% (9·7–11·2)
Student	12 590	6·5% (6·1–7·0)	12 425	7·0% (6·6–7·5)	3388	5·7% (4·9–6·4)
Farmer	117 376	60·6% (60·3–60·9)	83 248	46·9% (46·6–47·2)	24 514	41·0% (40·4–41·6)
Other employment	30 022	15·5% (15·1–15·9)	37 808	21·3% (20·9–21·7)	15 181	25·4% (24·7–26·1)
Household annual income (mean, 95% CI)						
Urban	16 811	US$2339 (2302–2375)	16 802	US$3191 (3140–3238)	5621	US$4761 (4565–4956)
Rural	40 212	US$939 (929–948)	39 654	US$1684 (1666–1702)	13 201	US$2587 (2523–2651)

Data are number and % (95% CI) unless otherwise stated. Household income adjusted for inflation and based on 2003 Yuan values.

Table 1: **Characteristics of survey respondents—from the National Health Services Survey of 2003, 2008, and 2011**

high (95%). The comparison of the age distribution of the NHSS 2008 (Delta dissimilarity index and Gini concentration index) with that of the 2007 national sampling survey of population change, using Myer's index and household size, showed that the sample is representative of the national population for age and population structure.

The interviews were done with a structured questionnaire. Designed and implemented every 5 years since 1993, the questionnaire has demonstrated consistency and reliability over time.[5,6] Within every household, all members aged 15 years and older were interviewed, and questions about children younger than 15 years were answered by adult family members.

Three sets of indicators were chosen to measure trends in access and coverage, health-care activities, and financial protection (appendix). These indicators were measured in the same way in every round, showed reliability across surveys, and were selected to monitor progress towards the health-care reform goals.

Data were disaggregated by urban or rural residence and three geographic regions: east, central, and west (appendix). The sampling design did not aim for provincial-level estimates. Data were also disaggregated by (self-reported) household income. To generate income quartiles, we measured total disposable income using household reports of wages, government subsidies received, and any other income. In rural areas, business and agricultural investments were subtracted from income.

We examined changes in equity across and within regions for a set of seven indicators: physical access, use of outpatient care, antenatal care, hospital delivery, health-insurance coverage, inpatient reimbursement, and households with catastrophic expenses. The indicators were chosen because of accuracy in measurement, special interest from an equity perspective, and sufficient sample sizes to detect changes by region and income.

To study the change across regions, the set of comparators were rural and urban areas, income

	2003			2008			2011			p value*	Annual rate of change	
	N	n	% (95% CI)	N	n	% (95% CI)	N	n	% (95% CI)		2003–08	2008–11
Physical access to health facility												
All	57 023	46 012	80·7% (80·3–81·0)	56 456	45 329	80·3% (80·0–80·6)	18 822	15 679	83·3% (82·8–83·8)	<0·0001	–0·1%	1·2%
Rural	40 212	30 684	76·3% (75·9–76·7)	39 654	29 966	75·6% (75·2–76·0)	13 201	10 667	80·8% (80·1–81·5)	<0·0001	–0·2%	2·2%
Urban	16 811	15 305	91·0% (90·6–91·5)	16 802	15 363	91·4% (91·0–91·9)	5621	5012	89·2% (88·4–90·0)	<0·0001	0·1%	–0·8%
West	21 052	14 851	70·5% (69·9–71·2)	20 459	14 455	70·7% (70·0–71·3)	6798	5093	74·9% (73·9–76·0)	<0·0001	0·0%	2·0%
Central	16 779	14 262	85·0% (84·5–85·5)	16 799	13 675	81·4% (80·8–82·0)	5606	4777	85·2% (84·3–86·2)	<0·0001	–0·9%	1·5%
East	19 192	16 876	87·9% (87·5–88·4)	19 198	17 199	89·6% (89·2–90·0)	6418	5809	90·5% (89·8–91·2)	<0·0001	0·4%	0·3%
Use of outpatient care												
All	193 689	25 905	13·4% (13·1–13·6)	177 501	25 813	14·5% (14·2–14·8)	59 835	8882	14·8% (14·4–15·3)	<0·0001	1·8%	0·7%
Rural	143 991	20 036	13·9% (13·6–14·2)	130 991	19 899	15·2% (14·8–15·5)	43 886	6704	15·3% (14·7–15·9)	<0·0001	1·8%	0·2%
Urban	49 698	5869	11·8% (11·3–12·3)	46 510	5914	12·7% (12·1–13·3)	15 949	2178	13·7% (12·8–14·6)	0·0017	1·6%	2·4%
West	76 137	10 980	14·4% (14·0–14·9)	68 295	9976	14·6% (14·1–15·1)	22 953	3528	15·4% (14·6–16·2)	0·1248	0·3%	1·7%
Central	54 268	5723	10·5% (10·1–11·0)	50 217	6212	12·4% (11·9–12·9)	17 042	2351	13·8% (12·9–14·7)	<0·0001	3·4%	3·6%
East	63 284	9202	14·5% (14·0–15·1)	58 989	9625	16·3% (15·8–16·9)	19 840	3003	15·1% (14·3–16·0)	<0·0001	2·4%	–2·5%
Five or more antenatal visits												
All	3852	1664	43·2% (41·6–44·8)	3666	1958	53·4% (51·8–55·0)	1272	799	62·8% (60·2–65·5)	<0·0001	4·5%	5·4%
Rural	3157	1130	35·8% (34·1–37·5)	2974	1397	47·0% (45·2–48·8)	993	586	59·0% (55·9–62·1)	<0·0001	5·7%	7·6%
Urban	695	534	76·8% (73·7–80·0)	692	561	81·1% (78·1–84·0)	279	214	76·8% (71·7–81·8)	0·11	1·1%	–1·8%
West	1710	651	38·1% (35·8–40·4)	1492	718	48·1% (45·6–50·7)	487	278	57·1% (52·6– 62·6)	<0·0001	4·9%	5·7%
Central	1033	339	32·8% (30·0–35·7)	957	410	42·8% (39·7–46·0)	373	196	52·6% (47·5–57·8)	<0·0001	5·6%	6·8%
East	1109	674	60·8% (57·9–63·7)	1217	830	68·2% (65·6–70·8)	412	323	78·5% (74·6–82·5)	<0·0001	2·4%	4·7%
Hospital delivery												
All	3852	2824	73·3% (71·9–74·7)	3666	3296	89·9% (88·9–90·9)	1272	1219	95·8% (94·7–97·0)	<0·0001	4·3%	2·1%
Rural	3157	2175	68·9% (67·3–70·5)	2974	2647	89·0% (87·9–90·2)	993	952	95·9% (94·7–97·2)	<0·0001	5·4%	2·5%
Urban	695	648	93·3% (91·5–95·2)	692	648	93·6% (91·8–95·4)	279	266	95·5% (93·0–98·0)	0·44	0·1%	0·7%
West	1710	1028	60·1% (57·8–62·4)	1492	1235	82·8% (80·9–84·7)	487	462	94·8% (92·7–96·8)	<0·0001	6·7%	4·5%
Central	1033	752	72·8% (70·0–75·5)	957	903	94·4% (92·9–95·9)	373	357	95·8% (93·7–97·9)	<0·0001	5·5%	0·5%
East	1109	1042	94·0% (92·6–95·4)	1217	1166	95·8% (93·8–96·3)	412	400	97·0% (95·4–98·7)	0·06	0·4%	0·4%

See appendix for definitions of each indicator and for regional categories. *p values reported for intertemporal differences.

Table 2: **Trends in access to health services in 2003–11 by region**

quartile 1 (poorest) and income quartile 4 (wealthiest), central and eastern regions, and western and eastern regions. Eastern China is the most developed region, and western China the least. For every pair, we divided the frequency for the less advantaged by the more advantaged group to see whether the differences between the two groups had decreased over time. The ratio indicates the gap between the two populations, where 1 implies no gap. The results also report a summary for every comparator group, by calculating the mean for each set of seven by year. To study differences within regions, we focused on the gaps between the poorest and wealthiest income quartiles within the eastern, central, and western regions. To study change within the regions, we presented quartile ratios by dividing the frequency for quartile 1 (poorest) by quartile 4 (wealthiest) to see whether the difference between the two groups has decreased over time. We estimated annual rates of change for 2003 and 2008, and for 2008 and 2011, to see whether the rates changed after 2008 in response to the comprehensive reforms. We also computed the absolute differences.

Statistical analysis

We did statistical analyses in STATA software 9.2. We used a Pearson χ^2 test to test for statistical significance of trends between 2003, 2008, and 2011. We used analysis of variance (ANOVA) to test for significance of the differences in means. We reported significance values at 0·01%, and 95% CIs for percentages.

Role of the funding source

The sponsor of the study had no role in study design, data collection, data analysis, data interpretation, or writing of the report. The first author had full access to all the data in the study and had final responsibility for the decision to submit for publication.

Results

Table 1 presents the number of households interviewed, the response rates, the basic characteristics of the respondents in 2003, 2008, and 2011, which are well balanced for most variables. Household incomes grew annually by 9·2% in urban and 13·1% in rural areas between 2003 and 2011.

Physical access to health services slightly increased between 2008 and 2011, with gains in rural areas, and western and central regions (table 2). Use of outpatient care was fairly similar across China and increased only moderately, mostly during 2003 and 2008. Between 2008 and 2011, increases in use of outpatient care occurred in the central and western regions, and urban areas. Coverage of antenatal care increased sharply by 19·6% between 2003 and 2011 nationwide. The largest annual increases occurred in rural areas, and central and

	2003			2008			2011			p value*	Annual rate of change	
	N	n	% (95% CI)	N	n	% (95% CI)	N	n	% (95% CI)		2003–08	2008–11
Hospital admissions												
All	193 689	6981	3·6% (3·5–3·7)	177 501	12 139	6·8% (6·7–7·0)	59 835	5288	8·8% (8·5–9·2)	<0·0001	13·5%	8·5%
Rural	143 991	4874	3·4% (3·3–3·5)	130 991	8846	6·8% (6·6–6·9)	43 886	3685	8·4% (8·0–8·8)	<0·0001	14·5%	7·3%
Urban	49 698	2107	4·2% (4·0–4·5)	46 510	3293	7·1% (6·8–7·4)	15 949	1603	10·1% (9·2–10·9)	<0·0001	10·8%	11·7%
West	76 137	2937	3·9% (3·7–4·0)	68 295	4940	7·2% (7·0–7·5)	22 953	2132	9·3% (8·7–9·8)	<0·0001	13·2%	8·3%
Central	54 268	1842	3·4% (3·2–3·6)	50 217	3568	7·1% (6·8–7·4)	17 042	1621	9·5% (8·8–10·3)	<0·0001	15·6%	9·7%
East	63 284	2202	3·5% (3·3–3·7)	58 989	3631	6·2% (5·9–6·4)	19 840	1535	7·7% (7·2–8·3)	<0·0001	12·0%	7·6%
Self discharge from hospital												
All	5972	2584	43·3% (42·0–44·5)	9767	3593	36·8% (35·8–37·7)	3966	1262	31·8% (30·4–33·3)	<0·0001	–3·4%	–4·8%
Rural	4196	1972	47·0% (45·5–48·5)	7203	2833	39·3% (38·2–40·5)	2828	952	33·7% (31·9–35·4)	<0·0001	–3·7%	–5·2%
Urban	1776	612	34·5% (32·3–36·7)	2564	760	29·6% (27·9–31·4)	1138	310	27·2% (24·7–29·8)	0·0001	–3·2%	–2·8%
West	2491	1161	46·6% (44·7–48·6)	3934	1557	39·6% (38·1–41·1)	1591	499	31·4% (29·1–33·7)	<0·0001	–3·4%	–7·8%
Central	1570	754	48·0% (45·6–50·5)	2891	1196	41·4% (39·6–43·2)	1203	473	39·3% (36·6–42·1)	<0·0001	–3·1%	–1·7%
East	1911	669	35·0% (32·9–37·2)	2942	840	28·6% (26·9–30·2)	1172	290	24·7% (22·3–27·2)	<0·0001	–4·3%	–4·8%
Caesarean section rate												
All	3835	736	19·2% (18·0–20·4)	3653	1108	30·3% (28·8–31·8)	1221	443	36·3% (33·6–39·0)	<0·0001	9·6%	6·0%
Rural	3142	415	13·2% (12·0–14·4)	2965	741	25·0% (23·4–26·6)	954	318	33·3% (30·3–36·3)	<0·0001	13·4%	9·6%
Urban	693	321	46·3% (42·6–50·0)	688	367	53·3% (49·6–57·1)	267	125	46·8% (40·8–52·8)	0·0221	3·0%	–4·4%
West	1698	184	10·8% (9·4–12·3)	1487	276	18·6% (16·6–20·2)	456	114	25·0% (21·0–29·0)	<0·0001	11·3%	9·9%
Central	1029	215	20·9% (18·4–23·4)	954	338	35·4% (32·4–38·5)	360	161	44·7% (39·6–49·9)	<0·0001	11·1%	7·8%
East	1108	337	30·4% (27·7–33·1)	1212	494	40·8% (38·0–43·5)	405	168	41·5% (36·7–46·3)	<0·0001	6·2%	0·6%

See appendix definitions of each indicator and for regional categories. *p values reported for intertemporal differences.

Table 3: **Trends in health-care activities by region: 2003, 2008, and 2011**

western regions between 2008 and 2011. Hospital delivery rates also increased significantly nationwide. The most rapid increases in hospital delivery occurred between 2003 and 2008, particularly in rural, western, and central regions.

By contrast with use of outpatient care, hospital admissions largely increased from 2003 to 2011 (table 3). On average, hospital admissions increased by 2·5 times by 2011. The largest increases over the 8-year period occurred in the central region and rural areas. Urban areas had the highest hospital admission rates in 2011. Between 2008 and 2011, hospital admissions continued to increase but the pace of change decreased by a third compared with 2003 and 2008. In urban areas, however, the rate of change increased slightly after 2008. Inpatient self-discharge in the preceding year decreased steadily over time. In 2011, the highest rates occured in the central region, where 39% of inpatients self-discharge from hospital. Caesarean section rates continued to increase, although at a slower rate between 2008 and 2011 than between 2003 to 2008. Urban women continued to have the highest rates of caesarean sections. However, the highest increases were found in rural areas, where one in three women delivered by caesarean section compared with 13% in 2003. Similarly, there was a 2·3-times increase in the western region in the 8-year period to 25%.

	2003			2008			2011			p value*	Annual rate of change	
	N	n	% (95% CI)†	N	n	% (95% CI)†	N	n	% (95% CI)†		2003–08	2008–11
Health insurance coverage												
All	193 689	57 526	29·7% (29·6–30·0)	177 501	156 023	87·9% (87·8–88·1)	59 835	57 262	95·7% (95·5–95·8)	<0·0001	22·8%	2·8%
Rural	143 991	30 238	21·0% (20·9–21·3)	130 991	121 822	93·0% (92·9–93·2)	43 886	42 745	97·4% (97·2–97·5)	<0·0001	31·3%	1·5%
Urban	49 698	27 433	55·2% (54·8–55·6)	46 510	34 185	73·5% (73·1–73·9)	15 949	14 498	90·9% (90·4–91·3)	<0·0001	6·0%	7·1%
West	76 137	20 785	27·3% (27·0–27·6)	68 295	61 670	90·3% (90·1–90·5)	22 953	22 173	96·6% (96·3–96·8)	<0·0001	25·2%	2·2%
Central	54 268	12 427	22·9% (22·5–23·2)	50 217	41 278	82·2% (81·9–82·6)	17 042	16 088	94·4% (94·0–94·7)	<0·0001	27·0%	4·6%
East	63 284	24 617	38·9% (38·5–39·3)	58 989	53 090	90·0% (89·7–90·2)	19 840	18 987	95·7% (95·4–96·0)	<0·0001	17·7%	2·1%
Inpatient reimbursement rates (mean, 95% CI)												
All	6018	..	14·4 (13·7–15·1)	8095	..	35·2 (34·6–35·8)	4011	..	46·9 (44·7–49·1)	<0·0001	18·8%	9·6%
Rural	4223	..	5·8 (5·2–6·4)	6112	..	32·9 (32·3–33·6)	2846	..	43·7 (40·7–46·7)	<0·0001	36·4%	9·5%
Urban	1795	..	34·5 (32·8–36·1)	1983	..	41·6 (40·2–42·9)	1165	..	54·6 (52·4–56·7)	<0·0001	3·9%	9·0%
West	2512	..	12·0 (11·0–13·0)	3319	..	37·4 (36·5–38·3)	1609	..	51·2 (49·4–53·0)	<0·0001	23·9%	10·5%
Central	1582	..	12·3 (11·0–13·6)	2349	..	32·1 (31·1–33·1)	1214	..	41·2 (34·6–47·6)	<0·0001	20·2%	8·3%
East	1924	..	19·2 (17·8–20·6)	2427	..	35·3 (34·2–36·4)	1188	..	46·8 (44·7–49·0)	<0·0001	12·8%	9·4%
Self discharge for financial reasons												
All	2584	1643	63·6% (61·8–65·5)	3593	1258	35·0% (33·5–36·6)	1262	353	28·0% (25·5–30·5)	<0·0001	–12·5%	–7·5%
Rural	1972	1321	67·0% (64·9–69·1)	2833	1037	36·6% (34·8–38·4)	941	266	28·3% (25·4–31·4)	<0·0001	–12·7%	–8·6%
Urban	612	323	52·8% (48·8–56·7)	760	222	29·2% (26·0–32·5)	307	83	27·0% (22·0–32·0)	<0·0001	–12·5%	–2·6%
West	1161	747	64·3% (61·6–67·1)	1557	618	39·7% (37·3–42·1)	494	149	30·2% (26·1–34·2)	<0·0001	–10·2%	–9·1%
Central	754	494	65·5% (62·1–68·9)	1196	413	34·5% (31·8–37·2)	469	146	31·1% (27·9–35·3)	<0·0001	–13·5%	–3·5%
East	669	403	60·2% (56·5–64·0)	840	228	27·1% (24·1–30·2)	285	54	19·0% (14·4–23·5)	<0·0001	–16·8%	–11·9%
Households with catastrophic health expenses												
All	56 894	6941	12·2% (12·0–12·5)	56 396	7895	14·0% (13·7–14·3)	18 800	2425	12·9% (12·5–13·4)	<0·0001	2·8%	–2·6%
Rural	33 498	4556	13·6% (13·3–13·9)	39 631	5984	15·1% (14·7–15·4)	13 194	1821	13·8% (13·2–14·4)	<0·0001	2·2%	–3·0%
Urban	16 780	1510	9·0% (8·6–9·4)	16 765	1894	11·3% (10·8–11·8)	5606	611	10·9% (10·1–11·7)	0·0002	4·8%	–1·2%
West	21 003	2646	12·6% (12·2–13·1)	20 449	3129	15·3% (14·8–15·8)	6788	903	13·3% (12·5–14·1)	<0·0001	4·0%	–4·7%
Central	16 727	1991	11·9% (11·5–12·4)	16 784	2383	14·2% (13·7–14·7)	5603	768	13·7% (12·8–14·6)	<0·0001	3·7%	–1·2%
East	19 164	2319	12·1% (11·6–12·6)	19 163	2376	12·4% (11·9–12·9)	6409	763	11·9% (11·1–12·7)	0·50	0·5%	–1·4%
Health spending as a share of total household expenditures (mean, 95% CI)												
All	56 362	..	11·3 (11·2–11·4)	55 997	..	12·0 (11·9–12·2)	18 794	..	12·9 (12·7–13·1)	0·0006	1·4%	2·3%
Rural	40 025	..	12·1 (12·0–12·2)	39 463	..	12·6 (12·5–12·8)	13 196	..	13·3 (13·1–13·6)	<0·0001	0·9%	1·8%
Urban	16 337	..	9·3 (9·1–9·5)	16 534	..	10·6 (10·4–10·8)	5598	..	11·9 (11·5–12·2)	0·0009	2·8%	3·7%
West	20 828	..	11·9 (11·7–12·1)	20 314	..	13·0 (12·8–13·2)	6793	..	13·1 (12·8–13·5)	0·0003	1·9%	0·3%
Central	16 586	..	11·0 (10·8–11·2)	16 604	..	11·8 (11·6–12·1)	5604	..	13·2 (12·8–13·6)	<0·0001	1·6%	3·6%
East	18 948	..	10·9 (10·7–11·1)	19 079	..	11·2 (11·0–11·4)	6397	..	12·4 (12·1–12·8)	<0·0001	0·6%	3·5%

See appendix for definitions of each indicator and for regional categories. *p values reported for intertemporal differences. †Dara are % (95% CI) or mean (95% CI).

Table 4: **Trends towards financial protection by region: 2003, 2008, and 2011**

With regard to financial protection, rapid increases in health insurance coverage have taken place since 2003 (table 4, appendix). The largest gains were made between 2003 and 2008. For rural residents, insurance coverage increased 4·6-times between 2003 and 2011, with 89·9% of rural residents covered by the NCMS programme in 2011 (appendix). Similarly, in the central region, coverage increased from 23% in 2003 to 94% in 2011. Insurance coverage among urban residents increased steadily throughout the 8-year period. In 2011, urban coverage remained slightly lower than rural coverage.

Inpatient reimbursement rates increased by more than three-times on average, and by 7·5 times in rural areas (p<0·0001; table 4). Similar to insurance coverage, the largest gains were made between 2003 and 2008, although increases continued after 2008 in western and rural regions. By 2011, the highest inpatient reimbursement rates on average were observed in urban areas (54·6%). Among inpatients that self-discharged, the proportion of those who did so for financial reasons decreased by more than half, with the largest decreases occurring between 2003 and 2008 (table 4). Decreases continued after 2008 but at a slower rate. With the total inpatient population as the denominator, those that self-discharged for financial reasons decreased from 27·5% (1643 of 5972) to 8·9% (353 of 3966) between 2003 and 2011 (p<0·0001).

The percent of households experiencing catastrophic health expenses increased by 2·8% annually between 2003 and 2008, and decreased by 2·6% annually between 2008 and 2011 (table 4). In 2011, the highest rates were found in the rural and the central region. Health spending as a share of total household spending increased between 2003 and 2011 (p=0·0006). The rate of increase was higher after 2008 than between 2003 and 2008. More rapid increases occurred in urban areas, and central and eastern regions between 2008 and 2011. Households dedicated on average 12·9% of their annual expenditure to health in 2011.

Table 5 describes whether the differences in access and financial protection between regions have reduced over time. In every section, ratios are presented for seven indicators to measure the differences between the comparators; 1 implies no gap. The appendix shows the absolute differences between these comparators. The mean difference between rural and urban for the seven indicators greatly decreased between 2003 and 2008, and improved further in 2011 (table 5). Dramatic progress was made for insurance coverage and inpatient reimbursement in rural areas between 2003 and 2008, and rural coverage now exceeds urban coverage. Strong progress was made after 2008 on increasing access to antenatal care in rural areas. The indicator for hospital delivery has reached parity, with no significant difference detected between rural and urban areas.

The gap between the poorest and best-off quartiles also decreased between 2003 and 2011 (table 5). By 2011, four of the seven indicators reached parity, with no significant differences between the poorest and wealthiest groups. Two additional indicators were near parity, but differences were statistically significant. The only exception is the percent of households with catastrophic health expenses; progress declined sharply between 2003 and 2008. By 2011, poor households experienced catastrophic health expenses twice as often as wealthier households.

	Ratio between less advantaged and more advantaged group						Absolute change between 2003 and 2011
	2003	p value	2008	p value	2011	p value	
Rural:urban							
Physical access to a facility	0·84	<0·0001	0·83	<0·0001	0·91	<0·0001	−6·4
Outpatient use	1·18	<0·0001	1·19	<0·0001	1·12	0·0036	0·5
Antenatal care (5+ visits)	0·47	<0·0001	0·58	<0·0001	0·77	<0·0001	−23·2
Hospital delivery	0·74	<0·0001	0·95	0·0003	1·00	0·60	−24·8
Health insurance coverage	0·38	<0·0001	1·27	<0·0001	1·07	<0·0001	−40·7
Inpatient reimbursement	0·17	<0·0001	0·79	<0·0001	0·80	<0·0001	−17·8
Catastrophic expenses (inverse)	0·66	<0·0001	0·75	<0·0001	0·79	<0·0001	−1·7
Mean rural:urban ratio	0·63		0·91		0·92		
Quartile 1:quartile 4							
Physical access to a facility	0·95	<0·0001	0·94	<0·0001	0·95	<0·0001	−0·1
Outpatient utilisation	0·86	0·0008	0·94	0·0283	0·98	0·71	−1·8
Antenatal care (5+ visits)	0·74	<0·0001	0·79	<0·0001	0·94	0·42	−10·2
Hospital delivery	0·91	0·0013	0·97	0·14	1·01	0·59	−7·8
Health insurance coverage	0·63	<0·0001	0·93	<0·0001	0·98	<0·0001	−12·1
Inpatient reimbursement	0·37	<0·0001	0·85	<0·0001	0·97	0·34	−11·8
Catastrophic expenses (inverse)	0·54	<0·0001	0·50	<0·0001	0·49	<0·0001	1·6
Mean quartile 1:quartile 4 ratio	0·72		0·85		0·90		
Central:east							
Physical access to a facility	0·97	<0·0001	0·91	<0·0001	0·94	<0·0001	2·4
Outpatient utilisation	0·73	<0·0001	0·76	<0·0001	0·91	0·0325	−2·7
Antenatal care (5+ visits)	0·54	<0·0001	0·63	<0·0001	0·67	<0·0001	−2·1
Hospital delivery	0·77	<0·0001	0·99	0·14	0·99	0·0466	−20·0
Health insurance coverage	0·59	<0·0001	0·91	<0·0001	0·99	<0·0001	−14·7
Inpatient reimbursement	0·64	<0·0001	0·91	<0·0001	0·88	0·11	−1·2
Catastrophic expenses (inverse)	1·01	0·66	0·87	<0·0001	0·87	0·0031	−2·0
Mean central:east ratio	0·75		0·85		0·89		
West:east							
Physical access to a facility	0·80	<0·0001	0·79	<0·0001	0·83	<0·0001	−1·8
Outpatient utilisation	0·99	0·72	0·90	<0·0001	1·02	0·69	−0·4
Antenatal care (5+ visits)	0·63	<0·0001	0·71	<0·0001	0·73	<0·0001	−1·3
Hospital delivery	0·64	<0·0001	0·86	<0·0001	0·98	0·0003	−31·7
Health insurance coverage	0·70	<0·0001	1·00	0·0491	1·01	<0·0001	−12·5
Inpatient reimbursement	0·62	<0·0001	1·06	0·0231	1·09	0·0024	−11·6
Catastrophic expenses (inverse)	0·96	0·10	0·81	0·0001	0·90	0·0192	−0·8
Mean west:east ratio	0·76		0·88		0·94		

Ratios generated by dividing the frequency for the less advantaged by the more advantaged group. The ratio indicates the gap between the comparison group—where 1 implies no gap. The mean ratio is calculated for each set of seven indicators by year. See appendix for definitions of each indicator and for regional categories. p values test for significant differences for each indicator and each year for the comparison group.

Table 5: **Trends in equity (ratio between comparison groups) in access and financial protection across regions and income groups: 2003, 2008, and 2011**

The gaps between the western and central regions with the eastern region also substantially decreased in the last 8 years (table 5). Most indicators improved, and a higher rate of improvement occurred during 2003 and 2008. Antenatal care coverage continued to have the largest gaps between central and east and between west and east. Regional differences in the percentage of households with catastrophic health expenses are small compared with income and differences between rural abnd urban residence.

The figure shows the absolute differences between the poorest and best-off quartiles within the eastern, central, and western regions for five indicators. For hospital delivery, a large reduction occurred in the gap between poor and wealthy in all regions (figure A). Parity was achieved in the east and central regions in 2008, and in the western region by 2011. All regions have high institutional delivery rates by 2011. For antenatal care (figure B), there were no gaps between quartiles in the eastern and western regions; but less change occurred in the gap for the central region. Large regional differences remain, with a 34·9% point difference in coverage between the poorest in the central region and the wealthiest in the eastern region (appendix).

All groups showed rapid increases in insurance coverage and inpatient reimbursements (figure). Parity

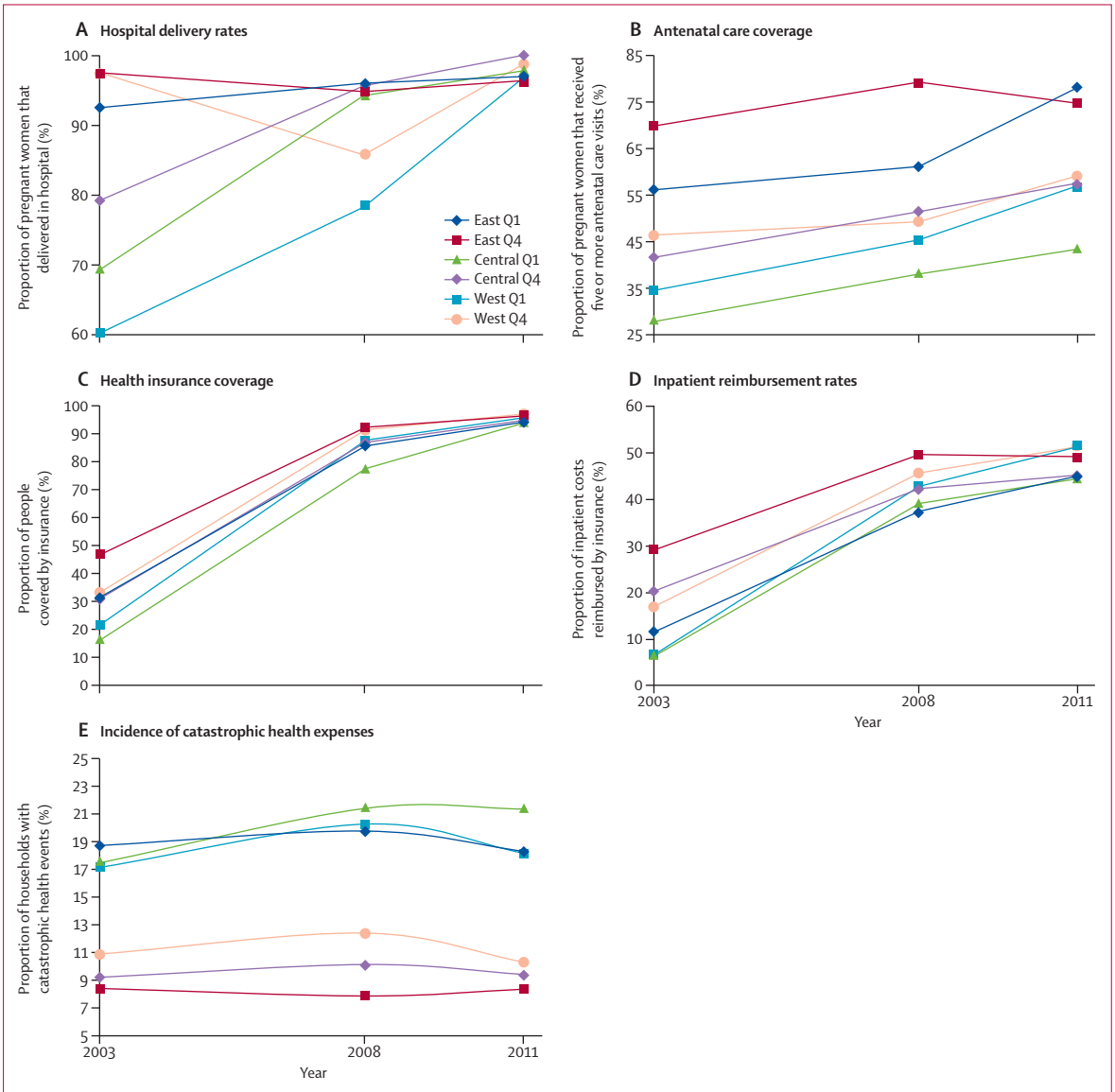


Figure: **Trends in equity between quartile 1 (Q1, poor) and quartile 4 (Q4, least poor) within the eastern, central, and western regions for selected indicators of access and financial protection: 2003, 2008, and 2011**

(A) Hospital delivery rates. (B) Antenatal care coverage. (C) Health insurance coverage. (D) Inpatient reimbursement rates. (E) Incidence of catastrophic health expenses. See appendix for definitions of each indicator and for regional categories.

has been achieved for reimbursement rates in all three regions, and for health insurance coverage in the central region. Although significant, the differences in insurance coverage between the income quartiles are small for the eastern and western regions (appendix). Finally, the gaps for catastrophic expenses persisted throughout the eight years, with little progress being made (figure).

Discussion

Data from three nationally representative surveys indicate positive trends in access to and use of health services since 2003. The strongest increases could be seen in hospital admissions, hospital delivery, and antenatal care, and for insurance coverage and inpatient reimbursement rates. An impressive achievement is the expansion of health-insurance coverage to 95·7%, covering about 1·28 billion people. Physical access to health services was achieved for 83·3% of the population.

These trends also describe substantial gains towards the reduction of inequalities in access and financial protection across regions and between the poorest and wealthiest groups. By 2011, the differences between higher and lower incomes had been reduced or eliminated for outpatient and inpatient use, antenatal care, hospital delivery, and inpatient reimbursement. Gaps in access to hospital delivery no longer exist between rural and urban regions.

Many of these changes occurred between 2003 and 2008, before the comprehensive reforms initiated in 2009. The greatest gains in insurance coverage for rural residents occurred through the rollout of the NCMS programme between 2003 and 2008. Similarly, the rates of inpatient reimbursement increased rapidly before 2008. The expansion of the insurance programme seems to have been instrumental in narrowing the inequalities in access between rural and urban areas, between western and central regions in comparison with the east, and between poorer and wealthier income groups. In urban residents, coverage increased throughout the 8-year period, which corresponded with the more gradual expansion of the urban resident's health insurance programme.

After 2008, further gains were made in public health, such as increased coverage and reduced inequity for antenatal care and hospital deliveries, particularly in rural areas and western and central regions. This change could be explained partly by the basic and major public health reforms, including subsidies for 17·81 million rural pregnant women to deliver in hospital. Additionally, inpatient reimbursement rates continued to increase rapidly after 2008, as did hospital admissions and household spending. Notably, inpatient self-discharge declined after 2008. Whereas parity has been achieved in reimbursement rates between poorer and wealthier households, it should be noted that poor households would face a greater financial burden.

Despite impressive achievements in insurance coverage, little change occurred for some key indicators of financial protection. Whereas inpatient reimbursement rates increased rapidly, they average less than half of the cost of an inpatient visit. Inpatient self-discharge remains common. Health spending as a share of total household expenditures continued to rise, with higher increases after 2008. Little change occurred in the percent of households having catastrophic health expenses, averaging 12·9% in 2011. This proportion amounts to about 173 million people living in households facing high-cost health expenses. Poor households had catastrophic health expenses twice as often as wealthier households. We do not assess whether high health expenditures are associated with poverty, although such high health shocks are very likely to contribute to poverty. One of the major drivers behind the reform was to increase protection against catastrophic events and reduce out-of-pocket health spending, which has led to high savings' rates in households. Urban households typically save an estimated 30% of disposable income.[14] Such high savings rates provide self-insurance against health shocks, especially among older adults. As yet, the large public investments do not seem to have offered strong financial protection for households against catastrophic health events.

Rural households are particularly vulnerable, with high rates of catastrophic spending and household health spending. Both the rural and urban residents' insurance schemes aimed for broad population coverage in the initial stages of reform. With the successful expansion in coverage and increases in government subsidies, there is an opportunity to examine in more detail the optimum benefits package, lower the deductibles and co-payments, and set higher reimbursement rates and ceilings. The annual premiums for the UR-BMI and NCMS programmes are mainly from central and local governments. Local government contributions vary by economic capacity, thus leading to variations in benefits packages. With the rollout of the reforms, a higher share of resources from central and provincial governments will be needed to overcome variations in benefits related to local economic capacity.

The insurance programmes set ceilings for maximum levels of patient reimbursement, which applies largely to inpatient care. For the rural and urban resident insurance programmes, the ceilings have been increased recently, which might help to reduce catastrophic expenses in the future. In 2007, the maximum reimbursement cap for inpatient care averaged about US$3600. More recently, the government has established a minimum cap of 50 000 Yuan ($7692). It is recognised that the reimbursement caps limit the system's ability to offer financial protection for catastrophic events. In 2011, pilot programmes were also initiated for covering the costs of specific conditions with very high health-care costs, such as childhood leukaemia and congenital heart disease whereby patients receive a subsidy that covers an additional 20% of treatment costs. An expansion is

envisioned to cover kidney dialysis and cervical and breast cancer therapies.

Another striking trend is the increase in hospital admissions by 2·5 times in the 8-year period. This trend contrasts with the overall reform goals, which emphasise higher use of primary level services and large-scale investments in the reconstruction of the primary care system. However, the design of the insurance programme does not provide financial incentives to support a shift in patients' care-seeking behaviour from hospital outpatient departments to primary care facilities. Some municipalities have initiated financial incentives to promote primary care use, including higher levels of reimbursement and outpatient coverage for primary care services. Overall, however, most programmes mainly reimburse for inpatient care. Therefore, large increases in hospital admission rates could be associated with reimbursement policies that focus on inpatient coverage. Additionally, the supply of health services expanded considerably during the same period. The number of general and specialist hospitals increased by 30% between 2000 and 2010.[15] Such a large increase in the supply of hospitals might have induced demand for their services.

The survey includes only a few indicators to assess health-care activities. Caesarean section deliveries have reached numbers that exceed clinical need and continue to increase. Although caesarean deliveries decreased in urban areas, increases occurred in rural and the western regions. Quality of care and efficiency should be closely monitored, since the health system does not implement strong controls on quality, volumes of services and medicines prescribed, or hospital fees. Important changes have been made to reform the financing of primary-level facilities, including the implementation of zero-profit mark-up for essential medicines. However, secondary and tertiary hospitals continue to rely on revenues from medicines and diagnostics for financing their operational costs. In 2010, some 4800 government-operated general hospitals generated on average 92·6% of their revenues from the sales of services and medicines, and government subsidies for operational costs covered an additional 7·2%.[16] The pressure to generate operational costs and the fee-for-service system seems to lead to overuse of technology and medicines, and to long lengths of stay (average 12·1 days; data not shown). By contrast, the mean average length of stay for acute care in OECD countries declined from 8·7 to 6·5 days between 1995 and 2007.[17] Policies to increase access to institutional delivery combined with financial incentives to generate revenues might have contributed to the high rates of caesarean sections. This is consistent with results from other studies in China,[18] showing that revenues generated from caesarean deliveries are used to pay for a share of operational costs for hospital delivery units.[18] Experience in other countries shows strong associations between financial incentives and caesarean delivery.[19] Payments for caesarean delivery also contribute to higher health-care costs. Future reforms will most likely focus on improvement of the quality of care received, reduction of the reliance on fee for services, and emphasis of cost-effectiveness in the choice of publicly funded services and medicines.

Monitoring is essential for assessing progress and making adjustments in implementation. The NHSS is an important medium for monitoring the reforms; its strength is consistency in methods and data. The instruments and sampling procedures have remained the same over the years (panel), and this analysis shows the high reliability of the data for many indicators. However, the policy environment and demographics have changed rapidly, which will require changes in the design of the survey instruments in the future. Future surveys could emphasise more on measurement of quality of care and objective health outcomes, especially for non-communicable disorders as the main causes of morbidity and mortality. The data could be fully exploited to assess the effect of health-reform interventions on outcomes. Some vulnerable groups targeted under the health reform, such as migrant workers, might be under-represented in the NHSS sample, as is often the case with household

***Panel:* Research into context**

Systematic review

Our study assesses trends in access and financial protection in China between 2003 and 2011, when a series of health-care reforms were implemented. We referred to existing studies and reviews published in the international literature,[1–3,6–10] and used published government statistical reports.[4,5,11,12,15,16] A previous study[6] reported trends in use of health services between 1993 and 2003, using various datasets. The authors reported gaps across and within regions of China in coverage and access; using a different threshold, they reported high rates of catastrophic expenses in households. Several reviews focused on insurance reforms, showing changes in coverage and use before 2003, or providing qualitative reports of policies implemented between 2003 and 2008.[7–10] To the authors' knowledge, studies examining use and financial protection after 2008 are absent. Based on data from three large national household surveys in 2003, 2008, and 2011, this study provides the most up-to-date and comprehensive description of recent trends in core indicators of access and coverage of health care, and financial protection, which correlate with China's health reforms.

Interpretation

Our national study provides up-to-date evidence of major achievements in more equitable use and coverage during large-scale national health-care reforms in China. The findings are consistent with other studies, in highlighting the continued need for effective financial protection against health shocks. Additionally, we emphasise the importance of expanded efforts in monitoring and assessment of the reforms under a dynamic policy environment in China.

surveys. The lowest income group represents a diverse set of populations. Future studies should describe the specific vulnerabilities of the poorest. Data are based on self-reports and are therefore subject to bias, which could be especially problematic for questions about decision making, such as self-discharge from hospitals. These findings, therefore, need to be interpreted cautiously. In a few cases, external verification was possible. The hospital admission data reported by NHSS is consistent with the increases in admissions reported through the annual health statistical reports.[16] Some trends could be explained partly by other factors, including the rapid increase in household income in both rural and urban areas.

In conclusion, remarkable increases in health insurance coverage and inpatient reimbursement were accompanied by increased use and coverage. The increases in services use are particularly important in rural areas and at hospitals. Major advances have been made in achieving equal access to insurance coverage, inpatient reimbursement, and basic health services, most notably for hospital delivery, and use of outpatient and inpatient care. The increases in health-insurance coverage have not been accompanied by reductions in catastrophic health expenses among households. Greater attention to risk protection is needed, under the plans to expand the depth and scope of the health insurance schemes, as well as alternative ways of paying for services and health-care providers. Stronger emphasis in future surveys should be paid to measuring quality of care, efficiency, and objective health outcomes, particularly for non-communicable conditions.

Contributors

All authors participated in the conception and design of the report and take responsibility for the integrity of the work as a whole. JTB designed the study, and all authors made substantial contributions to the study conception and design, and data analysis and interpretation. JTB and SLB wrote the article and revised it critically for important intellectual content. All authors approve the final version to be published. QM, LX, and YZ take responsibility for acquisition of data, had full access to all the data in the study, and take responsibility for the integrity of the data and the accuracy of the data analysis.

Conflicts of interest

QM, LX, YGX, JCQ, MC, and YX work for the Chinese Ministry of Health, which is also responsible for implementation of the health-care reforms in China. The other authors declare that they have no conflicts of interest.

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