



**Poor infant and young child feeding practices and sources of caregivers' feeding knowledge in rural Hebei Province, China: findings from a cross-sectional survey**

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Title page

Poor infant and young child feeding practices and sources of caregivers' feeding knowledge in rural Hebei Province, China: findings from a cross-sectional survey

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**Abstract**

**Objectives:** To obtain a general overview of infant and young child feeding practices in one rural county in China and identify current delivery channels and challenges.

**Design:** A cross-sectional study.

**Setting:** A rural county Zhao County in Hebei Province China.

**Participants:** Ten clusters were first selected within each township (16 townships in total) with Proportional to Population Size sampling (PPS). In each cluster, name list was used to select 13 children aged 0-23 months old. We interviewed caregivers of all the selected children.

**Primary and secondary outcomes measures:** Coverage of infant feeding practices, reasons for low coverage, and current delivery channels.

**Results**

Findings from our survey indicated that infant feeding practices were poor. Early initiation of breastfeeding was only 22.4%, exclusive breastfeeding for 6 months was less than 10%, continued breastfeeding to the age of two was only 38.2% and only 32.5% of children were

given iron-rich or iron-fortified foods. The leading sources of infant feeding information were family members, neighbors, friends and popular media, only around 20% of the information came from health facilities and nearly none came from communities. Household property data showed 99.9% and 99.4% of households owned televisions and mobile phones respectively, and 61.2% of the households owned computers, with 54.8% having access to internet.

### ***Conclusions***

Few caregivers of children in Zhao County received feeding information during pregnancy and after delivery, and their feeding knowledge and practices were rather poor. Multi-channel approaches, delivered through health facilities, community resources, popular media and internet and mobile phones, hold potentials to improve infant feeding practices and should be explored in future studies.

### ***Strengths and Limitations***

Although only within one county, a full range of globally standard feeding indicators were used to assess feeding practices of caregivers in our study. In addition, health care information delivery channels and reasons for not initiating breastfeeding early and non-exclusive breastfeeding were first explored in our study.

***Trial registration number:*** ChiCTR-PRC-11001446.

**Main text**

**Background**

Nutritional status is an important determinate of maternal and child health [1, 2]. While maternal and child undernutrition is still highly prevalent in low and middle-income countries, resulting in significantly increased mortality and morbidity. Suboptimum breastfeeding and complementary feeding, which are the key factors for undernutrition in infants, was estimated to be responsible for 1.4 million child deaths and 44 million disability-adjusted life-years (DALYs) worldwide [3]. Studies have consistently shown that the period from birth to two years of age is the peak for growth faltering, micronutrient deficiencies and common childhood illnesses [3-5].

Appropriate infant and young child feeding (IYCF) is the basis for child survival, growth and development [3, 4, 6, 7]. The benefit of breastfeeding for both infants and mothers has been well documented in studies, including reducing the risk of morbidity and mortality, especially from infectious diseases [8, 9]. Introducing safe and adequate complementary foods at six months of age helps to fill dietary gaps that cannot be met by breast milk alone. Continued breastfeeding for two years or beyond is an essential component of appropriate complementary feeding [10].

To emphasize the importance of children’s feeding, the World Health Organization (WHO) and United Nations Children’s Fund (UNICEF) jointly developed the Global Strategy for Infant and Young Child Feeding(IYCF) in 2002 [11]. They formulated the global public health recommendations of exclusive breastfeeding for six months and providing safe and

appropriate complementary foods with continued breastfeeding for up to two years of age or beyond [11].

During the past decade, the Ministry of Health of China (MoHCh) adopted the WHO's feeding recommendations and implemented programs to improve nutrition practices [12, 13]. However, suboptimum infant feeding is still very common in China. The national data in 2008 showed that only 27.6% of Chinese children were exclusively breastfed to 6 months, only 43.3% aged 6 to 9 months had solid or semi-solid foods introduced, and only 37.0% of children aged 12 to 15 months received continued breastfeeding [14]. In addition, too early or too late introduction of complementary food [15-19] and a restriction in foods selection, especially for animal source food, were widespread in China [17-19]. In poor rural areas, the rate of exclusive breastfeeding, continued breastfeeding for 1 and 2 years were 28.7%, 55.5% and 9.4%, respectively [20]. While the rate of underweight, stunted and anaemic was 8.0%, 20.3% and 14.2%, respectively. It is noticeable that almost one third (31.9%) of children aged 6-11 months were anaemic [21]. These percentages can be translated into large absolute numbers of children in China. Stunting rate was reduced by two thirds between 1990 and 2010 [21], it was still estimated that 8.82million children in China were still stunted in 2010 [21].

The poor feeding practices and nutritional status indicated that those recommendations have not been put into practice. Therefore, the challenge is how to effectively translate the infant and young child feeding recommendations into caregivers' feeding behaviors in China, thereby enhancing children's dietary intake and growth. While the delivery channels for IYCF

recommendations were not fully assessed for its usage and potential in previous studies in China. Our study used a full range of globally standard breastfeeding and complementary feeding indicators to assess the feeding practices of caregivers in one of rural counties in China, and collected information on delivery channels, trying to fill this gap which can provide basis for developing effective infant and young child feeding strategies.

**Materials and Methods**

*Survey setting*

We conducted a cross-sectional household survey in Zhao County of Hebei province in 2011. Hebei province is located in the northern part of North China Plain, with an annual per capita net income of rural residents of 5,958 Yuan (946 USD) in 2010 [22], which is nearly the same as national average (5,919 Yuan) [23]. Zhao County is located in the middle-south part of Hebei Province. It has a total population of 571,000 (with under five population of 38,019), and the annual per capita net income of rural residents is 6,464 Yuan (1026 USD) in 2010 (data from Zhao county statistics bureau, unpublished.). There are four county level hospitals, 16 township hospitals, and 281 village clinics.

*Survey instrument*

The maternal, newborn and child health (MNCH) household survey (unpublished, 2009) was used as the survey instrument. It was developed by the WHO and has previously been used in Cambodia, Papua New Guinea and Viet Nam [24]. We translated standard WHO household survey from English to Chinese, and adapted following a consultation with Chinese experts and after three pilot studies. The instrument collects data on the coverage of key child health



interventions, delivery channels, reasons for coverage failure and health expenditures. Our survey included modules on antenatal care, delivery and neonatal care, breastfeeding and nutrition, immunization, cough and fever, diarrhoea and vitamin A. The breastfeeding and nutrition module aims to collect feeding information of children aged 0-23 months including caregivers' feeding knowledge and practice, delivery channel and reasons for low coverage.

In 2009, WHO and UNICEF jointly published the document *Indicators for Assessing Infant and Young Child Feeding Practices*, and set up 15 international standard infant and young child feeding coverage indicators (eight core indicators and seven supplementary indicators), which encourages researchers in all countries to use these indicators and makes the data comparable between countries [25]. Now, very few studies in China apply these standard indicators to assess infant feeding practices. Studies were either focused on breastfeeding practices [20] or confined to earthquake areas [26]. Since the breastfeeding and nutrition module in MNCH household survey has the standard questions for delivery channels, reasons for coverage failure, but only three core IYCF coverage indicators, we then inserted questions on the rest core coverage indicators from IYCF indicators to formulate our instrument.

### **Participants**

Caregivers in Zhao County were eligible if they had a child aged 0-23 months. Mothers were the primary target group for the breastfeeding and nutrition module. If mothers were not at home or did not live with the child for any reason, other caregivers were interviewed to collect other information, such as on basic household characteristics, cough and fever, diarrhea and immunization.

*Sample size and sampling*

The sample size for the survey was based on a planned cluster randomized control trial in Zhao County. The trial aims to develop and test the (cost-) effectiveness of scaled-up integrated child health interventions. The MNCH household survey is used as the baseline assessment for the trial. The sample size calculation and sampling method were based on the requirement of the trial, with townships as the randomization unit (8 townships per group). We expected to achieve a 10% reduction of anemia prevalence, and at least a 20% increase for knowledge and practice of appropriate feeding. With power of 80%, design effect of 2 and 5% as the significance level, we calculated that the sample size of 800 children under 2 years old per group would be sufficient for all key indicators. We over-sampled 30% children to compensate for possible refusal and loss to follow-up. We used a two-stage sampling procedure to select children for this survey. In the first stage, clusters were selected using Proportional to Population Size sampling, with 10 clusters chosen from each township. In the second stage, the name list of all eligible children under two years old in each village was obtained and 13 children per cluster were randomly selected using Microsoft Excel (version 2007) software. We interviewed ten caregivers out of 13 sampled children in each cluster based on the order in which they came to the village clinic.

*Training of interviewers*

We recruited 30 students from Hebei United University School of Public Health as interviewers. We trained them for three days, with half day for field practice, after which they

conducted the survey. The training included communication skills, explanation of questionnaires, demonstration, role plays, field practice, and group discussions. The supervisors were all from the Capital Institute of Pediatrics, Beijing.

### ***Data collection***

We used smartphones to record data instead of traditional pen-and-paper, with the standardized MNCH household survey questionnaire set up in specially developed software.

We tested and used smartphones for the MNCH survey several times in the field [27].

We carried the survey out from August 15th to 24th 2011 (10 days). Three teams of interviewers carried out the survey, with ten interviewers and two supervisors in each team. Interviewers first introduced mothers or other caregivers to the aim of the survey and obtained written informed consent. Then the interviewers questioned the mothers or other caregivers following the instructions on the smartphone. Once an interviewer completed a questionnaire, the data was wirelessly uploaded into an Excel database via the internet server. Then the data was saved in the memory card of the smartphone as a text file to have a backup. We gave each mother a towel (worth 5 Yuan, equal to 0.79 USD) to show appreciation for their participation.

### ***Data analysis***

Data uploaded onto an internet server were automatically transformed into a Microsoft Excel

sheet. After the data cleaning, we converted the database into data base file (dbf) for the final analysis. We carried out statistical analysis with SAS 9.1 for Windows. We presented the descriptive results of our findings; data are reported with percentages, except for age of parents, which are reported as a mean and range.

***Ethical considerations***

The study was approved by the Ethical Committee of Capital Institute of Pediatrics. All interviewees read the Information Sheet and provided both oral and written informed consent on behalf of the children involved in our study.

## Results

### Participants

A total of 1601 caregivers of children under 2 years old were interviewed. Among them, 90.1% (1443) were mothers, 8.6% (138) were grandparents, 1.1% (17) were fathers and 0.2% (9) were others (such as uncles and aunts). Table 1 presents the characteristics of children and their parents. Among children surveyed, 57.7% of them were aged 0-11 months and 43.3% of them were aged 12-23 months. The gender ratio (boys to girls) of children surveyed was 1.38. The mean age of mothers and fathers were 27 (ranging from 20 to 43) and 28 (ranging from 22 to 49) years old respectively. Overall education of fathers and mothers was good; more than 80% of them completed at least 9 years of education.

**Table 1 Characteristics of surveyed children and their parents**

	Category	Subcategory	Results (%)
<b>Children<sup>a</sup></b>	<b>Age group</b>	0-11 months	923(57.7)
		12-23 months	678(42.3)
	<b>Gender</b>	Boys	916(57.2)
		Girls	685(43.8)
<b>Mothers<sup>b</sup></b>	<b>Education</b>	completing junior high school (9 years)	1117(70.6)
		completing senior high school (12 years)	158(10.0)
<b>Fathers<sup>c</sup></b>	<b>Education</b>	completing junior high school (9 years)	1149(72.7)
		completing senior high school (12 years)	158(10.0)

<sup>a</sup> The total number of children was 1601

<sup>b&c</sup> The total number of mothers and fathers was 1583 and 1580 respectively, because some of the other caregivers of children did not know the education of the parents of the children.

*Knowledge and practices of infant and young child feeding*

As shown in Table 2, the feeding practices were generally suboptimal. Early initiation of breastfeeding was only 22.4%, exclusive breastfeeding for 6 months was less than 10%, continued breastfeeding up to the age of two was only 38.2% and only 32.5% of children were given iron-rich or iron-fortified foods. The knowledge of caregivers about feeding recommendations was similarly low.

**Table 2 Knowledge and practices of caregivers on key IYCF indicators**

	Number of mothers who responded positive on the particular knowledge/practices	Total number of mother eligible for the question	Percentage (%)
Mothers <b>knowing</b> to initiate breastfeeding within 1 hour of birth	469	1443	32.5
Children who were initiated breastfeeding within 1 hour of birth	317	1417 <sup>a</sup>	22.4
Mothers <b>knowing</b> the duration of Exclusive breastfeeding	539	1443	37.3
Children under 6 months exclusively breastfed	40	414 <sup>b</sup>	9.7
Mothers <b>knowing</b> continued breastfeeding until two years	84	1443	5.8
Children breastfed until two years	104	272 <sup>c</sup>	38.2
Caregivers <b>knowing</b> introduction of complementary foods at 6-8 m	759	1187	63.9
Children given complementary foods at 6-8 m	196	233 <sup>d</sup>	84.1
Caregivers <b>knowing</b> the minimum meal frequency	933	1182 <sup>f</sup>	60.0
Children given minimum meal	827	1187 <sup>e</sup>	69.7

frequency				
Caregivers <b>knowing</b> feeding	113	1182 <sup>f</sup>	9.6	
children with meat at 6-8 m				
Children given iron-rich or	386	1187 <sup>e</sup>	32.5	
iron-fortified foods				

<sup>a</sup>Only children ever breastfed were used to calculate this indicator (From MNCH household survey guideline)

<sup>b</sup>Only children aged 0 to 5 months were used to calculate this indicator (From Guideline of IYCF)

<sup>c</sup>Only children aged 20 to 23 months were used to calculate this indicator (From Guideline of IYCF)

<sup>d</sup>Only children aged 6 to 8 months were used to calculate this indicator (From Guideline of IYCF)

<sup>e</sup>Only children aged 6 to 23 months were used to calculate this indicator (From Guideline of IYCF)

<sup>f</sup>Data of 5 children on these two question were missing

The main reasons for not initiating breastfeeding early (Figure 1) were cesarean section, seeing the baby after delivery later than one hour and doctor's advice not to initiate breastfeeding early. Twenty-two percent of the mothers received advice on non-exclusive breastfeeding from relatives and 7.0% of them from the health workers (Figure 2).

### *Utilization of health care services*

Table 3 indicates that the maternal and child health care services were generally available and utilized by pregnant women, mothers and children, except for postnatal care. Only 11.4% and 23.7% of mothers received a home visit after delivery and attended postnatal care at 42 days after delivery respectively.

Table 3 Utilization of health care services by pregnant women, mothers and children

	Number of mothers who responded positive on the particular knowledge/practice	Total number of mother eligible for the question	Percentage (%)
proportion of pregnant women receiving antenatal care at least <i>once</i>	1350	1443	93.6
proportion of pregnant women receiving antenatal care <i>four times</i> or above	1014	1443	70.3
proportion of children delivered at hospital	1436	1443	99.5
proportion of mothers and children receiving home visit after delivery (within 7 days after discharge)	165	1442 <sup>a</sup>	11.4
proportion of mothers receiving post natal care at 42 days after delivery	340	1413	24.1
Proportion of children ever immunized	1598	1601	99.8

<sup>a</sup> Data of one children was missing

<sup>b</sup> Only children older than 42 days age were used to calculate this indicator.

Sources of infant feeding information

Table 4 shows that only around one-fourth of mothers ever received feeding information during pregnancy and after delivery. Table 5 describes the sources of feeding information through which mothers receive information. The leading sources were family members, neighbors, friends and popular media; these accounted for around 80% of the total information. Only around 20% of the information came from health facilities and nearly none came from the community.



**Table 4 Mothers ever receiving feeding information**

	Number of mothers who responded positive on the particular knowledge/practices	Total number of mother eligible for the question	Percentage (%)
Proportion of mothers ever receiving breastfeeding information during pregnancy	379	1443	26.3
Proportion of mothers ever receiving breastfeeding information after delivery	415	1443	28.8
Proportion of mothers ever receiving complementary feeding information during pregnancy	341	1440 <sup>a</sup>	23.7
Proportion of mothers ever receiving complementary feeding information after delivery	385	1440 <sup>a</sup>	26.7

<sup>a</sup> Data of three children was missing

**Table 5 Sources of feeding information for mothers during pregnancy and after delivery**

	breastfeeding		complementary feeding		formula feeding	
	n	% (N=749 <sup>a</sup> )	n	% (N=664 <sup>a</sup> )	n	% (N=244 <sup>a</sup> )
Family members/ neighbors/friends	276	36.8	316	47.6	144	59.0
popular media	312	41.7	228	34.3	5	2.0
Health facility	160	21.4	120	18.1	65	26.6
Community	1	0.1	0	0.0	1	0.4
Formula company	-	-	-	-	29	11.9
<b>Total</b>	<b>749</b>	<b>100.0</b>	<b>664</b>	<b>100.0</b>	<b>244</b>	<b>100.0</b>

<sup>a</sup> These are the multi-choice questions which mean all sources of information mentioned by interviewees are recorded as “yes”. To calculate the proportions, all “yes” answers in different categories are summed as denominators, and all “yes” answers in each category are summed as numerators.

*Household property*

Table 6 indicates that nearly all household owned a television and a mobile phone, and more than 60% of the households owned computers, with 54.8% having access to internet.

**Table 6 Households owning radio, TV, mobile phones, computers, and accessing to Internet**

	Number of mothers who responded positive on the particular knowledge/practices	Total number of mother eligible for the question	Percentage (%)
Proportion of households owning radio	377	1601	23.6
proportion of households owning TV	1600	1601	99.9
proportion of households owning mobile phones	1591	1601	99.4
proportion of households owning computers	979	1601	61.2
proportion of households accessing to Internet at home	876	1600	54.8

## Discussion

We found in our survey that caregivers' feeding practices were rather poor, which were consistent with the national data as indicated in the introduction of this paper. In addition, we found that the health care services were generally available and utilized by pregnant women and mothers, with notable exception of home visits, and visits to the health facility at 42 days after delivery. National data also showed that proportion of women who ever received antenatal care and postnatal care was 93.7% and 91.0% respectively, and hospital delivery rate was 98.7% [28]. However, the high utilization of health services was not translated into high coverage of interventions.

Mothers need support not only from health system but also from the family, community and workplace to initiate and sustain optimal breastfeeding and complementary feeding practices [10]. Mothers also need consistent IYCF messages that are reinforced through multiple channels [29]. Therefore, engagement of health care providers, community involvement and media support are all needed to maximize the effectiveness of IYCF programs. Three recommendations emerge from our study findings:

(i) Strengthening the quality of care at health facilities to improve feeding counseling:

China initiated the national Basic Public Health Service program [30] to provide universal basic public health services for all residents. Maternal and child healthcare workers are required by the program to provide face-to-face counseling to pregnant women and mothers of young children at antenatal care visits, hospital delivery, newborn home visits, postnatal care visits and child health care visits [31]. However, rural health workers in China are

generally of low education, lacking expertise and low motivation for their work, and healthcare services provided by rural health facilities is generally of low quality [32-34]. Our study also indicated that few mothers reported they ever received feeding counseling from health workers, which suggested that many health workers did not provide feeding counseling. In addition, we also found that more than 50% of reasons for late initiation of breastfeeding attributed to health facilities such as high cesarean section, separation of babies from mothers, and doctors' advice, and 7% of mothers reported they received advice on non-exclusive breastfeeding from health workers. Therefore, there is a need to strengthen the quality of healthcare services provided by rural health facilities as well as to increase the service coverage.

(ii) Mobilize community resources to deliver IYCF recommendations: Community-based breastfeeding promotion and support were proven to be effective. Therefore, the Global Strategy for Infant and Young Child Feeding recognizes it as one of the key components of a comprehensive program to improve breastfeeding practices [11]. Large-scale community-based programs have demonstrated that the community offers indispensable resources for breastfeeding promotion and support [35]. In the Regional Framework for Community IMCI of WHO Western Pacific Region, breastfeeding and complementary feeding are among the 12 key family practices which can be improved through community-based programs [36]. In addition, a study in China also indicated that community-based behavioral change approaches using trained village nutrition educators to provide feeding counseling to pregnant women and mothers is effective to improve

breastfeeding and complementary feeding practices [37].

Although the community can be an effective channel to deliver IYCF recommendations, our data showed less than one in hundred mothers received feeding information from their communities. Studies have shown that peer counseling and lay counseling are effective in promoting breastfeeding [38-41]. In rural China, existing community resources can be mobilized, for example, the village women cadres, family planning workers, primary school teachers and volunteers can be used for feeding counseling to pregnant women and mothers.

(iii) Utilize popular media as well as Internet and mobile phones to expand IYCF coverage:

According to our results, the leading sources of feeding information were family members, neighbors, or friends and popular media (newspaper, magazine, book, radio and TV): around 80% of information on breastfeeding and complementary feeding came from these two sources, whereas only 20% came from health facilities.

As those two main groups sources are both important, they should be fully used to disseminate accurate feeding information. However, we noted that some information from these two sources was not valid. As indicated in the results, around 60% of inaccurate advice to use formula feeding and more than 20% of non-exclusive breastfeeding originated from family members, neighbors, friends. Therefore, much more efforts must be made to strengthen these channels in terms of ensuring provision of correct information and broadening the scope to provide more mothers with accurate feeding advice.

Since there are two-thirds of mothers receiving no advice on feeding, new channels, such as

internet and mobile phones, should be explored. Evidence indicated that computer-tailored nutrition education is an innovative and promising tool to motivate people to make healthy dietary changes [42]. Also, a recent study showed that internet nutrition education can be a viable alternative to traditional nutrition education for increasing fruit and vegetable consumption of women, infants and children [43].

With the rapid socio-economic development and technical progress, many Chinese people have access to new information and communication products. Our survey showed that in Zhao County, nearly all households owned mobile phones, and more than 60% of households owned computers, with more than half of them having access to internet. Data showed that, by the end of 2010, 859 million Chinese people owned mobile phones and 457 million had access to the Internet, which gives a huge potential for delivery IYCF recommendations [22]. In addition, the young generations of parents are well educated. Around 95% of fathers and mothers attended junior high school. This enables us to deliver feeding recommendations through mobiles or Internet. Future studies are needed to test the feasibilities and effectiveness of these potential delivery channels in the context of rural China.

**Conclusions**

Findings of our study indicate that few caregivers of children in rural China received feeding information during pregnancy and after delivery, and their feeding knowledge and practices are rather poor, although the maternal and child health care services were generally available

and utilized by mothers. Health facilities need to be strengthened and fully utilized to provide high-quality feeding counseling. Other channels, such as community resources, popular media, internet and mobile phones, hold large potentials and should also be explored in future studies to maximize the effectiveness of IYCF programs.

## LIMITATIONS

Our study has several limitations. Firstly, the sampling of children was based on the name lists of children in each village. In Zhao County, all live births are reported to the Maternal and Child Health Hospital from all qualified delivery institutions each month, so we obtained the name list from the hospital. Then we sent the name lists to village doctors and asked them to remove children who had died or moved outside the village and added children who were living in the village but who were not on the list. Although all these efforts were made, we were not sure on the completeness of the name lists and selection bias may occur. Secondly, some indicators such as initiation of breastfeeding after birth were based on the mothers' recall, with longest time of two years, and this may introduce recall bias.

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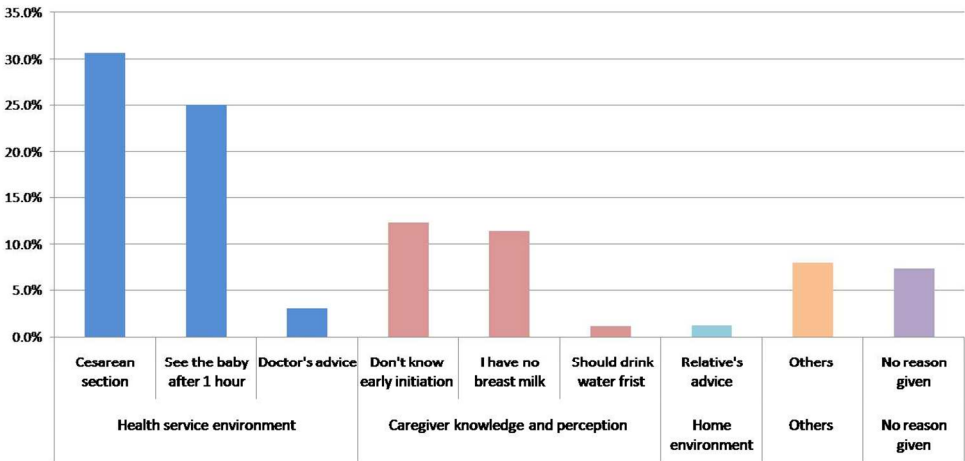
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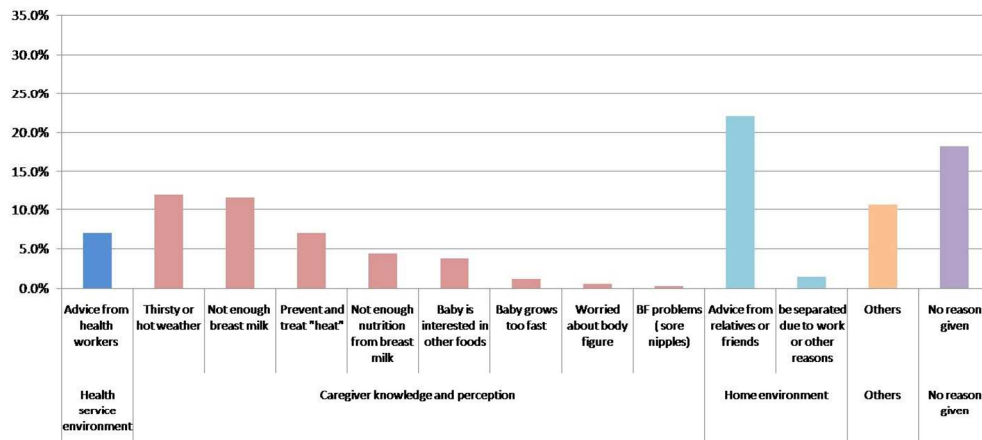
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STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(a) Indicate the study’s design with a commonly used term in the title or the abstract	3
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	3-4
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	5-7
Objectives	3	State specific objectives, including any prespecified hypotheses	7
Methods			
Study design	4	Present key elements of study design early in the paper	7
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	7
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants	8-9
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	7-8
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	7-8
Bias	9	Describe any efforts to address potential sources of bias	22
Study size	10	Explain how the study size was arrived at	9
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	11
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	10-11
		(b) Describe any methods used to examine subgroups and interactions	10-11
		(c) Explain how missing data were addressed	Not needed
		(d) If applicable, describe analytical methods taking account of sampling strategy	Not needed
		(e) Describe any sensitivity analyses	Not needed
Results			



Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	12
		(b) Give reasons for non-participation at each stage	12
		(c) Consider use of a flow diagram	Not needed
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	12
		(b) Indicate number of participants with missing data for each variable of interest	12, 16
Outcome data	15*	Report numbers of outcome events or summary measures	
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	Not needed, it is in one county, our previous experience tells us there is no difference for adjusted coverage.
		(b) Report category boundaries when continuous variables were categorized	12
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	Not needed
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	Not needed
<b>Discussion</b>			
Key results	18	Summarise key results with reference to study objectives	18
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	22
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	18-21
Generalisability	21	Discuss the generalisability (external validity) of the study results	18-21
<b>Other information</b>			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	22

\*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

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**Note:** An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at [www.strobe-statement.org](http://www.strobe-statement.org).

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# BMJ Open

## Poor infant and young child feeding practices and sources of caregivers' feeding knowledge in rural Hebei Province, China: findings from a cross-sectional survey

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ORIGINAL ARTICLE

Title page

Poor infant and young child feeding practices and sources of caregivers' feeding knowledge in rural Hebei Province, China: findings from a cross-sectional survey

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**Key words**

Breastfeeding, complementary feeding, undernutrition, mobile phone, China.

**Word count:** 5988

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**Abstract**

**Objectives:** To obtain a general overview of infant and young child feeding practices in one rural county in China and identify current delivery channels and challenges.

**Design:** A cross-sectional study.

**Setting:** A rural county, Zhao County, in Hebei Province, China.

**Participants:** Ten clusters were first selected within each township (16 townships in total) with Proportional to Population Size sampling . In each cluster, a name list was used to select 13 children aged 0-23 months. We interviewed caregivers of all the selected children.

**Primary and secondary outcomes measures:** Coverage of infant feeding practices, reasons for low coverage of infant feeding practices, and current delivery channels of infant feeding practices.

**Results**

Findings from our survey indicated that infant feeding practices were poor. Early initiation of breastfeeding was only 22.4%, exclusive breastfeeding for 6 months was less than 10%, and continued breastfeeding up to the age of two was just 38.2%.Only 32.5% of children were

given iron-rich or iron-fortified foods. The leading sources of infant feeding information were family members, neighbors, friends and popular media. Only around 20% of the information came from health facilities and nearly none came from communities. Household property data showed that 99.9% of households owned televisions and 99.4% owned mobile phones. In addition, 61.2% of the households owned computers, with 54.8% having access to the internet.

### ***Conclusions***

Few caregivers of children in Zhao County received feeding information during pregnancy and after delivery. Moreover, their feeding knowledge and practices were poor. Multi-channel approaches, delivered through health facilities, community resources, popular media, the internet and mobile phones, hold potential to improve infant feeding practices and should be explored in future studies.

### ***Strengths and Limitations***

Although this study took place only within one county, a full range of globally standard feeding indicators were used to assess feeding practices of caregivers in our study. The name lists of children in some villages may not be complete, and therefore selection bias may have occurred. Some indicators may have recall bias due to long recall time.

***Trial registration number:*** ChiCTR-PRC-11001446.

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**Main text**

**Background**

Nutritional status is an important determinant of maternal and child health [1, 2]. Maternal and child undernutrition is still highly prevalent in low- and middle-income countries and results in significantly increased mortality and morbidity in mothers and children. Suboptimal breastfeeding is a key factor for undernutrition in infants and was estimated to be responsible for 804,000 child deaths worldwide in 2011[3]. Studies have consistently shown that the peak for growth faltering, micronutrient deficiencies and common childhood illnesses occurs from birth up to two years of age[3-5].

Appropriate infant and young child feeding (IYCF) is the basis for child survival, growth and development [3, 4, 6, 7]. The benefits of breastfeeding for both infants and mothers have been well documented in studies, including reducing the risk of morbidity and mortality, especially from infectious diseases such as diarrhoea and pneumonia [8, 9]. Introducing safe and adequate complementary foods to children aged six months helps to fill dietary gaps that cannot be met by breast milk alone. Continued breastfeeding for two years or beyond is an essential component of appropriate complementary feeding [10].

To emphasize the importance of child feeding, the World Health Organization (WHO) and United Nations Children’s Fund (UNICEF) jointly developed the Global Strategy for Infant and Young Child Feeding(IYCF) in 2002 [11]. The recommendations in this strategy state that children should be exclusively breastfed for six months after birth, and provided with safe and appropriate complementary foods with continued breastfeeding up to two years or



beyond [11].

During the past decade, the Ministry of Health of China (MoHCh) adopted the WHO's infant and young child feeding recommendations and implemented programs to improve nutrition practices [12, 13]. However, suboptimal infant feeding is still very common in China. National Chinese data from 2008 showed that only 27.6% of Chinese children were exclusively breastfed up to 6 months, only 43.3% of children aged 6 to 9 months were introduced to solid or semi-solid foods, and only 37.0% of children aged 12 to 15 months received continued breastfeeding [14]. In addition, too early or too late introduction of complementary food and a restriction in food selection, especially for animal source food, were widespread in China [15-19]. In poor rural areas, the rate of exclusive breastfeeding, continued breastfeeding for 1 year, and continued breastfeeding for 2 years were 28.7%, 55.5% and 9.4%, respectively [20]. At the same time, the rate of underweight was 8.0%, and the rate of stunting was 20.3%. In addition, 14.2% of children were anaemic, and this rate was the highest among children aged 6-11 months (31.9%) [21]. These percentages can be translated into large absolute numbers of children in China. While the stunting rate was reduced by two thirds between 1990 and 2010 [21], it was estimated that 8.82million children in China were still stunted in 2010 [21].

The poor infant and young child feeding practices and nutritional status of children indicated that the recommendations from WHO and UNICEF have not been put into practice. Therefore, the challenge is how to effectively translate the infant and young child feeding recommendations into caregivers' feeding behaviors in China, thereby enhancing children's

1 dietary intake and growth. However, the delivery channels for IYCF recommendations were  
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6 not fully assessed for their usage and potential in previous studies in China. Thus, our study  
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9 used a full range of globally standard breastfeeding and complementary feeding indicators to  
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11 assess the feeding practices of caregivers in one rural county in China. In addition,  
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13 information on delivery channels was collected with the aim of filling this gap and providing  
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15 a basis for development of effective infant and young child feeding strategies.  
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21 **Materials and Methods**

22 *Survey setting*

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24 We conducted a cross-sectional household survey in Zhao County in Hebei Province in 2011.  
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26 Hebei province is located in the northern part of the North China Plain, with an annual per  
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28 capita net income of rural residents of 5,958 Yuan (946 USD) in 2010 [22], which was nearly  
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30 the same as national average (5,919 Yuan) [23]. Zhao County is located in the middle-south  
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32 part of Hebei Province. It has a total population of 571,000 (with under five population of  
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34 38,019), and the annual per capita net income of rural residents was 6,464 Yuan (1026 USD)  
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36 in 2010 (data from Zhao county statistics bureau, unpublished.). There are four county-level  
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38 hospitals, 16 township hospitals, and 281 village clinics in Zhao County.  
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47 *Survey instrument*

48 The maternal, newborn and child health (MNCH) household survey (unpublished, 2009) was  
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50 used as the survey instrument. It was developed by the WHO and has previously been used in  
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52 Cambodia, Papua New Guinea and Vietnam [24]. We translated the standard WHO  
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54 household survey from English into Chinese, and adapted the survey following a consultation  
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with Chinese experts and three pilot studies. The instrument collects data on the coverage of key child health interventions, delivery channels, reasons for coverage failure and health expenditure. The survey used in this study included modules on antenatal care, delivery and neonatal care, breastfeeding and nutrition, immunization, cough and fever, diarrhoea and vitamin A. The breastfeeding and nutrition module aims to collect feeding information on children aged 0-23 months, including caregivers' feeding knowledge and practices, delivery channels and reasons for low coverage.

In 2009, WHO and UNICEF jointly published the document *Indicators for Assessing Infant and Young Child Feeding Practices*, and set up 15 international standard infant and young child feeding coverage indicators (eight core indicators and seven supplementary indicators), which encourages researchers in all countries to use these indicators and makes the data comparable between countries [25]. To date, very few studies in China applied these standard indicators to assess infant feeding practices. Studies were either focused on breastfeeding practices [20] or confined to earthquake areas [26]. The breastfeeding and nutrition module in MNCH household survey has standard questions for delivery channels, reasons for coverage failure, but only three core IYCF coverage indicators. Therefore, we inserted questions on the remaining core coverage indicators from the IYCF instrument to complete our survey instrument.

### **Participants**

Caregivers in Zhao County were eligible to participate in the survey if they had a child aged 0-23 months. Mothers were the primary target group for the breastfeeding and nutrition module. If mothers were not at home or did not live with the child for any reason, other caregivers were interviewed to collect other information, such as basic household

characteristics, cough and fever, diarrhea and immunization.

*Sample size and sampling*

The sample size for the survey was based on a planned cluster randomized control trial in Zhao County. The trial aims to develop and test the (cost-) effectiveness of scaled-up integrated child health interventions. The MNCH household survey was used as the baseline assessment for the trial. The sample size calculation and sampling method were based on the requirement of the trial, with townships as the randomization unit (8 townships per group). We expected to achieve a 10% reduction of anemia prevalence, and at least a 20% increase for knowledge and practice of appropriate feeding. With power of 80%, design effect of 2 and 5% as the significance level, we calculated that a sample size of 800 children under 2 years old per group would be sufficient for all key indicators. We over-sampled 30% of children to compensate for possible refusal and loss to follow-up. We used a two-stage sampling procedure to select children for this survey. In the first stage, clusters were selected using Proportional to Population Size sampling, with 10 clusters chosen from each township. In the second stage, the name list of all eligible children under two years old in each village was obtained and 13 children per cluster were randomly selected using Microsoft Excel (version 2007) software. We interviewed 10 caregivers out of 13 sampled children in each cluster based on the order in which they came to the village clinic. If less than 10 sampled children were available, we asked village doctors to help us to find other children from the name list who lived nearest to the village clinics and were in the same age groups. We used those

children as substitutes for the unavailable children.

### *Training of interviewers*

We recruited 30 students from Hebei United University School of Public Health as interviewers. We trained them for three days, of which half a day was for field practice. The training included communication skills, explanation of questionnaires, demonstration, role plays, field practice, and group discussions. The survey supervisors were all from the Capital Institute of Pediatrics, Beijing.

### *Data collection*

We used smartphones to record data instead of traditional pen-and-paper data collection, with the standardized MNCH household survey questionnaire set up in special developed software.

We tested and used smartphones for the MNCH survey several times in the field [27].

We carried out the survey from August 15th to 24th 2011 (10 days). Three teams of interviewers carried out the survey, with ten interviewers and two supervisors in each team. Interviewers first introduced mothers or other caregivers to the aim of the survey and obtained written informed consent. Then the interviewers questioned the mothers or other caregivers following the instructions on the smartphone. Once an interviewer completed a questionnaire, the data were wirelessly uploaded into an Excel database via the internet server. Then the data were saved in the memory card of the smartphone as a text file to have a backup. We gave

each mother a towel (worth 5 Yuan, equal to 0.79 USD) to show appreciation for their participation.

**Data analysis**

Data uploaded onto an internet server were automatically transformed into a Microsoft Excel sheet. After the data cleaning, we converted the database into data base file (dbf) for the final analysis. We carried out statistical analysis with SAS 9.1 for Windows. We presented the descriptive results of our findings; data are reported with percentages, except for age of parents, which is reported as a mean and range.

**Ethical considerations**

The study was approved by the Ethical Committee of Capital Institute of Pediatrics. All interviewees read the Information Sheet and provided both oral and written informed consent on behalf of the children involved in our study.

## Results

### Participants

A total of 1601 caregivers of children under 2 years old were interviewed. Among them, 90.1% (1443) were mothers, 8.6% (138) were grandparents, 1.1% (17) were fathers and 0.2% (9) were others (such as uncles and aunts). Table 1 presents the characteristics of children and their parents. Among 1601 children surveyed, 57.7% were aged 0-11 months and 43.3% were aged 12-23 months. The gender ratio (boys to girls) of children surveyed was 138:100. The mean age of mothers was 27 years (ranging from 20 to 43 years) and the mean age of father was 28 years (ranging from 22 to 49 years). Overall, education of fathers and mothers was good; more than 80% of them completed at least 9 years of education.

**Table 1 Characteristics of surveyed children and their parents**

	Category	Subcategory	Results (%)
<b>Children<sup>a</sup></b>	<b>Age group</b>	0-11 months	923(57.7)
		12-23 months	678(42.3)
	<b>Gender</b>	Boys	916(57.2)
		Girls	685(43.8)
<b>Mothers<sup>b</sup></b>	<b>Education</b>	Completed junior high school (9 years)	1117(70.6)
		Completed senior high school (12 years)	158(10.0)
<b>Fathers<sup>c</sup></b>	<b>Education</b>	Completed junior high school (9 years)	1149(72.7)
		Completed senior high school (12 years)	158(10.0)

<sup>a</sup> The total number of children was 1601

<sup>b&c</sup> The total number of mothers and fathers was 1583 and 1580 respectively, because some of the other caregivers of children did not know the education of the parents of the children.

*Knowledge and practices of infant and young child feeding*

As shown in Table 2, the feeding practices were generally suboptimal. Early initiation of breastfeeding was only 22.4%, exclusive breastfeeding for 6 months was less than 10%, and continued breastfeeding up to the age of two was just 38.2%. Only 32.5% of children were given iron-rich or iron-fortified foods. The knowledge of caregivers about feeding recommendations was low.

**Table 2 Knowledge and practices of caregivers on key IYCF indicators**

	Number of mothers who responded positive on the particular knowledge/practices	Total number of mothers eligible for the question	Percentage (%) (95% CI)
Mothers <b>knowing</b> to initiate breastfeeding within 1 hour of birth	469	1443	32.5 (30.1, 34.9)
Children who were initiated breastfeeding within 1 hour of birth	317	1417 <sup>a</sup>	22.4 (20.2, 24.6 )
Mothers <b>knowing</b> the duration of Exclusive breastfeeding	539	1443	37.3 (34.8, 39.8)
Children under 6 months exclusively breastfed	40	414 <sup>b</sup>	9.7 (6.8, 12.6)
Mothers <b>knowing</b> continued breastfeeding until two years	84	1443	5.8 (4.6, 7.0)
Children breastfed until two years	104	272 <sup>c</sup>	38.2 (32.4, 44.0)
Caregivers <b>knowing</b> introduction of complementary foods at 6-8 months	759	1187	63.9 (61.2, 66.6)
Children given complementary foods at 6-8 months	196	233 <sup>d</sup>	84.1 (79.4, 88.8)
Caregivers <b>knowing</b> the minimum meal frequency	933	1182 <sup>f</sup>	60.0 (57.2, 62.8)



Children given minimum meal frequency	827	1187 <sup>e</sup>	69.7 (67.1, 72.3)
Caregivers <b>knowing</b> feeding children with meat at 6-8 months	113	1182 <sup>f</sup>	9.6 (7.9, 11.3)
Children given iron-rich or iron-fortified foods	386	1187 <sup>e</sup>	32.5 (29.8, 35.2)

<sup>a</sup>Only children ever breastfed were used to calculate this indicator (from MNCH household survey guideline)

<sup>b</sup>Only children aged 0 to 5 months were used to calculate this indicator (from IYCF guideline )

<sup>c</sup> Only children aged 20 to 23 months were used to calculate this indicator (from IYCF guideline )

<sup>d</sup> Only children aged 6 to 8 months were used to calculate this indicator (from IYCF guideline )

<sup>e</sup> Only children aged 6 to 23 months were used to calculate this indicator (from IYCF guideline )

<sup>f</sup> Data of 5 children on these two question were missing

The main reasons for not initiating breastfeeding early were cesarean section, seeing the baby after delivery later than one hour, not knowing about early initiation of breastfeeding, and having no breast milk (Figure 1). Twenty-two percent of the mothers received advice on non-exclusive breastfeeding from relatives and 7.0% of them from health workers (Figure 2).

### *Utilization of health care services*

Table 3 indicates that the maternal and child health care services were generally available and utilized by pregnant women, mothers and children, except for postnatal care. Only 11.4% of mothers received a home visit after delivery and 23.7% attended postnatal care at 42 days after delivery.

Table 3 Utilization of health care services by pregnant women, mothers and children

	Number of mothers who responded positive on the particular knowledge/practice	Total number of mothers eligible for the question	Percentage (%) (95% CI)
Pregnant women receiving antenatal care at least <i>once</i>	1350	1443	93.6 (92.3, 94.9)
Pregnant women receiving antenatal care <i>four times</i> or above	1014	1443	70.3 (67.9, 72.7)
Children delivered at hospital	1436	1443	99.5 (99.1, 99.9)
Mothers and children receiving home visit after delivery (within 7 days after discharge)	165	1442 <sup>a</sup>	11.4 (9.8, 13.0)
Mothers receiving post natal care at 42 days after delivery	340	1413	24.1 (21.9, 26.3)
Children ever immunized	1598	1601	99.8 (99.6, 100.0)

<sup>a</sup> Data of one child were missing

<sup>b</sup> Only children older than 42 days were used to calculate this indicator.

Sources of infant feeding information

Table 4 shows that only around one-fourth of mothers ever received feeding information during pregnancy and after delivery. Table 5 describes the sources of feeding information through which mothers received information. The leading sources were family members, neighbors, friends and popular media; these accounted for around 80% of the total information. Only around 20% of the information came from health facilities and nearly none came from the community.

**Table 4 Mothers ever receiving feeding information**

	Number of mothers who responded positive on the particular knowledge/practices	Total number of mothers eligible for the question	Percentage (%) (95% CI)
Receiving breastfeeding information during pregnancy	379	1443	26.3 (24.0, 28.6)
Receiving breastfeeding information after delivery	415	1443	28.8 (26.5, 31.1)
Receiving complementary feeding information during pregnancy	341	1440 <sup>a</sup>	23.7 (21.5, 25.9)
Receiving complementary feeding information after delivery	385	1440 <sup>a</sup>	26.7 (24.4, 29.0)

<sup>a</sup> Data of three children were missing

**Table 5 Sources of feeding information for mothers during pregnancy and after delivery**

	Breastfeeding		Complementary feeding		Formula feeding	
	n	% (N=749 <sup>a</sup> )	n	% (N=664 <sup>a</sup> )	n	% (N=244 <sup>a</sup> )
Family members/ neighbors/friends	276	36.8	316	47.6	144	59.0
Popular media	312	41.7	228	34.3	5	2.0
Health facility	160	21.4	120	18.1	65	26.6
Community	1	0.1	0	0.0	1	0.4
Formula company	-	-	-	-	29	11.9
<b>Total</b>	749	100.0	664	100.0	244	100.0

<sup>a</sup> These are the multi-choice questions which mean all sources of information mentioned by interviewees are recorded as “yes”. To calculate the proportions, all “yes” answers in different categories are summed up as denominators, and all “yes” answers in each category are summed up as numerators.

*Household property*

Table 6 indicates that nearly all households owned a television and a mobile phone. More than 60% of the households owned computers, with 54.8% having access to internet.

**Table 6 Households owning a radio, television, mobile phone, computer, and accessing to the internet**

	Number of mothers who responded positive on the particular knowledge/practices	Total number of mothers eligible for the question	Percentage (%) (95% CI)
Households owning a radio	377	1601	23.6 (21.5, 25.7)
Households owning a television	1600	1601	99.9 (99.7, 100)
Households owning a mobile phone	1591	1601	99.4 (99.0, 99.8)
Households owning a computer	979	1601	61.2 (58.8, 63.6)
Households with access to the internet at home	876	1600	54.8 (52.4, 57.2)

## Discussion

We found in our survey that caregivers' feeding practices were poor, which was consistent with the national data as indicated in the introduction of this paper. In addition, we found that the health care services were generally available and utilized by pregnant women and mothers, with notable exception of home visits, and visits to the health facility at 42 days after delivery. National data also showed that proportions of women who ever received antenatal care and postnatal care were 93.7% and 91.0% respectively. In addition, the hospital delivery rate was 98.7% [28]. However, high utilization of health services was not translated into high coverage of interventions.

Mothers need support not only from the health care system but also from the family, community and workplace to initiate and sustain optimal breastfeeding and complementary feeding practices [10]. Mothers also need consistent IYCF messages that are reinforced through multiple channels [29]. Therefore, health care providers' engagement, community involvement and media support are all needed to maximize the effectiveness of IYCF programs. Three recommendations emerged from our study findings:

### (i) Strengthening the quality of care at health facilities to improve feeding counseling:

China initiated the national Basic Public Health Service program [30] to provide universal basic public health services for all residents. Maternal and child health care workers are required by the program to provide face-to-face counseling to pregnant women during antenatal care visits and hospital delivery, and to mothers of young children during newborn home visits, postnatal care visits and child health care visits [31]. However, rural health

workers in China generally have low education, lack expertise and motivation for their work, which generally results in low quality health care services provided by rural health facilities [32-34]. Our study also indicated that few mothers reported that they ever received feeding counseling from health workers, which suggested that many health workers did not provide feeding counseling. In addition, we found that more than 50% of reasons for late initiation of breastfeeding were attributed to health facility environment such as high cesarean section, separation of babies from mothers, and doctors' advice. Also only 7% of mothers reported that they received advice on non-exclusive breastfeeding from health workers. It was reported that the current national rate of caesarean section in China was about 40%, which is the highest worldwide [35-36]. Therefore, there is a need to strengthen the quality of healthcare services provided by rural health facilities as well as to increase service coverage.

*(ii) Mobilize community resources to deliver IYCF recommendations:* Community-based breastfeeding promotion and support were proven to be effective. Therefore, the Global Strategy for Infant and Young Child Feeding recognizes this as one of the key components of a comprehensive program to improve breastfeeding practices [11]. Large-scale community-based programs have demonstrated that the community offers indispensable resources for breastfeeding promotion and support [37]. In the Regional Framework for Community IMCI of WHO Western Pacific Region, breastfeeding and complementary feeding are among the 12 key family practices that can be improved through community-based programs [38]. In addition, a study in China indicated that community-based behavioral change approaches that use trained village nutrition educators to

provide feeding counseling to pregnant women and mothers are effective to improve breastfeeding and complementary feeding practices [39]. Therefore, communities hold potential to effectively deliver IYCF recommendations in rural China.

Our data showed less than one in a hundred mothers received feeding information from their communities. Studies have shown that peer counseling and lay counseling are effective in promoting breastfeeding [40-43]. In rural China, existing community resources could be mobilized, such as the village women cadres, family planning workers, primary school teachers and volunteers, to provide feeding counseling to pregnant women and mothers.

*(iii) Utilize popular media as well as Internet and mobile phones to expand IYCF coverage:*

According to our results, the leading sources of feeding information were family members, neighbors, or friends and popular media (newspaper, magazine, book, radio and television: around 80% of information on breastfeeding and complementary feeding came from these two sources, whereas only 20% came from health facilities.

As those two main sources are both important, they should be fully used to disseminate accurate infant feeding information. However, we noted that some information from these two sources was invalid. As indicated in the results, around 60% of inaccurate advice to use formula feeding and more than 20% of inaccurate information on non-exclusive breastfeeding originated from family members, neighbors, and friends. Therefore, much more efforts must be made to strengthen these channels in terms of ensuring provision of correct information and broadening its scope to provide more mothers with accurate feeding advice.

Since there are two-thirds of mothers received no advice on feeding, new channels, such as internet and mobile phones, could be explored. Evidence indicated that computer-tailored nutrition education is an innovative and promising tool to motivate people to make healthy dietary changes [44]. Also, a recent study showed that internet nutrition education can be a viable alternative to traditional nutrition education for increasing fruit and vegetable consumption of women, infants and children [45].

With the rapid socio-economic development and technical progress, many Chinese people have access to new information and communication technologies. Data showed that, by the end of 2013, there were 1229 million mobile phone users and 618 million internet users in China [46]. Our survey showed that in Zhao County, nearly all households owned mobile phones, and more than 60% of households owned computers, with more than half of them having access to internet. . In addition, the young generation of parents is well educated; around 95% of fathers and mothers attended junior high school (9 years of education). This implies a potential to deliver feeding recommendations through mobile phones or the internet. Future studies are needed to test the feasibility and effectiveness of these potential delivery channels in the context of rural China.

**Conclusions**

Findings of our study indicated that few caregivers of children in rural China received feeding information during pregnancy and after delivery. Moreover, their feeding knowledge and



practices are poor, though the maternal and child health care services were generally available and utilized by mothers. Health facilities need to be strengthened and fully utilized to provide high-quality feeding counseling. Other channels, such as community resources, popular media, internet and mobile phones, hold great potential and should also be explored in future studies to maximize the effectiveness of IYCF programs.

## LIMITATIONS

Our study has several limitations. Firstly, the sampling of children was based on the name lists of children in each village. In Zhao County, all live births are reported to the Maternal and Child Health Hospital from all qualified delivery institutions each month. Therefore we obtained the name list from the hospital. Then we sent the name lists to village doctors and asked them to remove children who had died or moved outside the village and added children who were living in the village but who were not on the list. Although all these efforts were made, we were not sure on the completeness of the name lists and selection bias may have occurred. Secondly, some indicators such as initiation of breastfeeding after birth were based on the mothers' recall, with a longest recall time of two years, which may have introduced recall bias.

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**Contributorship statement**

The study was initiated and conceptualized by YFZ and RS. YFZ supervised the study. QW and YL collected and coded the data. QW performed data analysis. QW, YFZ, RS and MV participated in the explanation and discussion of the results. The manuscript was drafted by QW, reviewed and revised by YFZ, RS, MV, LC, WW, YL and JC. All authors read and approved the final manuscript.

**Competing interests**

The authors declare no competing interest.

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## Data sharing

All the data in this study belong to the Capital Institute of Pediatrics.

For peer review only

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**Figure legends:**

Figure 1: Distribution of reported reasons for late initiation of breastfeeding

Figure 2: Distribution of reasons for non-exclusive breastfeeding

ORIGINAL ARTICLE

Title page

Poor infant and young child feeding practices and sources of caregivers’ feeding knowledge in rural Hebei Province, China: findings from a cross-sectional survey

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**Key words**

Breastfeeding, complementary feeding, undernutrition, mobile phone, China.

Word count: ~~5988~~5649

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**Abstract**

**Objectives:** To obtain a general overview of infant and young child feeding practices in one rural county in China and identify current delivery channels and challenges.

**Design:** A cross-sectional study.

**Setting:** A rural county, Zhao County, in Hebei Province, China.

**Participants:** Ten clusters were first selected within each township (16 townships in total) with Proportional to Population Size sampling (~~PPS~~). In each cluster, a name list was used to select 13 children aged 0-23 months~~-old~~. We interviewed caregivers of all the selected children.

**Primary and secondary outcomes measures:** Coverage of infant feeding practices, reasons for low coverage of infant feeding practices, and current delivery channels of infant feeding practices.

**Results**

Findings from our survey indicated that infant feeding practices were poor. Early initiation of breastfeeding was only 22.4%, exclusive breastfeeding for 6 months was less than 10%, and

continued breastfeeding up to the age of two was ~~just only~~ 38.2%, ~~and only~~ 32.5% of children were given iron-rich or iron-fortified foods. The leading sources of infant feeding information were family members, neighbors, friends and popular media, ~~only~~ around 20% of the information came from health facilities and nearly none came from communities. Household property data showed that 99.9% of households owned televisions and 99.4% ~~of households owned televisions and owned~~ mobile phones ~~respectively, and~~ In addition, 61.2% of the households owned computers, with 54.8% having access to the internet.

### **Conclusions**

Few caregivers of children in Zhao County received feeding information during pregnancy and after delivery. Moreover, ~~and~~ their feeding knowledge and practices were ~~rather~~ poor. Multi-channel approaches, delivered through health facilities, community resources, popular media, ~~and the~~ internet and mobile phones, hold potentials to improve infant feeding practices and should be explored in future studies.

### **Strengths and Limitations**

Although this study took place only within one county, a full range of globally standard feeding indicators were used to assess feeding practices of caregivers in our study. ~~In addition, health care information delivery channels and reasons for not initiating breastfeeding early and non-exclusive breastfeeding were first explored in our study.~~ The name lists of children in some villages may not be complete, and therefore selection bias may have occurred. Some

indicators may have recall bias due to long recall time.

*Trial registration number:* ChiCTR-PRC-11001446.

**Main text**

**Background**

Nutritional status is an important determinant of maternal and child health [1, 2]. ~~While~~ ~~Maternal~~ maternal and child undernutrition is still highly prevalent in low- and middle-income countries ~~and~~ ~~resulting~~ in significantly increased mortality and morbidity in mothers and children. Suboptimal ~~um~~ breastfeeding ~~is a and complementary feeding, which are the~~ key factors for undernutrition in infants ~~and~~ was estimated to be responsible for ~~1.4 million~~ 804,000 child deaths worldwide in 2011 ~~and 44 million disability-adjusted life years (DALYs) worldwide~~ [3]. Studies have consistently shown that the peak for growth faltering, micronutrient deficiencies and common childhood illnesses occurs ~~the period~~ from birth up to two years of age ~~is the peak for growth faltering, micronutrient deficiencies and common childhood illnesses~~ [3-5].

Appropriate infant and young child feeding (IYCF) is the basis for child survival, growth and development [3, 4, 6, 7]. The benefits of breastfeeding for both infants and mothers ~~have~~ been well documented in studies, including reducing the risk of morbidity and mortality, especially from infectious diseases such as diarrhoea and pneumonia [8, 9]. Introducing safe and adequate complementary foods to children aged at six months ~~of age~~ helps to fill dietary gaps that cannot be met by breast milk alone. Continued breastfeeding for two years or

beyond is an essential component of appropriate complementary feeding [10].

To emphasize the importance of children's feeding, the World Health Organization (WHO) and United Nations Children's Fund (UNICEF) jointly developed the Global Strategy for Infant and Young Child Feeding (IYCF) in 2002 [11]. ~~They formulated the global public health. The~~ recommendations in this strategy state that children should be exclusively breastfed ~~ing~~ for six months after birth, and provided ~~ing~~ with safe and appropriate complementary foods with continued breastfeeding ~~for~~ up to two years ~~of age~~ or beyond [11].

During the past decade, the Ministry of Health of China (MoHCh) adopted the WHO's infant and young child feeding recommendations and implemented programs to improve nutrition practices [12, 13]. However, suboptimal ~~um~~ infant feeding is still very common in China. ~~The~~ National Chinese data from 2008 showed that only 27.6% of Chinese children were exclusively breastfed up to 6 months, only 43.3% of children aged 6 to 9 months were introduced to ~~had~~ solid or semi-solid foods ~~introduced~~, and only 37.0% of children aged 12 to 15 months received continued breastfeeding [14]. In addition, too early or too late introduction of complementary food ~~[15-19]~~ and a restriction in food ~~s~~ selection, especially for animal source food, were widespread in China [15-19]. In poor rural areas, the rate of exclusive breastfeeding, continued breastfeeding for 1 year, and continued breastfeeding for 2 years were 28.7%, 55.5% and 9.4%, respectively [20]. ~~While~~ At the same time, the rate of underweight was 8.0%, and the rate of stunting was 20.3%. In addition, and anaemic was 8.0%, 20.3% and 14.2% of children were anaemic, and this rate was the highest among children aged 6-11 months (31.9%) respectively. It is noticeable that almost one third (31.9%)

~~of children aged 6-11 months were anaemic~~ [21]. These percentages can be translated into large absolute numbers of children in China. ~~While the s~~Stunting rate was reduced by two thirds between 1990 and 2010 [21], it was ~~still~~ estimated that 8.82million children in China were still stunted in 2010 [21].

The poor ~~infant and young child~~ feeding practices and nutritional status ~~of children~~ indicated that ~~these~~ recommendations ~~from WHO and UNICEF~~ have not been put into practice. Therefore, the challenge is how to effectively translate the infant and young child feeding recommendations into caregivers' feeding behaviors in China, thereby enhancing children's dietary intake and growth. ~~However, While~~ the delivery channels for IYCF recommendations were not fully assessed for ~~its~~~~their~~ usage and potential in previous studies in China. ~~Thus,~~ ~~Our~~ study used a full range of globally standard breastfeeding and complementary feeding indicators to assess the feeding practices of caregivers in ~~one-of~~ rural county~~ies~~ in China. ~~In addition, and collected~~ information on delivery channels ~~was collected with the aim of~~ ~~trying to~~ ~~filling~~ this gap ~~which can~~ ~~and~~ providing ~~a~~ basis for develop~~menting~~ ~~of~~ effective infant and young child feeding strategies.

**Materials and Methods**

*Survey setting*

We conducted a cross-sectional household survey in Zhao County ~~of-in~~ Hebei ~~P~~province in 2011. Hebei province is located in the northern part of ~~the~~ North China Plain, with an annual per capita net income of rural residents of 5,958 Yuan (946 USD) in 2010 [22], which ~~was~~ ~~is~~ nearly the same as national average (5,919 Yuan) [23]. Zhao County is located in the



middle-south part of Hebei Province. It has a total population of 571,000 (with under five population of 38,019), and the annual per capita net income of rural residents ~~was~~ 6,464 Yuan (1026 USD) in 2010 (data from Zhao county statistics bureau, unpublished.). There are four county-level hospitals, 16 township hospitals, and 281 village clinics in Zhao County.

### Survey instrument

The maternal, newborn and child health (MNCH) household survey (unpublished, 2009) was used as the survey instrument. It was developed by the WHO and has previously been used in Cambodia, Papua New Guinea and Vietn-Nam [24]. We translated the standard WHO household survey from English into Chinese, and adapted the survey following a consultation with Chinese experts and ~~after~~ three pilot studies. The instrument collects data on the coverage of key child health interventions, delivery channels, reasons for coverage failure and health expenditures. ~~Our~~ The survey used in this study included modules on antenatal care, delivery and neonatal care, breastfeeding and nutrition, immunization, cough and fever, diarrhoea and vitamin A. The breastfeeding and nutrition module aims to collect feeding information on children aged 0-23 months, including caregivers' feeding knowledge and practices, delivery channels and reasons for low coverage.

In 2009, WHO and UNICEF jointly published the document *Indicators for Assessing Infant and Young Child Feeding Practices*, and set up 15 international standard infant and young child feeding coverage indicators (eight core indicators and seven supplementary indicators), which encourages researchers in all countries to use these indicators and makes the data comparable between countries [25]. ~~To date~~ Now, very few studies in China applied these standard indicators to assess infant feeding practices. Studies were either focused on breastfeeding practices [20] or confined to earthquake areas [26]. ~~Since~~ The breastfeeding

and nutrition module in MNCH household survey has ~~the~~ standard questions for delivery channels, reasons for coverage failure, but only three core IYCF coverage indicators. Therefore, we ~~then~~ inserted questions on the ~~rest~~remaining core coverage indicators from the IYCF ~~instrument indicators~~ to ~~complete~~formulate our survey instrument.

**Participants**

Caregivers in Zhao County were eligible to participate in the survey if they had a child aged 0-23 months. Mothers were the primary target group for the breastfeeding and nutrition module. If mothers were not at home or did not live with the child for any reason, other caregivers were interviewed to collect other information, such as ~~on~~ basic household characteristics, cough and fever, diarrhea and immunization.

**Sample size and sampling**

The sample size for the survey was based on a planned cluster randomized control trial in Zhao County. The trial aims to develop and test the (cost-) effectiveness of scaled-up integrated child health interventions. The MNCH household survey ~~is~~was used as the baseline assessment for the trial. The sample size calculation and sampling method were based on the requirement of the trial, with townships as the randomization unit (8 townships per group). We expected to achieve a 10% reduction of anemia prevalence, and at least a 20% increase for knowledge and practice of appropriate feeding. With power of 80%, design effect of 2 and 5% as the significance level, we calculated that ~~a~~the sample size of 800 children under 2 years old per group would be sufficient for all key indicators. We over-sampled 30%

of children to compensate for possible refusal and loss to follow-up. We used a two-stage sampling procedure to select children for this survey. In the first stage, clusters were selected using Proportional to Population Size sampling, with 10 clusters chosen from each township. In the second stage, the name list of all eligible children under two years old in each village was obtained and 13 children per cluster were randomly selected using Microsoft Excel (version 2007) software. We interviewed ~~10~~ten caregivers out of 13 sampled children in each cluster based on the order in which they came to the village clinic. If less than 10 sampled children were available, we asked village doctors to help us to find other children from the name list who lived nearest to the village clinics and were in the same age groups. We used those children as substitutes for the unavailable children.

### *Training of interviewers*

We recruited 30 students from Hebei United University School of Public Health as interviewers. We trained them for three days, of which with half a day was for field practice, ~~after which they conducted the survey~~. The training included communication skills, explanation of questionnaires, demonstration, role plays, field practice, and group discussions. The survey supervisors were all from the Capital Institute of Pediatrics, Beijing.

### *Data collection*

We used smartphones to record data instead of traditional pen-and-paper data collection, with the standardized MNCH household survey questionnaire set up in specially developed

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software. We tested and used smartphones for the MNCH survey several times in the field [27].

We carried out the survey ~~out~~ from August 15th to 24th 2011 (10 days). Three teams of interviewers carried out the survey, with ten interviewers and two supervisors in each team. Interviewers first introduced mothers or other caregivers to the aim of the survey and obtained written informed consent. Then the interviewers questioned the mothers or other caregivers following the instructions on the smartphone. Once an interviewer completed a questionnaire, the data wereas wirelessly uploaded into an Excel database via the internet server. Then the data wereas saved in the memory card of the smartphone as a text file to have a backup. We gave each mother a towel (worth 5 Yuan, equal to 0.79 USD) to show appreciation for their participation.

**Data analysis**

Data uploaded onto an internet server were automatically transformed into a Microsoft Excel sheet. After the data cleaning, we converted the database into data base file (dbf) for the final analysis. We carried out statistical analysis with SAS 9.1 for Windows. We presented the descriptive results of our findings; data are reported with percentages, except for age of parents, which isare reported as a mean and range.

**Ethical considerations**

The study was approved by the Ethical Committee of Capital Institute of Pediatrics. All

interviewees read the Information Sheet and provided both oral and written informed consent on behalf of the children involved in our study.

For peer review only

Results

Participants

A total of 1601 caregivers of children under 2 years old were interviewed. Among them, 90.1% (1443) were mothers, 8.6% (138) were grandparents, 1.1% (17) were fathers and 0.2% (9) were others (such as uncles and aunts). Table 1 presents the characteristics of children and their parents. Among 1601 children surveyed, 57.7% ~~of them~~ were aged 0-11 months and 43.3% ~~of them~~ were aged 12-23 months. The gender ratio (boys to girls) of children surveyed was 1:38:100. The mean age of mothers ~~and fathers~~ ~~was~~ ere 27 years (ranging from 20 to 43 years) and the mean age of father was 28 years (ranging from 22 to 49 years) ~~years old~~ ~~respectively~~. Overall, education of fathers and mothers was good; more than 80% of them completed at least 9 years of education.

Table 1 Characteristics of surveyed children and their parents

	Category	Subcategory	Results (%)
Children <sup>a</sup>	Age group	0-11 months	923(57.7)
		12-23 months	678(42.3)
	Gender	Boys	916(57.2)
		Girls	685(43.8)
Mothers <sup>b</sup>	Education	<del>C</del> ompleted <del>ing</del> junior high school (9 years)	1117(70.6)
		<del>C</del> ompleted <del>ing</del> senior high school (12 years)	158(10.0)
Fathers <sup>c</sup>	Education	<del>C</del> ompleted <del>ing</del> junior high school (9 years)	1149(72.7)
		<del>C</del> ompleted <del>ing</del> senior high school (12 years)	158(10.0)

<sup>a</sup> The total number of children was 1601  
<sup>b&c</sup> The total number of mothers and fathers was 1583 and 1580 respectively, because some of the other caregivers of children did not know the education of the parents of the children.

### Knowledge and practices of infant and young child feeding

As shown in Table 2, the feeding practices were generally suboptimal. Early initiation of breastfeeding was only 22.4%, exclusive breastfeeding for 6 months was less than 10%, and continued breastfeeding up to the age of two was ~~just only~~ 38.2% ~~and~~ Only 32.5% of children were given iron-rich or iron-fortified foods. The knowledge of caregivers about feeding recommendations was ~~similarly~~ low.

**Table 2 Knowledge and practices of caregivers on key IYCF indicators**

	Number of mothers who responded positive on the particular knowledge/practices	Total number of mothers eligible for the question	Percentage (%) <u>(95% CI)</u>
Mothers <b>knowing</b> to initiate breastfeeding within 1 hour of birth	469	1443	32.5 <u>(30.1, 34.9)</u>
Children who were initiated breastfeeding within 1 hour of birth	317	1417 <sup>a</sup>	22.4 <u>(20.2, 24.6)</u>
Mothers <b>knowing</b> the duration of Exclusive breastfeeding	539	1443	37.3 <u>(34.8, 39.8)</u>
Children under 6 months exclusively breastfed	40	414 <sup>b</sup>	9.7 <u>(6.8, 12.6)</u>
Mothers <b>knowing</b> continued breastfeeding until two years	84	1443	5.8 <u>(4.6, 7.0)</u>
Children breastfed until two years	104	272 <sup>c</sup>	38.2 <u>(32.4, 44.0)</u>
Caregivers <b>knowing</b> introduction of complementary foods at 6-8 months	759	1187	63.9 <u>(61.2, 66.6)</u>
Children given complementary foods at 6-8 months	196	233 <sup>d</sup>	84.1 <u>(79.4, 88.8)</u>
Caregivers <b>knowing</b> the minimum	933	1182 <sup>f</sup>	60.0

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meal frequency			(57.2, 62.8)
Children given minimum meal frequency	827	1187 <sup>e</sup>	69.7 (67.1, 72.3)
Caregivers <b>knowing</b> feeding children with meat at 6-8 months	113	1182 <sup>f</sup>	9.6 (7.9, 11.3)
Children given iron-rich or iron-fortified foods	386	1187 <sup>e</sup>	32.5 (29.8, 35.2)

<sup>a</sup>Only children ever breastfed were used to calculate this indicator (~~f~~From MNCH household survey guideline)

<sup>b</sup>Only children aged 0 to 5 months were used to calculate this indicator (~~f~~From ~~IYCF~~ ~~G~~ guideline ~~of~~ ~~IYCF~~)

<sup>c</sup>Only children aged 20 to 23 months were used to calculate this indicator (~~f~~From ~~IYCF~~ ~~g~~ guideline ~~of~~ ~~IYCF~~)

<sup>d</sup>Only children aged 6 to 8 months were used to calculate this indicator (~~f~~From ~~IYCF~~ ~~g~~ guideline ~~of~~ ~~IYCF~~)

<sup>e</sup>Only children aged 6 to 23 months were used to calculate this indicator (~~f~~From ~~IYCF~~ ~~g~~ guideline ~~of~~ ~~IYCF~~)

<sup>f</sup>Data of 5 children on these two question were missing

The main reasons for not initiating breastfeeding early (~~Figure 1~~) were cesarean section, seeing the baby after delivery later than one hour, not knowing about early initiation of breastfeeding, and having no breast milk (Figure 1). ~~and doctor's advice not to initiate breastfeeding early.~~ Twenty-two percent of the mothers received advice on non-exclusive breastfeeding from relatives and 7.0% of them from ~~the~~ health workers (Figure 2).

*Utilization of health care services*

Table 3 indicates that the maternal and child health care services were generally available and utilized by pregnant women, mothers and children, except for postnatal care. Only 11.4% of mothers received a home visit after delivery and 23.7% ~~of mothers received a home visit after delivery and~~ attended postnatal care at 42 days after delivery ~~respectively~~.



Table 3 Utilization of health care services by pregnant women, mothers and children

	Number of mothers who responded positive on the particular knowledge/practice	Total number of mothers eligible for the question	Percentage (%) <u>(95% CI)</u>
<del>proportion of p</del> Pregnant women receiving antenatal care at least <i>once</i>	1350	1443	93.6 <u>(92.3, 94.9)</u>
<del>proportion of p</del> Pregnant women receiving antenatal care <i>four times</i> or above	1014	1443	70.3 <u>(67.9, 72.7)</u>
<del>proportion of e</del> Children delivered at hospital	1436	1443	99.5 <u>(99.1, 99.9)</u>
<del>proportion of m</del> Mothers and children receiving home visit after delivery (within 7 days after discharge)	165	1442 <sup>a</sup>	11.4 <u>(9.8, 13.0)</u>
<del>proportion of m</del> Mothers receiving post natal care at 42 days after delivery	340	1413	24.1 <u>(21.9, 26.3)</u>
<del>Proportion of e</del> Children ever immunized	1598	1601	99.8 <u>(99.6, 100.0)</u>

<sup>a</sup> Data of one child~~ren~~ ~~were~~as missing

<sup>b</sup> Only children older than 42 days ~~age~~ were used to calculate this indicator.

### Sources of infant feeding information

Table 4 shows that only around one-fourth of mothers ever received feeding information during pregnancy and after delivery. Table 5 describes the sources of feeding information through which mothers received d information. The leading sources were family members, neighbors, friends and popular media; these accounted for around 80% of the total

information. Only around 20% of the information came from health facilities and nearly none came from the community.

Table 4 Mothers ever receiving feeding information

	Number of mothers who responded positive on the particular knowledge/practices	Total number of mothers eligible for the question	Percentage (%) <u>(95% CI)</u>
<del>Proportion of mothers ever r</del> Receiving breastfeeding information during pregnancy	379	1443	26.3 <u>(24.0, 28.6)</u>
<del>Proportion of mothers ever r</del> Receiving breastfeeding information after delivery	415	1443	28.8 <u>(26.5, 31.1)</u>
<del>Proportion of mothers ever r</del> Receiving complementary feeding information during pregnancy	341	1440 <sup>a</sup>	23.7 <u>(21.5, 25.9)</u>
<del>Proportion of mothers ever r</del> Receiving complementary feeding information after delivery	385	1440 <sup>a</sup>	26.7 <u>(24.4, 29.0)</u>

<sup>a</sup> Data of three children ~~were~~was missing

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Table 5 Sources of feeding information for mothers during pregnancy and after delivery

	<del>B</del> reastfeeding		<del>C</del> omplementary feeding		<del>F</del> ormula feeding	
	n	% (N=749 <sup>a</sup> )	n	% (N=664 <sup>a</sup> )	n	% (N=244 <sup>a</sup> )
Family members/ neighbors/friends	276	36.8	316	47.6	144	59.0
<del>P</del> opular media	312	41.7	228	34.3	5	2.0
Health facility	160	21.4	120	18.1	65	26.6
Community	1	0.1	0	0.0	1	0.4
Formula company	-	-	-	-	29	11.9

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<b>Total</b>	749	100.0	664	100.0	244	100.0
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<sup>a</sup> These are the multi-choice questions which mean all sources of information mentioned by interviewees are recorded as “yes”. To calculate the proportions, all “yes” answers in different categories are summed up as denominators, and all “yes” answers in each category are summed up as numerators.

### Household property

Table 6 indicates that nearly all households s owned a television and a mobile phone, ~~and~~  
~~m~~More than 60% of the households owned computers, with 54.8% having access to internet.

**Table 6 Households owning a radio, televisionTV, mobile phones, computers, and accessing to the internet**

	Number of mothers who responded positive on the particular knowledge/practices	Total number of mothers eligible for the question	Percentage (%) <u>(95% CI)</u>
<del>Proportion of h</del> Households owning <u>a</u> radio	377	1601	23.6 <u>(21.5, 25.7)</u>
<del>proportion of h</del> Households owning <u>a</u> <u>televisionTV</u>	1600	1601	99.9 <u>(99.7, 100)</u>
<del>proportion of h</del> Households owning <u>a</u> mobile phones	1591	1601	99.4 <u>(99.0, 99.8)</u>
<del>proportion of h</del> Households owning <u>a</u> computers	979	1601	61.2 <u>(58.8, 63.6)</u>
<del>proportion of h</del> Households <u>with</u> accessing to <u>the i</u> nternet at home	876	1600	54.8 <u>(52.4, 57.2)</u>

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**Discussion**

We found in our survey that caregivers’ feeding practices were ~~rather~~ poor, which ~~were~~ was consistent with the national data as indicated in the introduction of this paper. In addition, we found that the health care services were generally available and utilized by pregnant women and mothers, with notable exception of home visits, and visits to the health facility at 42 days after delivery. National data also showed that proportions of women who ever received antenatal care and postnatal care ~~were~~ as 93.7% and 91.0% respectively. ~~In addition, and the~~ hospital delivery rate was 98.7% [28]. However, ~~the~~ high utilization of health services was not translated into high coverage of interventions.

Mothers need support not only from the health care system but also from the family, community and workplace to initiate and sustain optimal breastfeeding and complementary feeding practices [10]. Mothers also need consistent IYCF messages that are reinforced through multiple channels [29]. Therefore, ~~engagement of~~ health care providers’ engagement, community involvement and media support are all needed to maximize the effectiveness of IYCF programs. Three recommendations emerged d from our study findings:

(i) Strengthening the quality of care at health facilities to improve feeding counseling:

China initiated the national Basic Public Health Service program [30] to provide universal

basic public health services for all residents. Maternal and child health care workers are required by the program to provide face-to-face counseling to pregnant women ~~and mothers of young children at~~ during antenatal care visits ~~and~~ hospital delivery, ~~and to mothers of young children during~~ newborn home visits, postnatal care visits and child health care visits [31]. However, rural health workers in China ~~are~~ generally ~~have of~~ low education, lacking expertise and ~~low~~ motivation for their work, ~~which generally results in low quality, and~~ health care services provided by rural health facilities ~~is generally of low quality~~ [32-34]. Our study also indicated that few mothers reported ~~that~~ they ever received feeding counseling from health workers, which suggested that many health workers did not provide feeding counseling. In addition, we ~~also~~ found that more than 50% of reasons for late initiation of breastfeeding ~~were~~ attributed to health facility ~~environmenties~~ such as high cesarean section, separation of babies from mothers, and doctors' advice. ~~Also only, and~~ 7% of mothers reported ~~that~~ they received advice on non-exclusive breastfeeding from health workers. ~~It was reported that the current national rate of caesarean section in China was about 40%, which is the highest worldwide [35-36].~~ Therefore, there is a need to strengthen the quality of healthcare services provided by rural health facilities as well as to increase ~~the~~ service coverage.

*(ii) Mobilize community resources to deliver IYCF recommendations:* Community-based breastfeeding promotion and support were proven to be effective. Therefore, the Global Strategy for Infant and Young Child Feeding recognizes ~~it~~ ~~this~~ as one of the key components of a comprehensive program to improve breastfeeding practices [11]. Large-scale

community-based programs have demonstrated that the community offers indispensable resources for breastfeeding promotion and support [375]. In the Regional Framework for Community IMCI of WHO Western Pacific Region, breastfeeding and complementary feeding are among the 12 key family practices ~~that~~<sup>which</sup> can be improved through community-based programs [386]. In addition, a study in China ~~also~~ indicated that community-based behavioral change approaches ~~that~~ <sup>using</sup> trained village nutrition educators to provide feeding counseling to pregnant women and mothers ~~is~~ <sup>are</sup> effective to improve breastfeeding and complementary feeding practices [397]. Therefore, communities hold potential to effectively deliver IYCF recommendations in rural China.

~~Although the community can be an effective channel to deliver IYCF recommendations, o~~Our data showed less than one in a hundred mothers received feeding information from their communities. Studies have shown that peer counseling and lay counseling are effective in promoting breastfeeding [4038-434]. In rural China, existing community resources ~~could~~ <sup>can</sup> be mobilized, ~~for example, such as~~ the village women cadres, family planning workers, primary school teachers and volunteers, ~~can be used for~~ <sup>to provide</sup> feeding counseling to pregnant women and mothers.

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(iii) Utilize popular media as well as Internet and mobile phones to expand IYCF coverage:

According to our results, the leading sources of feeding information were family members, neighbors, or friends and popular media (newspaper, magazine, book, radio and televisionTV): around 80% of information on breastfeeding and complementary feeding came from these two sources, whereas only 20% came from health facilities.

As those two main ~~groups~~ sources are both important, they should be fully used to disseminate accurate infant feeding information. However, we noted that some information from these two sources was ~~not in~~ valid. As indicated in the results, around 60% of inaccurate advice to use formula feeding and more than 20% of inaccurate information on non-exclusive breastfeeding originated from family members, neighbors, and friends. Therefore, much more efforts must be made to strengthen these channels in terms of ensuring provision of correct information and broadening ~~its~~ the scope to provide more mothers with accurate feeding advice.

Since there are two-thirds of mothers receiving ~~ed~~ no advice on feeding, new channels, such as internet and mobile phones, ~~sh~~ could be explored. Evidence indicated that computer-tailored nutrition education is an innovative and promising tool to motivate people to make healthy dietary changes [44]. Also, a recent study showed that internet nutrition education can be a viable alternative to traditional nutrition education for increasing fruit and vegetable consumption of women, infants and children [45].

With the rapid socio-economic development and technical progress, many Chinese people have access to new information and communication ~~technologies~~ products. Data showed that, by the end of 2013, there were 1229 million mobile phone users and 618 million internet users in China [46]. Our survey showed that in Zhao County, nearly all households owned mobile phones, and more than 60% of households owned computers, with more than half of them having access to internet. ~~Data showed that, by the end of 2010, 859 million Chinese people owned mobile phones and 457 million had access to the Internet, which gives a huge~~

~~potential for delivery IYCF recommendations [22].~~ In addition, the young generations of parents ~~are is~~ well educated. ~~a~~ Around 95% of fathers and mothers attended junior high school ~~(9 years of education)~~. This ~~implies a potential enables us~~ to deliver feeding recommendations through mobile ~~phones~~ or ~~the i~~Internet. Future studies are needed to test the feasibility~~ies~~ and effectiveness of these potential delivery channels in the context of rural China.

**Conclusions**

Findings of our study indicated~~d~~ that few caregivers of children in rural China received feeding information during pregnancy and after delivery. ~~Moreover, and~~ their feeding knowledge and practices are ~~rather~~ poor, ~~although~~ the maternal and child health care services were generally available and utilized by mothers. Health facilities need to be strengthened and fully utilized to provide high-quality feeding counseling. Other channels, such as community resources, popular media, internet and mobile phones, hold ~~large-great~~ potentials and should also be explored in future studies to maximize the effectiveness of IYCF programs.

**LIMITATIONS**

Our study has several limitations. Firstly, the sampling of children was based on the name lists of children in each village. In Zhao County, all live births are reported to the Maternal and Child Health Hospital from all qualified delivery institutions each month. ~~Therefore, so~~ we obtained the name list from the hospital. Then we sent the name lists to village doctors



and asked them to remove children who had died or moved outside the village and added children who were living in the village but who were not on the list. Although all these efforts were made, we were not sure on the completeness of the name lists and selection bias may have occurred. Secondly, some indicators such as initiation of breastfeeding after birth were based on the mothers' recall, with a longest recall time of two years, which and this may have introduced recall bias.

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### Contributorship statement

The study was initiated and conceptualized by YFZ and RS. YFZ supervised the study. QW and YL collected and coded the data. QW performed data analysis. QW, YFZ, RS and MV participated in the explanation and discussion of the results. The manuscript was drafted by QW, reviewed and revised by YFZ, RS, MV, LC, WW, YL and JC. All authors read and approved the final manuscript.

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**Competing interests**

The authors declare no competing interest.

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**Data sharing**

All the data in this study belong to the Capital Institute of Pediatrics.

**Conflict interest and funding disclosure**

~~The authors declare no competing interest. The survey was funded by the Ministry of Health of China (Project NO. 201002006).~~

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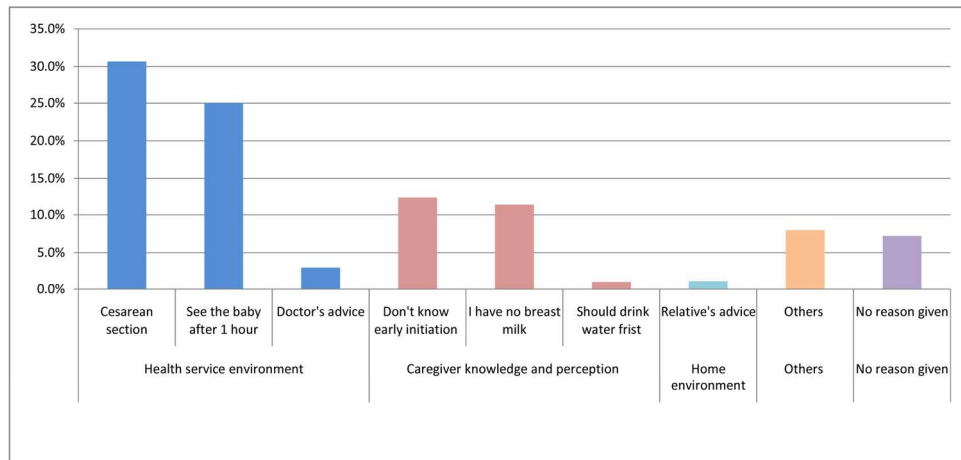
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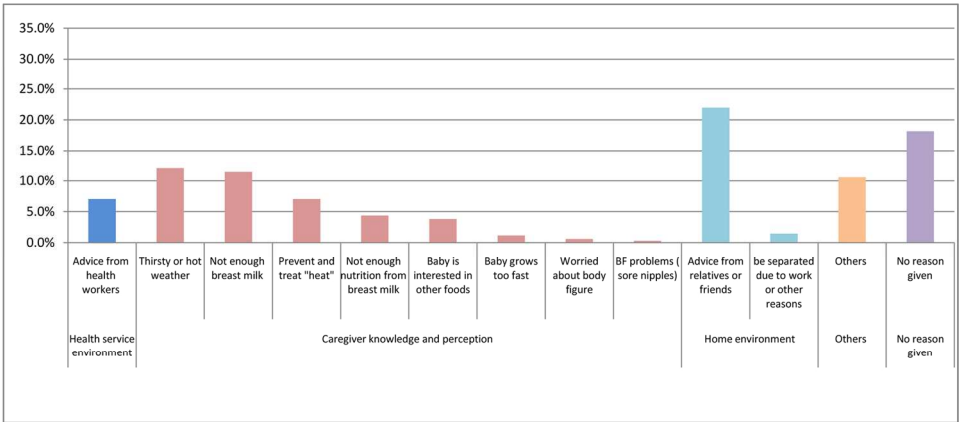
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Distribution of reported reasons for late initiation of breastfeeding  
172x82mm (300 x 300 DPI)



Distribution of reasons for non-exclusive breastfeeding  
172x82mm (300 x 300 DPI)

STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(a) Indicate the study’s design with a commonly used term in the title or the abstract	3
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	3-4
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	5-7
Objectives	3	State specific objectives, including any prespecified hypotheses	7
Methods			
Study design	4	Present key elements of study design early in the paper	7
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	7
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants	8-9
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	7-8
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	7-8
Bias	9	Describe any efforts to address potential sources of bias	22
Study size	10	Explain how the study size was arrived at	9
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	11
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	10-11
		(b) Describe any methods used to examine subgroups and interactions	10-11
		(c) Explain how missing data were addressed	Not needed
		(d) If applicable, describe analytical methods taking account of sampling strategy	Not needed
		(e) Describe any sensitivity analyses	Not needed
Results			

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	12
		(b) Give reasons for non-participation at each stage	12
		(c) Consider use of a flow diagram	Not needed
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	12
		(b) Indicate number of participants with missing data for each variable of interest	12, 14,15,16
Outcome data	15*	Report numbers of outcome events or summary measures	
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	Not needed, it is in one county, our previous experience tells us there is no difference for adjusted coverage.
		(b) Report category boundaries when continuous variables were categorized	12
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	Not needed
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	Not needed
Discussion			
Key results	18	Summarise key results with reference to study objectives	18
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	22
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	18-21
Generalisability	21	Discuss the generalisability (external validity) of the study results	18-21
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	23

\*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

**Note:** An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at [www.strobe-statement.org](http://www.strobe-statement.org).

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# BMJ Open

## Poor infant and young child feeding practices and sources of caregivers' feeding knowledge in rural Hebei Province, China: findings from a cross-sectional survey

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ORIGINAL ARTICLE

Title page

Poor infant and young child feeding practices and sources of caregivers' feeding knowledge in rural Hebei Province, China: findings from a cross-sectional survey

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Breastfeeding, complementary feeding, undernutrition, mobile phone, China.

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**Abstract**

**Objectives:** To obtain a general overview of infant and young child feeding practices in one rural county in China and identify current delivery channels and challenges.

**Design:** A cross-sectional study.

**Setting:** A rural county, Zhao County, in Hebei Province, China.

**Participants:** Ten clusters were first selected within each township (16 townships in total) with Proportional to Population Size sampling. In each cluster, a name list was used to select 13 children aged 0-23 months. We interviewed caregivers of all the selected children.

**Primary and secondary outcomes measures:** Coverage of infant feeding practices, reasons for low coverage of infant feeding practices, and current delivery channels of infant feeding practices.

**Results**

Findings from our survey indicated that infant feeding practices were poor. Early initiation of breastfeeding was only 22.4%, exclusive breastfeeding for 6 months was less than 10%, and continued breastfeeding up to the age of two was just 38.2%. Only 32.5% of children were

given iron-rich or iron-fortified foods. The leading sources of infant feeding information were family members, neighbors, friends and popular media. Only around 20% of the information came from health facilities and nearly none came from communities. Household property data showed that 99.9% of households owned televisions and 99.4% owned mobile phones. In addition, 61.2% of the households owned computers, with 54.8% having access to the internet.

### ***Conclusions***

Few caregivers of children in Zhao County received feeding information during pregnancy and after delivery. Moreover, their feeding knowledge and practices were poor. Multi-channel approaches, delivered through health facilities, community resources, popular media, the internet and mobile phones, hold potential to improve infant feeding practices and should be explored in future studies.

### ***Strengths and Limitations***

Although this study took place only within one county, a full range of globally standard feeding indicators were used to assess feeding practices of caregivers in our study. The name lists of children in some villages may not be complete, and therefore selection bias may have occurred. Some indicators may have recall bias due to long recall time.

***Trial registration number:*** ChiCTR-PRC-11001446.

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**Main text**

**Background**

Nutritional status is an important determinant of maternal and child health [1, 2]. Maternal and child undernutrition is still highly prevalent in low- and middle-income countries and results in significantly increased mortality and morbidity in mothers and children. Suboptimal breastfeeding is a key factor for undernutrition in infants and was estimated to be responsible for 804,000 child deaths worldwide in 2011[3]. Studies have consistently shown that the peak for growth faltering, micronutrient deficiencies and common childhood illnesses occurs from birth up to two years of age[3-5].

Appropriate infant and young child feeding (IYCF) is the basis for child survival, growth and development [3, 4, 6, 7]. The benefits of breastfeeding for both infants and mothers have been well documented in studies, including reducing the risk of morbidity and mortality, especially from infectious diseases such as diarrhoea and pneumonia [8, 9]. Introducing safe and adequate complementary foods to children aged six months helps to fill dietary gaps that cannot be met by breast milk alone. Continued breastfeeding for two years or beyond is an essential component of appropriate complementary feeding [10].

To emphasize the importance of child feeding, the World Health Organization (WHO) and United Nations Children’s Fund (UNICEF) jointly developed the Global Strategy for Infant and Young Child Feeding(IYCF) in 2002 [11]. The recommendations in this strategy state that children should be exclusively breastfed for six months after birth, and provided with safe and appropriate complementary foods with continued breastfeeding up to two years or

beyond [11].

During the past decade, the Ministry of Health of China (MoHCh) adopted the WHO's infant and young child feeding recommendations and implemented programs to improve nutrition practices [12, 13]. However, suboptimal infant feeding is still very common in China. National Chinese data from 2008 showed that only 27.6% of Chinese children were exclusively breastfed up to 6 months, only 43.3% of children aged 6 to 9 months were introduced to solid or semi-solid foods, and only 37.0% of children aged 12 to 15 months received continued breastfeeding [14]. In addition, too early or too late introduction of complementary food and a restriction in food selection, especially for animal source food, were widespread in China [15-19]. In poor rural areas, the rate of exclusive breastfeeding, continued breastfeeding for 1 year, and continued breastfeeding for 2 years were 28.7%, 55.5% and 9.4%, respectively [20]. At the same time, the rates of underweight, stunting and anemia among under five year old children were 8.0%, 20.3% and 14.2%, respectively. It is noticeable that almost one third (31.9%) of children aged 6-11 months were anemic, which was the highest among under- five children [21]. These percentages can be translated into large absolute numbers of children in China. While the stunting rate was reduced by two thirds between 1990 and 2010 [21], it was estimated that 8.82million children in China were still stunted in 2010 [21].

The poor infant and young child feeding practices and nutritional status of children indicated that the recommendations from WHO and UNICEF have not been put into practice. Therefore, the challenge is how to effectively translate the infant and young child feeding

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recommendations into caregivers’ feeding behaviors in China, thereby enhancing children’s dietary intake and growth. However, the delivery channels for IYCF recommendations were not fully assessed for their usage and potential in previous studies in China. Thus, our study used a full range of globally standard breastfeeding and complementary feeding indicators to assess the feeding practices of caregivers in one rural county in China. In addition, information on delivery channels was collected with the aim of filling this gap and providing a basis for development of effective infant and young child feeding strategies.

**Materials and Methods**

*Survey setting*

We conducted a cross-sectional household survey in Zhao County in Hebei Province in 2011. Hebei province is located in the northern part of the North China Plain, with an annual per capita net income of rural residents of 5,958 Yuan (946 USD) in 2010 [22], which was nearly the same as national average (5,919 Yuan) [23]. Zhao County is located in the middle-south part of Hebei Province. It has a total population of 571,000 (with under five population of 38,019), and the annual per capita net income of rural residents was 6,464 Yuan (1026 USD) in 2010 (data from Zhao county statistics bureau, unpublished.). There are four county-level hospitals, 16 township hospitals, and 281 village clinics in Zhao County.

*Survey instrument*

The maternal, newborn and child health (MNCH) household survey (unpublished, 2009) was used as the survey instrument. It was developed by the WHO and has previously been used in Cambodia, Papua New Guinea and Vietnam [24]. We translated the standard WHO

household survey from English into Chinese, and adapted the survey following a consultation with Chinese experts and three pilot studies. The instrument collects data on the coverage of key child health interventions, delivery channels, reasons for coverage failure and health expenditure. The survey used in this study included modules on antenatal care, delivery and neonatal care, breastfeeding and nutrition, immunization, cough and fever, diarrhoea and vitamin A. The breastfeeding and nutrition module aims to collect feeding information on children aged 0-23 months, including caregivers' feeding knowledge and practices, delivery channels and reasons for low coverage.

In 2009, WHO and UNICEF jointly published the document *Indicators for Assessing Infant and Young Child Feeding Practices*, and set up 15 international standard infant and young child feeding coverage indicators (eight core indicators and seven supplementary indicators), which encourages researchers in all countries to use these indicators and makes the data comparable between countries [25]. To date, very few studies in China applied these standard indicators to assess infant feeding practices. Studies were either focused on breastfeeding practices [20] or confined to earthquake areas [26]. The breastfeeding and nutrition module in MNCH household survey has standard questions for delivery channels, reasons for coverage failure, but only three core IYCF coverage indicators. Therefore, we inserted questions on the remaining core coverage indicators from the IYCF instrument to complete our survey instrument.

### ***Participants***

Caregivers in Zhao County were eligible to participate in the survey if they had a child aged 0-23 months. Mothers were the primary target group for the breastfeeding and nutrition module. If mothers were not at home or did not live with the child for any reason, other

caregivers were interviewed to collect other information, such as basic household characteristics, cough and fever, diarrhea and immunization.

*Sample size and sampling*

The sample size for the survey was based on a planned cluster randomized control trial in Zhao County. The trial aims to develop and test the (cost-) effectiveness of scaled-up integrated child health interventions. The MNCH household survey was used as the baseline assessment for the trial. The sample size calculation and sampling method were based on the requirement of the trial, with townships as the randomization unit (8 townships per group).

We expected that the anemia prevalence would decrease from 30% to 20%, with power of 80%, design effect of 2 and 5% as the significance level, we calculated that a sample size of 800 children under 2 years old for each group would be sufficient. For feeding knowledge indicators, we expected that the proportion of knowing duration of exclusive breastfeeding, knowing duration of breastfeeding, and knowing time of first introducing complementary foods would increase from 41% to 80%, 6% to 80%, and 59% to 80%, respectively. We calculated that samples of 241, 206 and 342 would be enough for each proportion. Therefore, we used the size 800 for each group as our final sample size. Meanwhile, we over-sampled 30% of children to compensate for possible refusal and loss to follow-up. We used a two-stage sampling procedure to select children for this survey. In the first stage, clusters were selected using Proportional to Population Size sampling, with 10 clusters chosen from each township. In the second stage, the name list of all eligible children under two years old

in each village was obtained and 13 children per cluster were randomly selected using Microsoft Excel (version 2007) software. We interviewed 10 caregivers out of 13 sampled children in each cluster based on the order in which they came to the village clinic. If less than 10 sampled children were available, we asked village doctors to help us to find other children from the name list who lived nearest to the village clinics and were in the same age groups. We used those children as substitutes for the unavailable children.

### ***Training of interviewers***

We recruited 30 students from Hebei United University School of Public Health as interviewers. We trained them for three days, of which half a day was for field practice. The training included communication skills, explanation of questionnaires, demonstration, role plays, field practice, and group discussions. The survey supervisors were all from the Capital Institute of Pediatrics, Beijing.

### ***Data collection***

We used smartphones to record data instead of traditional pen-and-paper data collection, with the standardized MNCH household survey questionnaire set up in special developed software. We tested and used smartphones for the MNCH survey several times in the field [27].

We carried out the survey from August 15th to 24th 2011 (10 days). Three teams of interviewers carried out the survey, with ten interviewers and two supervisors in each team.



Interviewers first introduced mothers or other caregivers to the aim of the survey and obtained written informed consent. Then the interviewers questioned the mothers or other caregivers following the instructions on the smartphone. Once an interviewer completed a questionnaire, the data were wirelessly uploaded into an Excel database via the internet server. Then the data were saved in the memory card of the smartphone as a text file to have a backup. We gave each mother a towel (worth 5 Yuan, equal to 0.79 USD) to show appreciation for their participation.

**Data analysis**

Data uploaded onto an internet server were automatically transformed into a Microsoft Excel sheet. After the data cleaning, we converted the database into data base file (dbf) for the final analysis. We carried out statistical analysis with SAS 9.1 for Windows. We presented the descriptive results of our findings; data are reported with percentages, except for age of parents, which is reported as a mean and range.

**Ethical considerations**

The study was approved by the Ethical Committee of Capital Institute of Pediatrics. All interviewees read the Information Sheet and provided both oral and written informed consent on behalf of the children involved in our study.

## Results

### Participants

A total of 1601 caregivers of children under 2 years old were interviewed. Among them, 90.1% (1443) were mothers, 8.6% (138) were grandparents, 1.1% (17) were fathers and 0.2% (9) were others (such as uncles and aunts). Table 1 presents the characteristics of children and their parents. Among 1601 children surveyed, 57.7% were aged 0-11 months and 42.3% were aged 12-23 months. The gender ratio (boys to girls) of children surveyed was 138:100. The median age of mothers was 27 years (ranging from 20 to 43 years) and the median age of father was 28 years (ranging from 22 to 49 years). Overall, education of fathers and mothers was good; more than 80% of them completed at least 9 years of education.

**Table 1 Characteristics of surveyed children and their parents**

	Category	Subcategory	Results (%)
<b>Children<sup>a</sup></b>	<b>Age group</b>	0-11 months	923(57.7)
		12-23 months	678(42.3)
	<b>Gender</b>	Boys	916(57.2)
		Girls	685(43.8)
<b>Mothers<sup>b</sup></b>	<b>Education</b>	Completed junior high school (9 years)	1117(70.6)
		Completed senior high school (12 years)	158(10.0)
<b>Fathers<sup>c</sup></b>	<b>Education</b>	Completed junior high school (9 years)	1149(72.7)
		Completed senior high school (12 years)	158(10.0)

<sup>a</sup> The total number of children was 1601

<sup>b&c</sup> The total number of mothers and fathers was 1583 and 1580 respectively, because some of the other caregivers of children did not know the education of the parents of the children.

*Knowledge and practices of infant and young child feeding*

As shown in Table 2, both the knowledge of caregivers about feeding recommendations and the feeding practices were generally suboptimal. Around one third of mothers knew to initiate breastfeeding within 1 hour of birth, while only about one fifth of mothers followed the recommendation. Moreover, the practice of exclusive breastfeeding for 6 months was even worse. Although only less than 10% of mothers knew to continue breastfeeding up to the age of two and giving children meat at the age of 6-8 months, only 38.2% and 32.5% of children were breastfed for two years and were given iron-rich or iron-fortified foods, respectively.

**Table 2 Knowledge and practices of caregivers on key IYCF indicators**

	Number of mothers who responded positive on the particular knowledge/practices	Total number of mothers eligible for the question	Percentage (%) (95% CI)
Mothers <b>knowing</b> to initiate breastfeeding within 1 hour of birth	469	1443	32.5 (30.1, 34.9)
Children who were initiated breastfeeding within 1 hour of birth	317	1417 <sup>a</sup>	22.4 (20.2, 24.6 )
Mothers <b>knowing</b> the duration of Exclusive breastfeeding	539	1443	37.3 (34.8, 39.8)
Children under 6 months exclusively breastfed	40	414 <sup>b</sup>	9.7 (6.8, 12.6)
Mothers <b>knowing</b> continued breastfeeding until two years	84	1443	5.8 (4.6, 7.0)
Children breastfed until two years	104	272 <sup>c</sup>	38.2 (32.4, 44.0)
Caregivers <b>knowing</b> introduction of complementary foods at 6-8 months	759	1187	63.9 (61.2, 66.6)
Children given complementary	196	233 <sup>d</sup>	84.1

foods at 6-8 months			(79.4, 88.8)
Caregivers <b>knowing</b> the minimum meal frequency	933	1182 <sup>f</sup>	60.0 (57.2, 62.8)
Children given minimum meal frequency	827	1187 <sup>e</sup>	69.7 (67.1, 72.3)
Caregivers <b>knowing</b> feeding children with meat at 6-8 months	113	1182 <sup>f</sup>	9.6 (7.9, 11.3)
Children given iron-rich or iron-fortified foods <sup>g</sup>	386	1187 <sup>e</sup>	32.5 (29.8, 35.2)

<sup>a</sup>Only children ever breastfed were used to calculate this indicator (from MNCH household survey guideline)

<sup>b</sup>Only children aged 0 to 5 months were used to calculate this indicator (from IYCF guideline )

<sup>c</sup>Only children aged 20 to 23 months were used to calculate this indicator (from IYCF guideline )

<sup>d</sup>Only children aged 6 to 8 months were used to calculate this indicator (from IYCF guideline )

<sup>e</sup>Only children aged 6 to 23 months were used to calculate this indicator (from IYCF guideline )

<sup>f</sup>Data of 5 children on these two question were missing

<sup>g</sup> Suitable iron-rich or iron-fortified foods include meat, fish, poultry and liver/organ meat, commercially fortified foods specially designed for infants and young children which contain iron, or foods fortified in the home with a micronutrient powder containing iron or a lipid-based nutrient supplement containing iron.

The main reasons for not initiating breastfeeding early were cesarean section, seeing the baby after delivery later than one hour, not knowing about early initiation of breastfeeding, and having no breast milk (Figure 1). Twenty-two percent of the mothers received advice on non-exclusive breastfeeding from relatives and 7.0% of them from health workers (Figure 2).

### *Utilization of health care services*

Table 3 indicates that the maternal and child health care services were generally available and utilized by pregnant women, mothers and children, except for postnatal care. Only 11.4% of mothers received a home visit after delivery and 23.7% attended postnatal care at 42 days

after delivery.

**Table 3 Utilization of health care services by pregnant women, mothers and children**

	Number of mothers who responded positive on the particular knowledge/practice	Total number of mothers eligible for the question	Percentage (%) (95% CI)
Pregnant women receiving antenatal care at least <i>once</i>	1350	1443	93.6 (92.3, 94.9)
Pregnant women receiving antenatal care <i>four times</i> or above	1014	1443	70.3 (67.9, 72.7)
Children delivered at hospital	1436	1443	99.5 (99.1, 99.9)
Mothers and children receiving home visit after delivery (within 7 days after discharge)	165	1442 <sup>a</sup>	11.4 (9.8, 13.0)
Mothers receiving post natal care at 42 days after delivery	340	1413	24.1 (21.9, 26.3)
Children ever immunized	1598	1601	99.8 (99.6, 100.0)

<sup>a</sup> Data of one child were missing

<sup>b</sup> Only children older than 42 days were used to calculate this indicator.

***Sources of infant feeding information***

Table 4 shows that only around one-fourth of mothers ever received feeding information during pregnancy and after delivery. Table 5 describes the sources of feeding information through which mothers received information. The leading sources were family members, neighbors, friends and popular media; these accounted for around 80% of the total information. Only around 20% of the information came from health facilities and nearly none

came from the community.

**Table 4 Mothers ever receiving feeding information**

	Number of mothers who responded positive on the particular knowledge/practices	Total number of mothers eligible for the question	Percentage (%) (95% CI)
Receiving breastfeeding information during pregnancy	379	1443	26.3 (24.0, 28.6)
Receiving breastfeeding information after delivery	415	1443	28.8 (26.5, 31.1)
Receiving complementary feeding information during pregnancy	341	1440 <sup>a</sup>	23.7 (21.5, 25.9)
Receiving complementary feeding information after delivery	385	1440 <sup>a</sup>	26.7 (24.4, 29.0)

<sup>a</sup> Data of three children were missing

**Table 5 Sources of feeding information for mothers during pregnancy and after delivery**

	Breastfeeding		Complementary feeding		Formula feeding	
	n	% (N=749 <sup>a</sup> )	n	% (N=664 <sup>a</sup> )	n	% (N=244 <sup>a</sup> )
Family members/ neighbors/friends	276	36.8	316	47.6	144	59.0

Popular media	312	41.7	228	34.3	5	2.0
Health facility	160	21.4	120	18.1	65	26.6
Community	1	0.1	0	0.0	1	0.4
Formula company	-	-	-	-	29	11.9
<b>Total</b>	<b>749</b>	<b>100.0</b>	<b>664</b>	<b>100.0</b>	<b>244</b>	<b>100.0</b>

<sup>a</sup> These are the multi-choice questions which mean all sources of information mentioned by interviewees are recorded as “yes”. To calculate the proportions, all “yes” answers in different categories are summed up as denominators, and all “yes” answers in each category are summed up as numerators.

**Household property**

Table 6 indicates that nearly all households owned a television and a mobile phone. More than 60% of the households owned computers, with 54.8% having access to internet.

**Table 6 Households owning a radio, television, mobile phone, computer, and accessing to the internet**

	Number of mothers who responded positive on the particular knowledge/practices	Total number of mothers eligible for the question	Percentage (%) (95% CI)
Households owning a radio	377	1601	23.6 (21.5, 25.7)
Households owning a television	1600	1601	99.9 (99.7, 100)
Households owning a mobile phone	1591	1601	99.4 (99.0, 99.8)
Households owning a computer	979	1601	61.2 (58.8, 63.6)
Households with access to the internet at home	876	1600	54.8 (52.4, 57.2)

## Discussion

We found in our survey that caregivers' feeding practices were poor, which was consistent with the national data as indicated in the introduction of this paper. In addition, we found that the health care services were generally available and utilized by pregnant women and mothers, with notable exception of home visits, and visits to the health facility at 42 days after delivery. National data also showed that proportions of women who ever received antenatal care and postnatal care were 93.7% and 91.0% respectively. In addition, the hospital delivery rate was 98.7% [28]. However, high utilization of health services was not translated into high coverage of interventions.

Mothers need support not only from the health care system but also from the family, community and workplace to initiate and sustain optimal breastfeeding and complementary feeding practices [10]. Mothers also need consistent IYCF messages that are reinforced through multiple channels [29]. Therefore, health care providers' engagement, community involvement and media support are all needed to maximize the effectiveness of IYCF programs. Three recommendations emerged from our study findings:

(i) Strengthening the quality of care at health facilities to improve feeding counseling:

China initiated the national Basic Public Health Service program [30] to provide universal basic public health services for all residents. Maternal and child health care workers are required by the program to provide face-to-face counseling to pregnant women during antenatal care visits and hospital delivery, and to mothers of young children during newborn home visits, postnatal care visits and child health care visits [31]. However, rural health



workers in China generally have low education, lack expertise and motivation for their work, which generally results in low quality health care services provided by rural health facilities [32-34]. Our study also indicated that few mothers reported that they ever received feeding counseling from health workers, which suggested that many health workers did not provide feeding counseling. Feeding counseling was the component of antenatal care in the late phase of antenatal care, which involves the village doctor, township hospital doctor and county-level hospital doctor. In addition, we found that the knowledge and practice of early initiation of breastfeeding was 32.5% and 22.4% respectively. Hospital delivery is a requirement in China. Therefore, it is the duty of the hospitals to ensure that deliveries take place in hospital. However, we found that more than 50% of reasons for late initiation of breastfeeding were attributed to the health facility environment, such as high cesarean section, separation of babies from mothers, and doctors' advice. Also 7% of mothers reported that they received advice on non-exclusive breastfeeding from health workers. It was reported that the current national rate of caesarean section in China was about 40%, which is the highest worldwide [35-36]. Therefore, there is a need to strengthen the quality of healthcare services provided by rural health facilities as well as to increase service coverage.

*(ii) Mobilize community resources to deliver IYCF recommendations:* Community-based breastfeeding promotion and support were proven to be effective. Therefore, the Global Strategy for Infant and Young Child Feeding recognizes this as one of the key components of a comprehensive program to improve breastfeeding practices [11]. Large-scale community-based programs have demonstrated that the community offers indispensable

resources for breastfeeding promotion and support [37]. In the Regional Framework for Community IMCI of WHO Western Pacific Region, breastfeeding and complementary feeding are among the 12 key family practices that can be improved through community-based programs [38]. In addition, a study in China indicated that community-based behavioral change approaches that use trained village nutrition educators to provide feeding counseling to pregnant women and mothers are effective to improve breastfeeding and complementary feeding practices [39]. Therefore, communities hold potential to effectively deliver IYCF recommendations in rural China.

The rate of knowledge and practice of 6-month exclusive breastfeeding was 37.3% and 9.7% respectively. Thus, there is a gap in breastfeeding and exclusive breastfeeding practices. In our study site, most village doctors were male. Other resources from the community have the potential to provide the support for exclusive breastfeeding. Our data showed less than one in a hundred mothers received feeding information from their communities. Studies have shown that peer counseling and lay counseling are effective in promoting breastfeeding [40-43]. In rural China, existing community resources could be mobilized, such as the village women cadres, family planning workers, primary school teachers and volunteers, to provide feeding counseling to pregnant women and mothers.

(iii) Utilize popular media as well as Internet and mobile phones to expand IYCF coverage:

According to our results, the leading sources of feeding information were family members, neighbors, or friends and popular media (newspaper, magazine, book, radio and television: around 80% of information on breastfeeding and complementary feeding came from these

two sources, whereas only 20% came from health facilities.

As those two main sources are both important, they should be fully used to disseminate accurate infant feeding information. However, we noted that some information from these two sources was invalid. As indicated in the results, around 60% of inaccurate advice to use formula feeding and more than 20% of inaccurate information on non-exclusive breastfeeding originated from family members, neighbors, and friends. Therefore, much more efforts must be made to strengthen these channels in terms of ensuring provision of correct information and broadening its scope to provide more mothers with accurate feeding advice.

Since there are two-thirds of mothers received no advice on feeding, new channels, such as internet and mobile phones, could be explored. Evidence indicated that computer-tailored nutrition education is an innovative and promising tool to motivate people to make healthy dietary changes [44]. Also, a recent study showed that internet nutrition education can be a viable alternative to traditional nutrition education for increasing fruit and vegetable consumption of women, infants and children [45].

With the rapid socio-economic development and technical progress, many Chinese people have access to new information and communication technologies. Data showed that, by the end of 2013, there were 1229 million mobile phone users and 618 million internet users in China [46]. Our survey showed that in Zhao County, nearly all households owned mobile phones, and more than 60% of households owned computers, with more than half of them having access to internet. . In addition, the young generation of parents is well educated; around 95% of fathers and mothers attended junior high school (9 years of education). This

implies a potential to deliver feeding recommendations through mobile phones or the internet. Future studies are needed to test the feasibility and effectiveness of these potential delivery channels in the context of rural China.

## Conclusions

Findings of our study indicated that few caregivers of children in rural China received feeding information during pregnancy and after delivery. Moreover, their feeding knowledge and practices are poor, though the maternal and child health care services were generally available and utilized by mothers. Health facilities need to be strengthened and fully utilized to provide high-quality feeding counseling. Other channels, such as community resources, popular media, internet and mobile phones, hold great potential and could also be explored in future studies to maximize the effectiveness of IYCF programs.

## LIMITATIONS

Our study has several limitations. Firstly, the sampling of children was based on the name lists of children in each village. In Zhao County, all live births are reported to the Maternal and Child Health Hospital from all qualified delivery institutions each month. Therefore we obtained the name list from the hospital. Then we sent the name lists to village doctors and asked them to remove children who had died or moved outside the village and added children who were living in the village but who were not on the list. Although all these efforts were made, we were not sure on the completeness of the name lists and selection bias may have

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occurred. Secondly, some indicators such as initiation of breastfeeding after birth were based on the mothers’ recall, with a longest recall time of two years, which may have introduced recall bias.

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## Contributorship statement

The study was initiated and conceptualized by YFZ and RS. YFZ supervised the study. QW and YL collected and coded the data. QW performed data analysis. QW, YFZ, RS and MV participated in the explanation and discussion of the results. The manuscript was drafted by QW, reviewed and revised by YFZ, RS, MV, LC, WW, YL and JC. All authors read and approved the final manuscript.

## Competing interests

The authors declare no competing interest.

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**Data sharing**

No additional data available.

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**FIGURE LEGENDS:**

**Figure 1: Distribution of reported reasons for late initiation of breastfeeding**

**Figure 2 : Distribution of reasons for non-exclusive breastfeeding**

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## ORIGINAL ARTICLE

## Title page

**Poor infant and young child feeding practices and sources of caregivers' feeding knowledge in rural Hebei Province, China: findings from a cross-sectional survey**

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**Key words**

Breastfeeding, complementary feeding, undernutrition, mobile phone, China.

**Word count:** 5988

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## Abstract

**Objectives:** To obtain a general overview of infant and young child feeding practices in one rural county in China and identify current delivery channels and challenges.

**Design:** A cross-sectional study.

**Setting:** A rural county, Zhao County, in Hebei Province, China.

**Participants:** Ten clusters were first selected within each township (16 townships in total) with Proportional to Population Size sampling. In each cluster, a name list was used to select 13 children aged 0-23 months. We interviewed caregivers of all the selected children.

**Primary and secondary outcomes measures:** Coverage of infant feeding practices, reasons for low coverage of infant feeding practices, and current delivery channels of infant feeding practices.

## Results

Findings from our survey indicated that infant feeding practices were poor. Early initiation of breastfeeding was only 22.4%, exclusive breastfeeding for 6 months was less than 10%, and continued breastfeeding up to the age of two was just 38.2%. Only 32.5% of children were



given iron-rich or iron-fortified foods. The leading sources of infant feeding information were family members, neighbors, friends and popular media. Only around 20% of the information came from health facilities and nearly none came from communities. Household property data showed that 99.9% of households owned televisions and 99.4% owned mobile phones. In addition, 61.2% of the households owned computers, with 54.8% having access to the internet.

**Conclusions**

Few caregivers of children in Zhao County received feeding information during pregnancy and after delivery. Moreover, their feeding knowledge and practices were poor. Multi-channel approaches, delivered through health facilities, community resources, popular media, the internet and mobile phones, hold potential to improve infant feeding practices and should be explored in future studies.

**Strengths and Limitations**

Although this study took place only within one county, a full range of globally standard feeding indicators were used to assess feeding practices of caregivers in our study. The name lists of children in some villages may not be complete, and therefore selection bias may have occurred. Some indicators may have recall bias due to long recall time.

**Trial registration number:** ChiCTR-PRC-11001446.

## Main text

### Background

Nutritional status is an important determinant of maternal and child health [1, 2]. Maternal and child undernutrition is still highly prevalent in low- and middle-income countries and results in significantly increased mortality and morbidity in mothers and children. Suboptimal breastfeeding is a key factor for undernutrition in infants and was estimated to be responsible for 804,000 child deaths worldwide in 2011[3]. Studies have consistently shown that the peak for growth faltering, micronutrient deficiencies and common childhood illnesses occurs from birth up to two years of age[3-5].

Appropriate infant and young child feeding (IYCF) is the basis for child survival, growth and development [3, 4, 6, 7]. The benefits of breastfeeding for both infants and mothers have been well documented in studies, including reducing the risk of morbidity and mortality, especially from infectious diseases such as diarrhoea and pneumonia [8, 9]. Introducing safe and adequate complementary foods to children aged six months helps to fill dietary gaps that cannot be met by breast milk alone. Continued breastfeeding for two years or beyond is an essential component of appropriate complementary feeding [10].

To emphasize the importance of child feeding, the World Health Organization (WHO) and United Nations Children's Fund (UNICEF) jointly developed the Global Strategy for Infant and Young Child Feeding(IYCF) in 2002 [11]. The recommendations in this strategy state that children should be exclusively breastfed for six months after birth, and provided with safe and appropriate complementary foods with continued breastfeeding up to two years or

beyond [11].

During the past decade, the Ministry of Health of China (MoHCh) adopted the WHO's infant and young child feeding recommendations and implemented programs to improve nutrition practices [12, 13]. However, suboptimal infant feeding is still very common in China. National Chinese data from 2008 showed that only 27.6% of Chinese children were exclusively breastfed up to 6 months, only 43.3% of children aged 6 to 9 months were introduced to solid or semi-solid foods, and only 37.0% of children aged 12 to 15 months received continued breastfeeding [14]. In addition, too early or too late introduction of complementary food and a restriction in food selection, especially for animal source food, were widespread in China [15-19]. In poor rural areas, the rate of exclusive breastfeeding, continued breastfeeding for 1 year, and continued breastfeeding for 2 years were 28.7%, 55.5% and 9.4%, respectively [20]. At the same time, the rates of underweight, [stunting and anemia among under five year old children were 8.0%, 20.3% and 14.2%, respectively. It is noticeable that almost one third \(31.9%\) of children aged 6-11 months were anemic, which was the highest among under- five children, was 8.0%, and the rate of stunting was 20.3%. In addition, 14.2% of children were anaemic, and this rate was the highest among children aged 6-11 months \(31.9%\)](#)[21]. These percentages can be translated into large absolute numbers of children in China. While the stunting rate was reduced by two thirds between 1990 and 2010 [21], it was estimated that 8.82million children in China were still stunted in 2010 [21].

The poor infant and young child feeding practices and nutritional status of children indicated that the recommendations from WHO and UNICEF have not been put into practice. Therefore,

the challenge is how to effectively translate the infant and young child feeding recommendations into caregivers' feeding behaviors in China, thereby enhancing children's dietary intake and growth. However, the delivery channels for IYCF recommendations were not fully assessed for their usage and potential in previous studies in China. Thus, our study used a full range of globally standard breastfeeding and complementary feeding indicators to assess the feeding practices of caregivers in one rural county in China. In addition, information on delivery channels was collected with the aim of filling this gap and providing a basis for development of effective infant and young child feeding strategies.

## Materials and Methods

### *Survey setting*

We conducted a cross-sectional household survey in Zhao County in Hebei Province in 2011. Hebei province is located in the northern part of the North China Plain, with an annual per capita net income of rural residents of 5,958 Yuan (946 USD) in 2010 [22], which was nearly the same as national average (5,919 Yuan) [23]. Zhao County is located in the middle-south part of Hebei Province. It has a total population of 571,000 (with under five population of 38,019), and the annual per capita net income of rural residents was 6,464 Yuan (1026 USD) in 2010 (data from Zhao county statistics bureau, unpublished.). There are four county-level hospitals, 16 township hospitals, and 281 village clinics in Zhao County.

### *Survey instrument*

The maternal, newborn and child health (MNCH) household survey (unpublished, 2009) was used as the survey instrument. It was developed by the WHO and has previously been used in

Cambodia, Papua New Guinea and Vietnam [24]. We translated the standard WHO household survey from English into Chinese, and adapted the survey following a consultation with Chinese experts and three pilot studies. The instrument collects data on the coverage of key child health interventions, delivery channels, reasons for coverage failure and health expenditure. The survey used in this study included modules on antenatal care, delivery and neonatal care, breastfeeding and nutrition, immunization, cough and fever, diarrhoea and vitamin A. The breastfeeding and nutrition module aims to collect feeding information on children aged 0-23 months, including caregivers' feeding knowledge and practices, delivery channels and reasons for low coverage.

In 2009, WHO and UNICEF jointly published the document *Indicators for Assessing Infant and Young Child Feeding Practices*, and set up 15 international standard infant and young child feeding coverage indicators (eight core indicators and seven supplementary indicators), which encourages researchers in all countries to use these indicators and makes the data comparable between countries [25]. To date, very few studies in China applied these standard indicators to assess infant feeding practices. Studies were either focused on breastfeeding practices [20] or confined to earthquake areas [26]. The breastfeeding and nutrition module in MNCH household survey has standard questions for delivery channels, reasons for coverage failure, but only three core IYCF coverage indicators. Therefore, we inserted questions on the remaining core coverage indicators from the IYCF instrument to complete our survey instrument.

**Participants**

Caregivers in Zhao County were eligible to participate in the survey if they had a child aged 0-23 months. Mothers were the primary target group for the breastfeeding and nutrition

module. If mothers were not at home or did not live with the child for any reason, other caregivers were interviewed to collect other information, such as basic household characteristics, cough and fever, diarrhea and immunization.

### *Sample size and sampling*

The sample size for the survey was based on a planned cluster randomized control trial in Zhao County. The trial aims to develop and test the (cost-) effectiveness of scaled-up integrated child health interventions. The MNCH household survey was used as the baseline assessment for the trial. The sample size calculation and sampling method were based on the requirement of the trial, with townships as the randomization unit (8 townships per group).

We expected that to achieve a 10% reduction of the anemia prevalence would decrease from 30% to 20%, and at least a 20% increase for knowledge and practice of appropriate feeding w. With power of 80%, design effect of 2 and 5% as the significance level, we calculated that a sample size of 800 children under 2 years old for each group would be sufficient. For feeding knowledge indicators, we expected that the proportion of knowing duration of exclusive breastfeeding, knowing duration of breastfeeding, and knowing time of first introducing complementary foods would increase from 41% to 80%, 6% to 80%, and 59% to 80%, respectively. We calculated that samples of 241, 206 and 342 would be enough for each proportion. Therefore, we used the size 800 for each group as our final sample size for all key indicators. Meanwhile, wWe over-sampled 30% of children to compensate for possible refusal and loss to follow-up. We used a two-stage sampling procedure to select children for

this survey. In the first stage, clusters were selected using Proportional to Population Size sampling, with 10 clusters chosen from each township. In the second stage, the name list of all eligible children under two years old in each village was obtained and 13 children per cluster were randomly selected using Microsoft Excel (version 2007) software. We interviewed 10 caregivers out of 13 sampled children in each cluster based on the order in which they came to the village clinic. If less than 10 sampled children were available, we asked village doctors to help us to find other children from the name list who lived nearest to the village clinics and were in the same age groups. We used those children as substitutes for the unavailable children.

***Training of interviewers***

We recruited 30 students from Hebei United University School of Public Health as interviewers. We trained them for three days, of which half a day was for field practice. The training included communication skills, explanation of questionnaires, demonstration, role plays, field practice, and group discussions. The survey supervisors were all from the Capital Institute of Pediatrics, Beijing.

***Data collection***

We used smartphones to record data instead of traditional pen-and-paper data collection, with the standardized MNCH household survey questionnaire set up in special developed software. We tested and used smartphones for the MNCH survey several times in the field [27].

We carried out the survey from August 15th to 24th 2011 (10 days). Three teams of interviewers carried out the survey, with ten interviewers and two supervisors in each team. Interviewers first introduced mothers or other caregivers to the aim of the survey and obtained written informed consent. Then the interviewers questioned the mothers or other caregivers following the instructions on the smartphone. Once an interviewer completed a questionnaire, the data were wirelessly uploaded into an Excel database via the internet server. Then the data were saved in the memory card of the smartphone as a text file to have a backup. We gave each mother a towel (worth 5 Yuan, equal to 0.79 USD) to show appreciation for their participation.

### *Data analysis*

Data uploaded onto an internet server were automatically transformed into a Microsoft Excel sheet. After the data cleaning, we converted the database into data base file (dbf) for the final analysis. We carried out statistical analysis with SAS 9.1 for Windows. We presented the descriptive results of our findings; data are reported with percentages, except for age of parents, which is reported as a mean and range.

### *Ethical considerations*

The study was approved by the Ethical Committee of Capital Institute of Pediatrics. All interviewees read the Information Sheet and provided both oral and written informed consent on behalf of the children involved in our study.



Results

Participants

A total of 1601 caregivers of children under 2 years old were interviewed. Among them, 90.1% (1443) were mothers, 8.6% (138) were grandparents, 1.1% (17) were fathers and 0.2% (9) were others (such as uncles and aunts). Table 1 presents the characteristics of children and their parents. Among 1601 children surveyed, 57.7% were aged 0-11 months and 43.3% were aged 12-23 months. The gender ratio (boys to girls) of children surveyed was 138:100. The ~~median~~~~mean~~ age of mothers was 27 years (ranging from 20 to 43 years) and the ~~median~~~~mean~~ age of father was 28 years (ranging from 22 to 49 years). Overall, education of fathers and mothers was good; more than 80% of them completed at least 9 years of education.

Table 1 Characteristics of surveyed children and their parents

	Category	Subcategory	Results (%)
Children <sup>a</sup>	Age group	0-11 months	923(57.7)
		12-23 months	678(42.3)
	Gender	Boys	916(57.2)
		Girls	685(43.8)
Mothers <sup>b</sup>	Education	Completed junior high school (9 years)	1117(70.6)
		Completed senior high school (12 years)	158(10.0)
Fathers <sup>c</sup>	Education	Completed junior high school (9 years)	1149(72.7)
		Completed senior high school (12 years)	158(10.0)

<sup>a</sup> The total number of children was 1601

<sup>b&c</sup> The total number of mothers and fathers was 1583 and 1580 respectively, because some of the other caregivers of children did not know the education of the parents of the children.

### *Knowledge and practices of infant and young child feeding*

As shown in Table 2, both the knowledge of caregivers about feeding recommendations and the feeding practices were generally suboptimal. Around one third of mothers knew to initiate breastfeeding within 1 hour of birth, while only about one fifth of mothers followed the recommendation. Moreover, the practice of exclusive breastfeeding for 6 months was even worse. Although only less than 10% of mothers knew to continue breastfeeding up to the age of two and giving children meat at the age of 6-8 months, only 38.2% and 32.5% of children were breastfed for two years and were given iron-rich or iron-fortified foods, respectively.

~~Early initiation of breastfeeding was only 22.4%, exclusive breastfeeding for 6 months was less than 10%, and continued breastfeeding up to the age of two was just 38.2%. Only 32.5% of children were given iron rich or iron fortified foods. The knowledge of caregivers about feeding recommendations was low.~~

**Table 2 Knowledge and practices of caregivers on key IYCF indicators**

	Number of mothers who responded positive on the particular knowledge/practices	Total number of mothers eligible for the question	Percentage (%) (95% CI)
Mothers <b>knowing</b> to initiate breastfeeding within 1 hour of birth	469	1443	32.5 (30.1, 34.9)
Children who were initiated breastfeeding within 1 hour of birth	317	1417 <sup>a</sup>	22.4 (20.2, 24.6)
Mothers <b>knowing</b> the duration of Exclusive breastfeeding	539	1443	37.3 (34.8, 39.8)
Children under 6 months exclusively breastfed	40	414 <sup>b</sup>	9.7 (6.8, 12.6)

Mothers <b>knowing</b> continued breastfeeding until two years	84	1443	5.8 (4.6, 7.0)
Children breastfed until two years	104	272 <sup>c</sup>	38.2 (32.4, 44.0)
Caregivers <b>knowing</b> introduction of complementary foods at 6-8 months	759	1187	63.9 (61.2, 66.6)
Children given complementary foods at 6-8 months	196	233 <sup>d</sup>	84.1 (79.4, 88.8)
Caregivers <b>knowing</b> the minimum meal frequency	933	1182 <sup>f</sup>	60.0 (57.2, 62.8)
Children given minimum meal frequency	827	1187 <sup>e</sup>	69.7 (67.1, 72.3)
Caregivers <b>knowing</b> feeding children with meat at 6-8 months	113	1182 <sup>f</sup>	9.6 (7.9, 11.3)
Children given iron-rich or iron-fortified foods <sup>g</sup>	386	1187 <sup>e</sup>	32.5 (29.8, 35.2)

<sup>a</sup>Only children ever breastfed were used to calculate this indicator (from MNCH household survey guideline)

<sup>b</sup>Only children aged 0 to 5 months were used to calculate this indicator (from IYCF guideline )

<sup>c</sup> Only children aged 20 to 23 months were used to calculate this indicator (from IYCF guideline )

<sup>d</sup> Only children aged 6 to 8 months were used to calculate this indicator (from IYCF guideline )

<sup>e</sup> Only children aged 6 to 23 months were used to calculate this indicator (from IYCF guideline )

<sup>f</sup> Data of 5 children on these two question were missing

<sup>g</sup> [Suitable iron-rich or iron-fortified foods include meat, fish, poultry and liver/organ meat, commercially fortified foods specially designed for infants and young children which contain iron, or foods fortified in the home with a micronutrient powder containing iron or a lipid-based nutrient supplement containing iron.](#)

The main reasons for not initiating breastfeeding early were cesarean section, seeing the baby after delivery later than one hour, not knowing about early initiation of breastfeeding, and having no breast milk (Figure 1). Twenty-two percent of the mothers received advice on non-exclusive breastfeeding from relatives and 7.0% of them from health workers (Figure 2).

### Utilization of health care services

Table 3 indicates that the maternal and child health care services were generally available and utilized by pregnant women, mothers and children, except for postnatal care. Only 11.4% of mothers received a home visit after delivery and 23.7% attended postnatal care at 42 days after delivery.

**Table 3 Utilization of health care services by pregnant women, mothers and children**

	Number of mothers who responded positive on the particular knowledge/practice	Total number of mothers eligible for the question	Percentage (%) (95% CI)
Pregnant women receiving antenatal care at least <i>once</i>	1350	1443	93.6 (92.3, 94.9)
Pregnant women receiving antenatal care <i>four times</i> or above	1014	1443	70.3 (67.9, 72.7)
Children delivered at hospital	1436	1443	99.5 (99.1, 99.9)
Mothers and children receiving home visit after delivery (within 7 days after discharge)	165	1442 <sup>a</sup>	11.4 (9.8, 13.0)
Mothers receiving post natal care at 42 days after delivery	340	1413	24.1 (21.9, 26.3)
Children ever immunized	1598	1601	99.8 (99.6, 100.0)

<sup>a</sup> Data of one child were missing

<sup>b</sup> Only children older than 42 days were used to calculate this indicator.

### Sources of infant feeding information

Table 4 shows that only around one-fourth of mothers ever received feeding information

during pregnancy and after delivery. Table 5 describes the sources of feeding information through which mothers received information. The leading sources were family members, neighbors, friends and popular media; these accounted for around 80% of the total information. Only around 20% of the information came from health facilities and nearly none came from the community.

Table 4 Mothers ever receiving feeding information

	Number of mothers who responded positive on the particular knowledge/practices	Total number of mothers eligible for the question	Percentage (%) (95% CI)
Receiving breastfeeding information during pregnancy	379	1443	26.3 (24.0, 28.6)
Receiving breastfeeding information after delivery	415	1443	28.8 (26.5, 31.1)
Receiving complementary feeding information during pregnancy	341	1440 <sup>a</sup>	23.7 (21.5, 25.9)
Receiving complementary feeding information after delivery	385	1440 <sup>a</sup>	26.7 (24.4, 29.0)

<sup>a</sup> Data of three children were missing

**Table 5 Sources of feeding information for mothers during pregnancy and after delivery**

	Breastfeeding		Complementary feeding		Formula feeding	
	n	% (N=749 <sup>a</sup> )	n	% (N=664 <sup>a</sup> )	n	% (N=244 <sup>a</sup> )
Family members/ neighbors/friends	276	36.8	316	47.6	144	59.0
Popular media	312	41.7	228	34.3	5	2.0
Health facility	160	21.4	120	18.1	65	26.6
Community	1	0.1	0	0.0	1	0.4
Formula company	-	-	-	-	29	11.9
<b>Total</b>	<b>749</b>	<b>100.0</b>	<b>664</b>	<b>100.0</b>	<b>244</b>	<b>100.0</b>

<sup>a</sup> These are the multi-choice questions which mean all sources of information mentioned by interviewees are recorded as “yes”. To calculate the proportions, all “yes” answers in different categories are summed up as denominators, and all “yes” answers in each category are summed up as numerators.

### *Household property*

Table 6 indicates that nearly all households owned a television and a mobile phone. More than 60% of the households owned computers, with 54.8% having access to internet.

**Table 6 Households owning a radio, television, mobile phone, computer, and accessing to the internet**

	Number of mothers who responded positive on the particular knowledge/practices	Total number of mothers eligible for the question	Percentage (%) (95% CI)
Households owning a radio	377	1601	23.6 (21.5, 25.7)
Households owning a television	1600	1601	99.9 (99.7, 100)
Households owning a mobile phone	1591	1601	99.4

			(99.0, 99.8)
Households owning a computer	979	1601	61.2
			(58.8, 63.6)
Households with access to the internet at home	876	1600	54.8
			(52.4, 57.2)

Discussion

We found in our survey that caregivers’ feeding practices were poor, which was consistent with the national data as indicated in the introduction of this paper. In addition, we found that the health care services were generally available and utilized by pregnant women and mothers, with notable exception of home visits, and visits to the health facility at 42 days after delivery. National data also showed that proportions of women who ever received antenatal care and postnatal care were 93.7% and 91.0% respectively. In addition, the hospital delivery rate was 98.7% [28]. However, high utilization of health services was not translated into high coverage of interventions.

Mothers need support not only from the health care system but also from the family, community and workplace to initiate and sustain optimal breastfeeding and complementary feeding practices [10]. Mothers also need consistent IYCF messages that are reinforced through multiple channels [29]. Therefore, health care providers’ engagement, community involvement and media support are all needed to maximize the effectiveness of IYCF programs. Three recommendations emerged from our study findings:

*(i) Strengthening the quality of care at health facilities to improve feeding counseling:*

China initiated the national Basic Public Health Service program [30] to provide universal

basic public health services for all residents. Maternal and child health care workers are required by the program to provide face-to-face counseling to pregnant women during antenatal care visits and hospital delivery, and to mothers of young children during newborn home visits, postnatal care visits and child health care visits [31]. However, rural health workers in China generally have low education, lack expertise and motivation for their work, which generally results in low quality health care services provided by rural health facilities [32-34]. Our study also indicated that few mothers reported that they ever received feeding counseling from health workers, which suggested that many health workers did not provide feeding counseling. Feeding counseling was the component of antenatal care in the late phase of antenatal care, which involves the village doctor, township hospital doctor and county-level hospital doctor. In addition, we found that the knowledge and practice of early initiation of breastfeeding was 32.5% and 22.4% respectively. Hospital delivery is a requirement in China. Therefore, it is the duty of the hospitals to ensure that deliveries take place in hospital. However, we found that more than 50% of reasons for late initiation of breastfeeding were attributed to the health facility environment, such as high cesarean section, separation of babies from mothers, and doctors' advice. Also ~~only~~ 7% of mothers reported that they received advice on non-exclusive breastfeeding from health workers. It was reported that the current national rate of caesarean section in China was about 40%, which is the highest worldwide [35-36]. Therefore, there is a need to strengthen the quality of healthcare services provided by rural health facilities as well as to increase service coverage.

(ii) Mobilize community resources to deliver IYCF recommendations: Community-based



breastfeeding promotion and support were proven to be effective. Therefore, the Global Strategy for Infant and Young Child Feeding recognizes this as one of the key components of a comprehensive program to improve breastfeeding practices [11]. Large-scale community-based programs have demonstrated that the community offers indispensable resources for breastfeeding promotion and support [37]. In the Regional Framework for Community IMCI of WHO Western Pacific Region, breastfeeding and complementary feeding are among the 12 key family practices that can be improved through community-based programs [38]. In addition, a study in China indicated that community-based behavioral change approaches that use trained village nutrition educators to provide feeding counseling to pregnant women and mothers are effective to improve breastfeeding and complementary feeding practices [39]. Therefore, communities hold potential to effectively deliver IYCF recommendations in rural China.

The rate of knowledge and practice of 6-month exclusive breastfeeding was 37.3% and 9.7% respectively. Thus, there is a gap in breastfeeding and exclusive breastfeeding practices. In our study site, most village doctors were male. Other resources from the community have the potential to provide the support for exclusive breastfeeding. Our data showed less than one in a hundred mothers received feeding information from their communities. Studies have shown that peer counseling and lay counseling are effective in promoting breastfeeding [40-43]. In rural China, existing community resources could be mobilized, such as the village women cadres, family planning workers, primary school teachers and volunteers, to provide feeding counseling to pregnant women and mothers.

(iii) Utilize popular media as well as Internet and mobile phones to expand IYCF coverage:

According to our results, the leading sources of feeding information were family members, neighbors, or friends and popular media (newspaper, magazine, book, radio and television: around 80% of information on breastfeeding and complementary feeding came from these two sources, whereas only 20% came from health facilities.

As those two main sources are both important, they should be fully used to disseminate accurate infant feeding information. However, we noted that some information from these two sources was invalid. As indicated in the results, around 60% of inaccurate advice to use formula feeding and more than 20% of inaccurate information on non-exclusive breastfeeding originated from family members, neighbors, and friends. Therefore, much more efforts must be made to strengthen these channels in terms of ensuring provision of correct information and broadening its scope to provide more mothers with accurate feeding advice.

Since there are two-thirds of mothers received no advice on feeding, new channels, such as internet and mobile phones, could be explored. Evidence indicated that computer-tailored nutrition education is an innovative and promising tool to motivate people to make healthy dietary changes [44]. Also, a recent study showed that internet nutrition education can be a viable alternative to traditional nutrition education for increasing fruit and vegetable consumption of women, infants and children [45].

With the rapid socio-economic development and technical progress, many Chinese people have access to new information and communication technologies. Data showed that, by the end of 2013, there were 1229 million mobile phone users and 618 million internet users in

China [46]. Our survey showed that in Zhao County, nearly all households owned mobile phones, and more than 60% of households owned computers, with more than half of them having access to internet. . In addition, the young generation of parents is well educated; around 95% of fathers and mothers attended junior high school (9 years of education). This implies a potential to deliver feeding recommendations through mobile phones or the internet. Future studies are needed to test the feasibility and effectiveness of these potential delivery channels in the context of rural China.

**Conclusions**

Findings of our study indicated that few caregivers of children in rural China received feeding information during pregnancy and after delivery. Moreover, their feeding knowledge and practices are poor, though the maternal and child health care services were generally available and utilized by mothers. Health facilities need to be strengthened and fully utilized to provide high-quality feeding counseling. Other channels, such as community resources, popular media, internet and mobile phones, hold great potential and should also be explored in future studies to maximize the effectiveness of IYCF programs.

**LIMITATIONS**

Our study has several limitations. Firstly, the sampling of children was based on the name lists of children in each village. In Zhao County, all live births are reported to the Maternal and Child Health Hospital from all qualified delivery institutions each month. Therefore we

obtained the name list from the hospital. Then we sent the name lists to village doctors and asked them to remove children who had died or moved outside the village and added children who were living in the village but who were not on the list. Although all these efforts were made, we were not sure on the completeness of the name lists and selection bias may have occurred. Secondly, some indicators such as initiation of breastfeeding after birth were based on the mothers' recall, with a longest recall time of two years, which may have introduced recall bias.

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### Contributorship statement

The study was initiated and conceptualized by YFZ and RS. YFZ supervised the study. QW and YL collected and coded the data. QW performed data analysis. QW, YFZ, RS and MV participated in the explanation and discussion of the results. The manuscript was drafted by QW, reviewed and revised by YFZ, RS, MV, LC, WW, YL and JC. All authors read and approved the final manuscript.

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**Competing interests**

The authors declare no competing interest.

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**Data sharing**

All the data in this study belong to the Capital Institute of Pediatrics.

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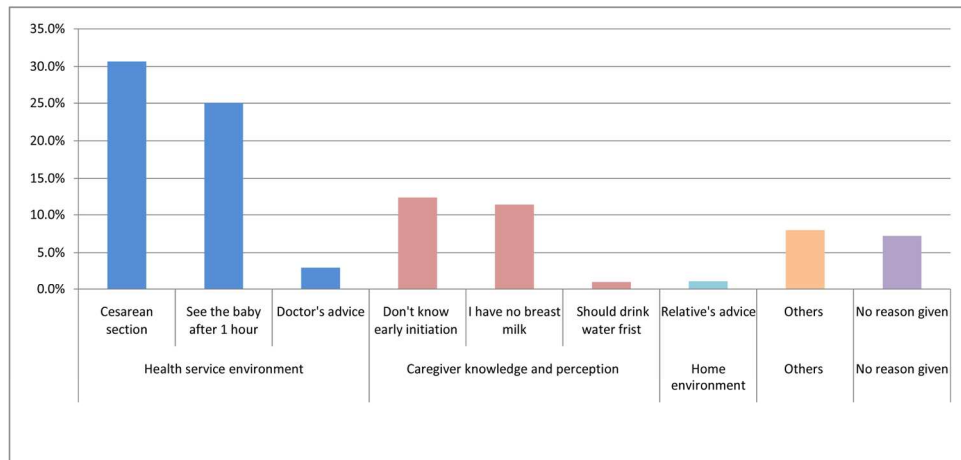
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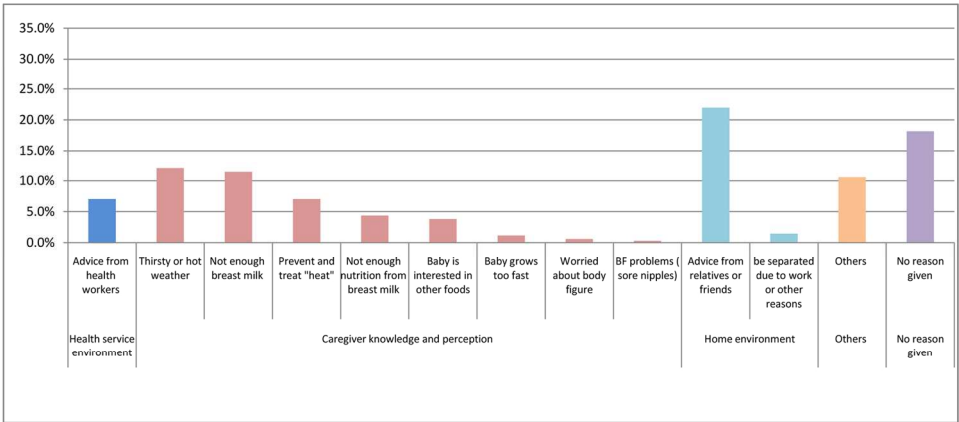
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Distribution of reported reasons for late initiation of breastfeeding  
172x82mm (300 x 300 DPI)



Distribution of reasons for non-exclusive breastfeeding  
172x82mm (300 x 300 DPI)

STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(a) Indicate the study’s design with a commonly used term in the title or the abstract	3
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	3-4
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	5-7
Objectives	3	State specific objectives, including any prespecified hypotheses	7
Methods			
Study design	4	Present key elements of study design early in the paper	7
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	7
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants	8-9
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	7-8
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	7-8
Bias	9	Describe any efforts to address potential sources of bias	22
Study size	10	Explain how the study size was arrived at	9
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	11
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	10-11
		(b) Describe any methods used to examine subgroups and interactions	10-11
		(c) Explain how missing data were addressed	Not needed
		(d) If applicable, describe analytical methods taking account of sampling strategy	Not needed
		(e) Describe any sensitivity analyses	Not needed
Results			

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	12
		(b) Give reasons for non-participation at each stage	12
		(c) Consider use of a flow diagram	Not needed
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	12
		(b) Indicate number of participants with missing data for each variable of interest	12, 14,15,16
Outcome data	15*	Report numbers of outcome events or summary measures	
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	Not needed, it is in one county, our previous experience tells us there is no difference for adjusted coverage.
		(b) Report category boundaries when continuous variables were categorized	12
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	Not needed
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	Not needed
Discussion			
Key results	18	Summarise key results with reference to study objectives	18
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	22
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	18-21
Generalisability	21	Discuss the generalisability (external validity) of the study results	18-21
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	23

\*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

**Note:** An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at [www.strobe-statement.org](http://www.strobe-statement.org).

For peer review only