The Relations between the Abolition of the Mandatory Premarital Medical Examination and the Change of Incidence Rates of Birth Defects：a Meta Analysis

Chao Guo, Haochen Wang, Ning Li, Xiaoying Zheng*

Abstract

Objective: To find out the change of birth defects rate before and after the abolition of compulsory premarital check-ups based on the literature review.

Methods: Based on previous literatures, collecting data of BDs and premarital check-ups, extracting cases of perinatal infants and BDs in 2002, 2003 and 2005, in many areas of China. Due to the lag effect of birth, the time of abolition (Oct, 2003) and integrating with monitoring conditions of BDs, merge cases of 2002 and 2003 respectively to compute the incidence rate of BDs. Take them as the control group to compare with the incidence rate of BDs in 2005. Use meta analysis module in STATA 11.0 to analyze incidence rates.

Results: The incidence rates of BDs in 2005, the year after the abolition of the compulsory premarital check-ups, is 1.11 times as that of merged incidence rates of BDs in 2002 and 2003 (D+L pooled RR=1.11，95%CI=1.04~1.18). The difference is statistically significant.

Conclusion: The incidence rate of BDs rose in China after the abolition of the compulsory premarital check-ups. It is necessary to advocate premarital check-ups and to increase the rate of premarital check-ups, in order to alleviate BD conditions in China.

Key words: Premarital check-ups, Incidence rate of birth defects, Meta analysis

1. Introduction

Birth defect is a congenital, physical anomaly which is recognizable at birth, and which is significant enough to be considered as a problem. Birth defects are one of the leading causes of infant deaths, accounting for more than 20% of all infant deaths in

* Corresponding author: Xiaoying Zheng

American 2006 [1]. China is one of countries with the highest incidence rate of birth defects in the world and the incidence rate of birth defects in 2000 was up to 10‰ [2]. "China birth defects prevention report (2012)", which was released on September 12, 2012 by the Ministry of Health of China, shows that the total incidence rate of perinatal birth defects in China is rising, from 10.979 ‰ in 2000 to 15.323‰ in 2011 [3]. In China, the premarital health work is an important content of the "Law of Maternal and Child Health of People's Republic of China". The form of pre-marital medical examination has changed from mandatory to voluntary, since October 1st, 2003, when the new "Marriage Registration Ordinance" was issued [4] . Since the abolition of mandatory premarital medical examination, especially from 2004 to 2005, this examination rate has significantly reduced [5]. How the change of policy affects Chinese maternal and child health care has attracted a lot of attention.

Premarital medical examination includes many aspects, such as spreading healthy baby knowledge, identifying significant genetic disease, specific infectious disease and relevant mental illness, and taking appropriate preventive measures to ensure the health of future generations. Therefore, what effects of decline in the rate of examination caused by abolition of mandatory premarital health examination on birth defects has been concerned and speculated by scholars, the mass and policy makers. However, in recent years, monitoring results of birth defects before and after the abolition of the premarital examination in China are different. Relationships between declining premarital examination rate and birth defects rate are mostly limited to small sample data with mixed results.

In recent years, The monitoring results of the birth defects are different in different parts of China before and after the abolition of the mandatory premarital medical examination, and the studies about the relations between the decrease of the premarital examination rate and the change of the incidence rates of birth defects are mostly limited to small sample data and with mixed results. A meta study showed no statistically significant difference in birth defects rate between before and after the abolition of the mandatory premarital examination [6]. However, the review period was from 2004 to 2007, and the number of available literatures is too small, only 15,

that study was not typical enough. By searching papers, 49 papers are available in this meta analysis. Reviewing literature comprehensively, rechecking the relationship between birth defects rate and the abolition of mandatory premarital health examination in 2003 changes in China, in order to get more accurate results and to provide evidence-based medical clues for maternal and child health care and public health care.

2. Methods

2.1. Selection of studies

The present study included all published studies from 2005 to 2011 that address the birth defects number and perinatal infants number of China. The author searched in the database of China Academic Journals (CNKI), scientific journals (VIP) and Wanfang Electronic journal by using a combination of computer and manual method of searching. By searching in Medline, the author traced similar literature written by domestic researchers but published in non-Chinese journals. Take "Birth defects monitoring" as the key words to search literature related to birth defects and premarital health examination and the retrieval period was from 2002 to 2012. By searching papers, 49 studies eventually met the inclusion criteria of our meta-analysis (see Table 1), involving 2371903 perinatal infants and 27014 birth defects infants were identified as eligible for the present meta-analysis.

Table 1 Study characteristics.

ID of Study	First author	Publication Year	Study Region	Number of Birth Defect for Study	Number of Perinatal Infants for Study
1	Zhang XR [7]	2009	Anhui Maanshan	79	15051
2	Zhang AZ [8]	2011	Beijing Changping	90	12983
3	Sun CY [9]	2007	Beijing Chongwen	44	3695
4	Zhu JL [10]	2010	Beijing Daxing	199	19904
5	Liu YL [11]	2010	Being Dongcheng	487	35397
6	Fu LP [12]	2008	Being Huairou	44	6500
7	Jia BL [13]	2009	Beijing Pinggu	68	7143
8	Bai ZX [14]	2008	Beijing Tongzhou	211	20028
9	Liu XF [15]	2008	Beijign Xuanwu	146	9777
10	Song MX [16]	2008	Fujian Nanping	177	15204
11	Ding XQ [17]	2011	Gansu	606	53181
12	Li B [18]	2008	Guangdong	5780	287532

13	Wang G [19]	2007	Guangxi Beihai	410	51164
14	Duan JH [20]	2009	Guangxi Guigang	651	40627
15	Gong KZ [21]	2011	Guangxi Nanning	1834	122823
16	Pu B [22]	2010	Guangxi Qingzhou	511	25713
17	Chen BC [23]	2008	Hainan Sanya	85	6951
18	Li ZR [24]	2008	Hebei Tangshan	157	25974
19	Sun LH [25]	2010	Henan	2504	279429
20	Yang S [26]	2009	Heilongjiang	841	131224
21	Zhou LQ [27]	2007	Hubei	1482	133972
22	Du QY [28]	2007	Hunan	1359	102405
23	Jin YH [29]	2011	Jilin Yanbian	173	24215
24	Jin LP [30]	2007	Jilin Changchun	451	27555
25	Ning WQ [31]	2009	Jiangsu	1083	89700
26	Liang Q [32]	2008	Jiangxi	1133	87514
27	Wen SY [33]	2007	Liaoning Fengcheng	189	18616
28	Zhou L [34]	2009	Liaoning Haicheng	285	31817
29	Yu J [35]	2009	Liaoning Shenyang	1204	136232
30	Wen XY [36]	2006	Neimenggu Baotou	253	31937
31	Yan Q [37]	2007	Ningxia Shizuishan	116	8848
32	Liu JN [38]	2011	Qinghai	331	29705
33	Xiu XH [39]	2010	Shandong Qingdao	790	174138
34	Chen YY [40]	2007	Shandong Rizhao	248	25869
35	Zhao LP [41]	2008	Shanxi Weinan	399	38365
36	Jin XZ [42]	2007	Shanghai Jiading	127	14326
37	Lu J [43]	2008	Shanghai Changning	197	16932
38	Song ZM [44]	2007	Chengdu Chenghua	130	10796
39	Yan DY [45]	2008	Chengdu Longquanyi	110	12365
40	Zheng XL [46]	2011	Chengdu Pixian	106	10282
41	Huang P [47]	2009	Chengdu Qiangbaijiang	80	8036
42	Yang HR [48]	2012	Sichuan Chongzhou	112	10008
43	Wang H [49]	2007	Xinjiang Shihezi	71	9296
44	Wang R [50]	2006	Yunnan	867	82629
45	Lei XL [51]	2009	Zhejiang Lishui	211	17103
46	Ruan XL [52]	2009	Zhejiang Shangyu	81	10725
47	Wang Y [53]	2010	Zhejiang Shaoxing	168	13853
48	Zheng F [54]	2010	Zhejiang Xianjuxian	100	10481
49	Wu MF [55]	2008	Zhejiang Xiangshanxian	234	13883

In addition, we got the premarital medical examination rate and the incidence rates of birth defects of different areas in Beijing from 2002 to 2005 as a specific example to test the relations between the premarital medical examination rate and the incidence rates of birth defects.

2.2. Inclusion criteria

Criteria for inclusion of studies into the meta-analysis were as follows: (1) The studies that have reported the number of birth defects and perinatal infants born in 2002、2003 and 2005 based hospital monitoring data; (2) The study in which the number of hospitals that provided data was more than three; (3) The studies of the larger administrative affiliation for region were incorporated into when there were crosses in the areas in different studies.

We decided to exclude studies if the literatures that were reported repetitively and in which the data was not described clearly after evaluating the quality of the retrieved articles with the Lichtenstein standards and remove the studies of Shanxi Province which once implemented a large-scale "Clipping Program" for birth defects during the period of this study.

2.3. Calculation and analysis of effect sizes

Considering the time of abolition the mandatory premarital medical examination (October, 2003), the hysteresis effect of fertility and the situation of birth defects monitoring that very year, the birth defects number and perinatal infants number of 2002 and 2003 were amalgamated to calculate the merger birth defect rate as control group (unexposed group) to compare with the birth defect rate of 2005 that was the exposed group in this study. The number of birth defects of exposed group and unexposed group were 11860 and 15154 respectively.

The software STATA 11.0 was used for data analysis. The model was selected according to the heterogeneity of the data provided by the literatures, and the RR (relative risk) value of the individual study was the effect scale. Q statistics Chi-square test was used to evaluate the heterogeneity of results in these studies, and the result of the test showed that there was significantly heterogeneous, $Q(48) = 258.36$, $P < 0.05$. Therefore, random-effects models were used to pool the results of individual studies to partially eliminate the influence of heterogeneity.

2.4. Publication bias

With the “metabias” command of STATA，Egger’s test and a funnel plot were used to evaluate publication bias. Funnel plots revealed a symmetrical distribution with no

evidence of publication bias (Egger's test: intercept =-0.351;P = 0.556)(see Fig. 1)for all studies.

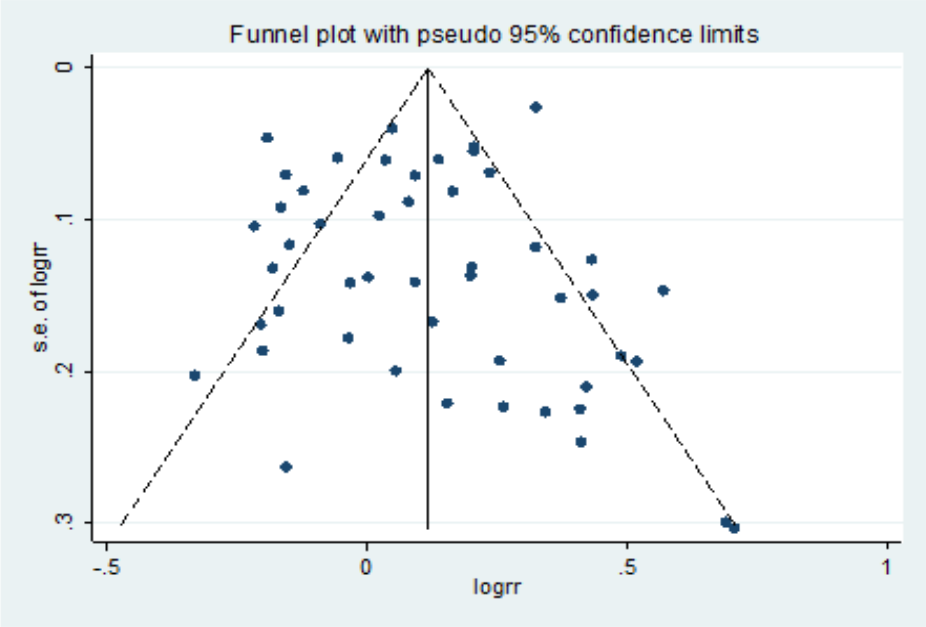

Fig.1 Meta-analysis of relations between the abolition of the mandatory premarital medical examination and the change of the birth defect rate: funnel plot with pseudo 95% confidence limits for all studies.

3. Results

Table 1 provides an overview of all 49 studies (N=2,371,903 perinatal infants) included in this meta-analysis, with the respective study characteristics. Within the 49 studies available for this meta analysis, after abolishing the mandatory premarital medical examination, 16 studies showed the birth defect rates were higher than before, 33 studies showed the change of the birth defect rates were not significant. The RR (relative risk) value and 95% CI(confidence intervals) of individual study was showed as Table 2 and Fig.2. D+L pooled RR is 1.11(95%CI=1.04~1.18) , which indicated that after the abolition of the mandatory premarital medical examination, the birth defects rate of 2005 was 1.11 times as that of the merger birth defect rate of 2002 and 2003.

Table 2 Birth defect rate of 2005 and merger birth defect rate of 2002 and 2003

ID of Study	2005 (exposed group)			merger of 2002&2003 (unexposed group)			RR	95%CI
	Birth Defect (n)	Perinatal Infants (n)	BD Rate (/10^4)	Birth Defect (n)	Perinatal Infants (n)	BD Rate (/10^4)		
1	37	5551	66.65	42	9500	44.21	1.50	0.97~2.34
2	47	5417	86.76	43	7566	56.83	1.52	1.01~2.30

3	22	1228	179.15	22	2467	89.18	1.99	1.11~3.58
4	93	8842	105.18	106	11062	95.82	1.10	0.83~1.45
5	191	15333	124.57	296	20064	147.53	0.85	0.71~1.01
6	25	2551	98.00	19	3949	48.11	2.03	1.12~3.67
7	27	2164	124.77	41	4979	82.35	1.51	0.93~2.45
8	95	9013	105.40	116	11015	105.31	1.00	0.76~1.31
9	59	3656	161.38	87	6121	142.13	1.13	0.82~1.57
10	81	5357	151.20	96	9847	97.49	1.54	1.15~2.07
11	266	21205	125.44	340	31976	106.33	1.18	1.00~1.38
12	2790	115323	241.93	2990	172209	173.63	1.38	1.32~1.46
13	147	19430	75.66	263	31734	82.88	0.91	0.75~1.12
14	235	15866	148.12	416	24761	168.01	0.88	0.75~1.04
15	941	69008	136.36	893	53815	165.94	0.82	0.75~0.90
16	225	10812	208.10	286	14901	191.93	1.08	0.91~1.29
17	33	2448	134.80	52	4503	115.48	1.17	0.76~1.80
18	52	9831	52.89	105	16143	65.04	0.81	0.58~1.13
19	1090	118343	92.11	1414	161086	87.78	1.05	0.97~1.13
20	384	52318	73.40	457	78906	57.92	1.27	1.11~1.45
21	668	53599	124.63	814	80373	101.28	1.23	1.11~1.36
22	573	38121	150.31	786	64284	122.27	1.23	1.10~1.36
23	91	10478	86.85	82	13737	59.69	1.45	1.08~1.95
24	162	9757	166.03	289	17798	162.38	1.02	0.84~1.24
25	476	38651	123.15	607	51049	118.91	1.04	0.92~1.17
26	446	31606	141.11	687	55908	122.88	1.15	1.02~1.29
27	79	5356	147.50	110	13260	82.96	1.77	1.33~2.35
28	136	12633	107.65	149	19184	77.67	1.38	1.10~1.74
29	454	53218	85.31	750	83014	90.35	0.94	0.84~1.06
30	87	12341	70.50	166	19596	84.71	0.83	0.64~1.08
31	34	3249	104.65	82	5599	146.45	0.72	0.48~1.07
32	109	10801	100.92	222	18904	117.44	0.86	0.69~1.08
33	397	83512	47.54	393	90626	43.37	1.10	0.95~1.26
34	121	9863	122.68	127	16006	79.35	1.54	1.20~1.97
35	139	15333	90.65	260	23032	112.89	0.80	0.66~0.99
36	56	6446	86.88	71	7880	90.10	0.96	0.68~1.37
37	97	8479	114.40	100	8453	118.30	0.97	0.73~1.28
38	42	3986	105.37	88	6810	129.22	0.82	0.57~1.18
39	56	4794	116.81	54	7571	71.32	1.63	1.12~2.37
40	49	3467	141.33	57	6815	83.64	1.68	1.15~2.46
41	32	2575	124.27	48	5461	87.90	1.41	0.90~2.20
42	43	3254	132.15	69	6754	102.16	1.29	0.88~1.88
43	20	2925	68.38	51	6371	80.05	0.86	0.51~1.43
44	313	32916	95.09	554	49713	111.44	0.85	0.74~0.98
45	101	7336	137.68	110	9767	112.62	1.22	0.93~1.59
46	35	3958	88.43	46	6767	67.98	1.30	0.84~2.01

47	60	5512	108.85	108	8341	129.48	0.84	0.62~1.15
48	46	4681	98.27	54	5800	93.10	1.05	0.71~1.56
49	98	5140	190.66	136	8743	155.55	1.22	0.94~1.58
Pooled	11860	977683	121.31	15154	1394220	108.69	1.11	1.04~1.18

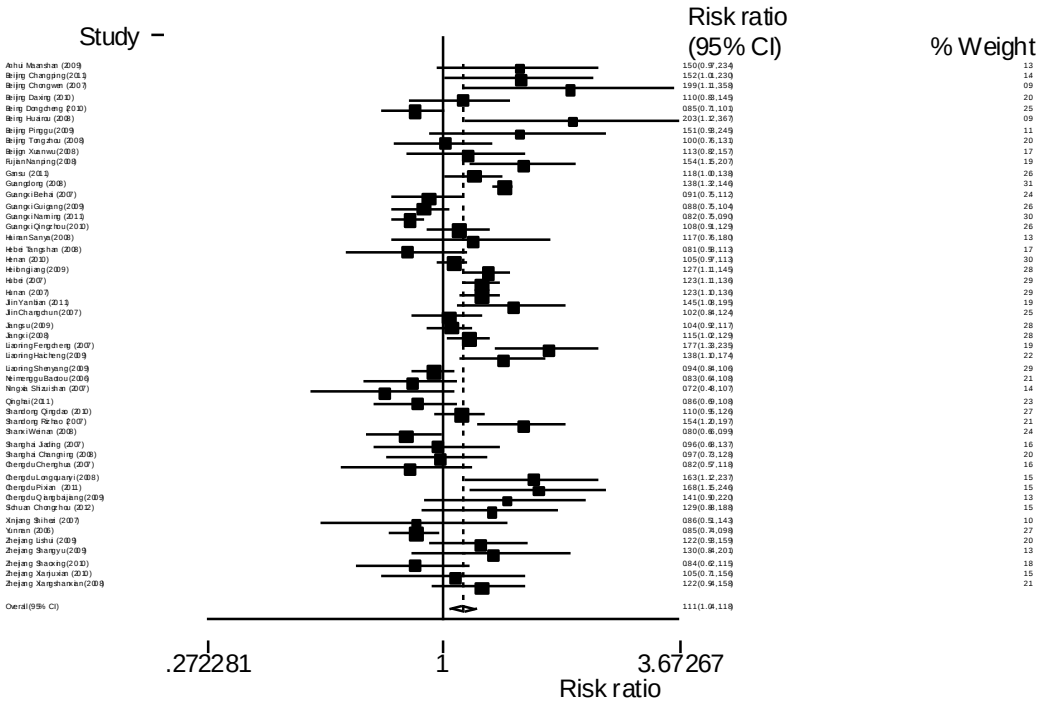

Fig.2 Meta-analysis of relations between the abolition of the mandatory premarital medical examination and the change of the birth defect rate: relative risk estimate and 95% confidence intervals for individual studies.

As to the relations between the premarital medical examination rate and the incidence rates of birth defects, on one hand, the premarital medical examination rate of Beijing in 2002 was up to 98%, but which has decreased to 5% during 2004 to 2006 since the form of pre-marital medical examination has changed from mandatory to voluntary in October 2003[56]. On the other hand, the merger incidence rate of birth defects of Huairou District in 2002 and 2003 was 4.13‰, 9.62‰ in 2004 and up to 9.80‰ in 2005[6]. Similarly, the merger incidence rates of birth defects of Pinggu District in 2002 and 2003 was 6.82‰, 10.93‰ in 2004 and up to 12.48‰ in 2005 [7]. The merger incidence rate of birth defects of Huairou District in 2002 and 2003, the incidence rate of birth defects in 2005, the merger premarital medical examination rate in 2002 and 2003 in this area and the premarital medical examination rate in 2005

were tested with the Spearman Test, P=0.026, and the difference was statistically significant. The result of Spearman Test of Pinggu District also showed the statistically difference ($p < 0.05$).

4. Discussion

The first purpose of this study is to identify the change of incidence rate of birth defects (BDs) before and after the abolition of mandatory premarital check-ups based on the research review and compare with the similar studies by others before. Different from the study of Su (2008), which showed there was no statistical difference in the incidence rates of birth defects before and after the abolition of mandatory premarital check-ups, our meta-analysis indicated that the birth defects rate of 2005 after abolishing the mandatory premarital medical examination was 1.11 times as that of the merger birth defect rate of 2002 and 2003 and the difference was statistically significant (95%CI=1.04~1.18). This result indicated that the birth defect rate of China increased after the policy of abolition of the mandatory premarital medical examination. Because as the increase of the inclusion of studies, the number of the samples involved is increasing. The retrieval period of Su's study was from 2004 to 2007, and only 15 studies met the inclusion criteria; the number of samples of 2002 and 2003 was 2.1 billion and 3.4 billion in 2005; and because the data involved were only from one or two cities in a province, the representativeness was not enough so that the conclusion may be limited. Time elapsing, more individual studies were published, which provided more samples and evidences for the meta-analysis. In our study, 49 studies eventually met the inclusion criteria of our meta-analysis (see Table 1), the range of study was enlarged to more than 40 areas and the number of samples increased. In our study, the merger number of perinatal infants of 2002 and 2003 is 1.39 million and 0.98 million in 2005. The increase of the number of samples and the range of study reduced the range of the confidence interval and enhanced the representativeness of samples and reliability of the conclusion. As more samples are included in the study, RR will increase. Shanxi Province has high incident rate of birth defects. A study indicated that the epidemiological characteristics between the

areas with high incident rate of birth defects and other areas were different [57], so the impact of "Clipping Program" on Shanxi would make it different from others. In addition, the exclusion of Shanxi Province would be easy to compare with the study of Su (2008) that excluded the studies about Shanxi Province as well.

From the point of practical significance, there are many factors that could restrain the incident of birth defects. In order to avoid the study bias, we removed the studies of Shanxi Province which once implemented a large-scale "Clipping Program" for decreasing birth defects during the period of this study. In studies involved in this study, some provinces implemented "Clipping Program" for birth defects, which was beneficial to reduce the incidence rate of birth defects and the RR value. In addition, as the increase of health consciousness and pre-pregnancy health care, folic acid and multiple nutritious pills are more taken by women before pregnancy, which contributes to the decrease of the incident of birth defects and also reduce the RR value. However, RR value of the study still showed statistical significance. It is obvious that the abolition of the mandatory premarital medical examination is a noteworthy issue.

As to the specific case, the incident rate of birth defects in various areas of Beijing has significantly changed after the abolition, which could be a specific evidence for the result of the meta-analysis. The reason why we chose Beijing for an example is that the data of Beijing is more integrated and available. Taking Beijing as an example to Spearman Test could identify the relations between the premarital medical examination rate and the incidence rate of birth defects. The results indicated that after the abolition of the mandatory premarital medical examination, the incident rate of birth defects has improved. One thing to note here is that citizen's awareness of privacy protection strengthens gradually, which is contradictious with the mandatory premarital medical examination. The transition of bearing concept, double incomes no kid (DINK) family and phenomenon of infertility indicate that the pre-pregnancy medical examination and health consultancy service are more direct for avoiding the birth defects. So the families that have the pregnancy project should pay more attention to the reproductive health and women’s living environment of, and take

more health consultancy service. As the pre-pregnancy medical examination is an essential link for healthy pregnancy, strengthening the effectiveness when carrying out is also conducive to prevent the incident of birth defects.

There are some limitations in our study. For the time interval of the study, we only chose the data before2005 to evaluate the level of birth defects after the abolition of the mandatory premarital medical examination, so it only represented the immediate effect after the abolition but didn't include more permanent changes. For the data, limited by the quality and range of previous studies, the meta-analysis could not take a strict and representative sampling and case-control study, and the individual studies we chose may have some problems on the representation. In addition, the monitor data came from hospitals which may have high false negative rate. Furthermore, other factors that related to the birth defects may change with time, such as the environmental pollution. But there is no obvious change of the related factors in 2002 to 2005. Meanwhile, the analysis of Beijing data also accords with the result of the meta-analysis.

5. Conclusion and Suggestion

Meta analysis indicated that the birth defect rate of China increased after the policy of abolition of the mandatory premarital medical examination. Therefore, in the context of abolition of the mandatory premarital medical examination of China, it is more necessary to advocate the maternal premarital examination to enhance medical examination rate. At the same time, people should realize that besides the premarital medical examination, the pre-pregnancy medical examination and health consultancy should be improved to reduce the incident of birth defects. All kinds of government departments should coordinate with each other to encourage people take the premarital examination on their own initiative. In addition, the important link of pre-pregnancy medical examination should be effective to control the birth defects directly. In conclusion, it is important to promote more effective and available premarital medical examination services and improve their level and quality, which is extremely essential to the control of Chinese birth defects.

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