

# STUDY ON THE INJECTION PRACTICES OF HEALTH FACILITIES IN JINGZHOU DISTRICT, HUBEI, CHINA

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## ABSTRACT

**BACKGROUND:** Some studies indicate unsafe injection practices, which are associated with the transmission of blood-borne pathogens, exist extensively, in the developing countries. **AIMS:** To investigate the status of injection services, knowledge and attitude of health workers with regard to injection practices at all levels of the health facilities in Jingzhou district of China; and to provide useful scientific data in order to formulate a feasible, standard measure on injection safety. **SETTINGS:** Four district health care facilities, 6 township health centers, 14 village clinics and 14 community health stations. **DESIGN:** A retrospective cross-sectional study. **MATERIALS AND METHODS:** By examining the medical records in 2004, observing injection practices and interviewing health workers, the quantitative and qualitative data were collected and analyzed. **RESULTS:** Out of 1,452 medical records sampled, 1,450 patients had received at least one injection in the period of hospitalization, with an injection rate of about 100% and an average of 10.9 injections per patient. The most frequent injected drug was antibiotic (48%, 7,674/15,857). The prescriptions of 5,655 outpatients were detected, with an injection rate of 52% (2,962). The field observation found that the proportion of unsafe injections was 16% (28/175) and that of unnecessary injections was 57% (99/175). Among 118 professional employees interviewed, those who knew that human immunodeficiency virus, hepatitis C virus and hepatitis B virus might be transmitted by the contaminated syringes and needles accounted for 95% (112), 59% (70) and 89% (105) respectively. **CONCLUSIONS:** Among the medical facilities of Jingzhou district, the injection rate was very high and the quality of injection practices should be further improved.

**Key words:** Health care facility, injection rate, knowledge of safe injections, safe injection

The widespread incidences of blood-borne diseases, which are often the result of infection due to unsafe injection practices,

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have been an important public health problem worldwide.<sup>[1]</sup> China is a high hepatitis B virus (HBV) infection area, where about 10% of the general population carry a positive hepatitis B virus surface antigen infected mainly due to unsafe injection practices.<sup>[2]</sup> Unsafe injection practices also are a major channel of hepatitis C virus (HCV) infection and human immunodeficiency virus (HIV) in

China. A sero-epidemiological study suggested that the positive rate of anti-HCV antibody was 3% in the general population of China.<sup>[3]</sup> Another report demonstrated that up to September 2004, a cumulated number of 89,067 infections with HIV virus was reported in China and the majority (69%) of them were infected through venous drug use, commercial plasma donating, blood transfusion or blood products injections.<sup>[4]</sup> WHO defines a safe injection as one that does not harm the recipient, does not expose the provider to any avoidable risk and does not result in waste that is dangerous to other people.<sup>[5]</sup> Since the 1980s, a series of legal laws, such as law of the PRC on the prevention and treatment of infectious diseases and sterilization management law, have been promulgated in China in order to ensure the safety of injections and decrease the frequency of medical infection. However, unsafe injections still exist extensively.<sup>[2-4]</sup> In recent years, some studies showed the quality of injection practices in health facilities was unsatisfactory.<sup>[6,7]</sup>

Jingzhou district lies in the middle of China and consists of nine townships and one urban district, with a population of about 580,000 in 2004. It has an integrated medical system, which consists of 7 district health care facilities, 8 township health centers, 140 village clinics and 102 community health stations, with 1,543 health workers. Up to now, there is no data available on 'injection safety' in this district. This study was carried out from May to August 2005 and its aim was to investigate the status of safe injections at all levels of health facilities, knowledge of safe injection practices and the attitude and

behavior of health workers in this regard in Jingzhou district and to provide a guide for developing a training plan and management measures about safe injections in this district.

## MATERIALS AND METHODS

In this study, the authors used a retrospective cross-sectional study, obtained samples by stratified random sampling and collected data by a retrospective investigation. This study was approved by the legal office of the Health Bureau of Jingzhou District and the participants. The study group was composed of eight public health workers and nine clinical workers and all the members were trained for this research before it started.

### Survey on the frequency of injection

Four district health facilities and 6 township health centers were sampled by a proportion of about 70%, while 14 village clinics and 14 community health stations by 10-15% respectively from all levels of health facilities in the study area by stratified random sampling. According to the hospitalized number, the medical records of 15 inpatients were randomly sampled per district health facility and township health center each month of 2004 respectively, to extract retrospectively the patient's basic information, such as name, sex, age, occupation and educational level, the number and type of injections and the sort of drugs used in the period of hospitalization. Two investigators randomly selected 15 prescriptions of the outpatients from each investigated health facility, where prescriptions were available, each month in 2004 and collected information

about the number and sort of drugs prescribed and their use, method for this purpose being a questionnaire.

### Assessment of the quality of injection practices

On the basis of above-mentioned reference definition of safe injections,<sup>[5]</sup> we defined an unsafe injection as one that harmed the recipient, exposed the provider to an avoidable risk and resulted in waste that was dangerous to other people. An unnecessary injection is one where oral alternatives are available, where the injected substance is inappropriate or harmful or where the symptoms or diagnoses do not warrant treatment by injection.<sup>[1]</sup> According to these criteria, the quality of injections was evaluated by two investigators by observing injection practices followed by health workers with regard to the injections administered to the outpatients and inpatients in the selected district health institutions and township health centers (10 cases per unit) and all the outpatients in village clinics and community health stations at field evaluation. To collect information on the cases, the injection providers and medical waste management; to calculate a safe injection rate, an unsafe injection rate and an unnecessary injection rate; and to analyze the risk factors related to unsafe injections, a questionnaire was used.

### Investigation about knowledge of safe injections among health workers

During the sampling of medical institutions, health workers (three doctors and three nurses selected randomly per district health unit and township health center and all health

workers per village clinic and community health station) were interviewed by a questionnaire to record their age, sex, occupation, professional title, knowledge and attitude regarding injection safety. Seven dependent variables (Y) which can reflect the knowledge levels of safe injections and five possible factors (independent variable X) influencing knowledge of the health workers were analyzed.

### Data analysis

All data were fed into Microsoft Excel 2000 and checked in order to establish an Excel database. Data were analyzed using SPSS 13.0 for Windows. The comparison of rates was done by the  $\chi^2$  test; meanwhile, a comparison of the means of injections was done by the Poisson test. The factors influencing knowledge of safe injections in health workers were analyzed by the logistic regression analysis.

## RESULTS

### Prevalence of injections in the inpatients and outpatients

A total of 1,452 medical records in 2004 were reviewed, in which 1,450 inpatients had received at least one therapeutic injection (total 15,857 injections) during the period of their hospitalization, with an injection rate of about 100% and an average of 10.9 (range: 1-138) injections per person. An average of 11.9 injections in district health facilities was obviously higher than that (10.1 injections) in township health centers,  $u = 10.27$ ,  $df = 8$ ,  $P < 0.001$  [Table 1]. The sort and proportion of drugs used for injection among the inpatients in district health units were

basically consistent with that of township health centers and the injection rate of antibiotics was the highest (48%, 7,674/15,857), followed by vitamins (27%, 4,283/15,857) and anesthetics (6%, 1,365/15,857). The proportion of intravenous injections was the highest (63%, 10,053/15,857), followed by intramuscular injections (22%, 3,489/15,857) and intradermic injections (12%, 1,950/15,857). A total number of 5,655 prescriptions of the outpatients were reviewed during the sampling of health care facilities. Out of them, 2,962 prescriptions included injected drugs, with a total number of 4,037 injections - an injection rate of 52% and a mean of 1.4 injections for the prescriptions containing at least one injectable medicine. Prevalence of injections among the outpatients in district health facilities was higher than that among township health centers, village clinics and community health stations ( $\chi^2 = 10.783$  and 61.493,  $df = 1$ ,  $P < 0.001$  and  $< 0.0001$ ) [Table

2]. The average number of injections for the outpatients in district health units and township health centers was 1.5 injections, which was higher than that (1.3) for village clinics and community health stations. In the outpatients, intravenous injections accounted for 46% (1,857/4,037) of the total number of injections, intramuscular injections for 28% (1,130/4,037) and intradermic injections for 26% (1,050/4,037). Among 2,962 prescription injections, the doctors prescribed antibiotic and / or antiviral drugs for 2,205 (74%) outpatients and hormones for 949 (32%) outpatients, especially in the village clinics and community health stations, where there was a high injection rate of 37% (692/1,879) for hormones.

### Quality of injections

Field observation showed that all levels of health facilities had used single-use plastic syringes and needles and 96% (168/175) of syringes and needles had been unharmedly

**Table 1: A comparison of the prevalence of injections among the inpatients in district health facilities and township health centers**

Unit	No. cases investigated	No. cases receiving injection	Injection rate (%)	Total number of injections	Mean of injection $\pm$ SD* (/person)	Total hospitalization (day)	Mean of injection (/person-day)
District health units	635	633	99.7	7583	11.9 $\pm$ 8.4	4514	1.7
Township health centers	817	817	100	8274	10.1 $\pm$ 7.1	4635	1.8
Total	1452	1450	99.9	15857	10.9 $\pm$ 7.7	9149	1.7

\*SD: Standard deviation

**Table 2: Comparison of the prevalence of injections among the outpatients at all levels of health facilities**

Unit	No. prescription detected	No. injection prescription	Injection rate (%)	Total number of injections	Mean $\pm$ SD (/person)
District health facilities	767	494	64	690	0.9 $\pm$ 1.2
Township health centers	1040	589	57	935	0.9 $\pm$ 1.1
Village clinics and community health stations	3848	1879	49	2412	0.6 $\pm$ 1.4
Total	5655	2962	52	4037	0.7 $\pm$ 1.3

Comparison of injection rate:  $\chi^2$  P

District health facilities vs. township health centers 10.7833  $< 0.001$

District health facilities vs. village clinics and community health stations 61.4925  $< 0.0001$

Township health centers vs. village clinics and community health stations 19.6361  $< 0.0001$

disposed by breaking and sterilizing after use.

Of the 175 therapeutic injections assessed, 147 were classified as safe injections and 28 as unsafe injections, with a safe injection rate of 84% and an unsafe injection rate of 16%. After regarding wearing gauze mask as one of the criteria for judging the quality of injections, unsafe injection rate rose to 69% (120/175), with a marked difference in different health settings ( $\chi^2 = 49.135$ ,  $df = 3$ ,  $P < 0.0001$ ) [Table 3]. Of the 28 unsafe injections, 25 were unsafe due to omission of skin sterilization before starting the skin allergic test, 2 due to a wrong method of sterilization and 1 due to the reuse of a contaminated syringe.

In 175 injections, 97 were unnecessary, with an unnecessary injection rate of 55%. Out of these, 87 injections were administered to the cases that did not clinically warrant treatment by injection, while 10 injections used inappropriate drugs. The unnecessary injection rates of all levels of health care facilities were different from each other, but there was no statistical difference ( $\chi^2 = 7.084$ ,  $df = 3$ ,  $P = 0.069$ ) [Table 3].

**Table 3: Comparison of the unsafe injection rates and unnecessary injection rates across all levels of health care facilities**

Unit	No. injections evaluated	No. unsafe injections	Unsafe injection rate (%)	No. unsafe injections after considering wearing mask	Unsafe injection rate after considering injections mask (%)	No. unnecessary injection rate (%)	Unnecessary
District health facilities	30	3	10	22	73	11	37
Township health centers	53	11	21	19	36	29	55
Village clinics	49	4	8	49	100	31	63
Community health stations	43	10	23	30	70	28	65
Total	175	28	16	120	69	97	57
$\chi^2$			5.619		49.135		7.084
P			0.132		<0.0001		0.069

### Knowledge of safe injections in health workers

A total of 118 health workers were investigated and the workers who knew that HIV, HCV and HBV could be transmitted by unsafe injection practices accounted for 95% (112), 59% (70) and 89% (105) respectively, while the workers who knew that HAV could not be transported by this mode accounted for 80% (94). Eighty-five (72%) medical workers believed single-use plastic syringes and needles were not absolutely safe, but 33 (20%) held an opposite viewpoint. Out of 118 medical workers, 94 (80%) thought wearing gauze mask was a measure ensuring the injection safety, 113 (96%) thought checking the drugs and patients was a necessity before injection and 95 (81%) knew being injured by used needles belonged to the category of unsafe injection practice.

A univariable logistic regression analysis indicated that age (X3) related significantly with the dependent variable Y2 - 'Could HCV be transmitted by unsafe injections?' ( $P = 0.046$ ). In addition, obvious relation was also seen between different grades of health unit (X1); occupation (X5); and the Y4 - 'Could HAV be transmitted by unsafe injections?'

( $P = 0.026$  and  $0.045$  respectively), between age (X3); and the Y5 - 'Whether or not single-use syringes and needles are absolutely safe?' ( $P < 0.001$ ) and between sex (X2); occupation (X5); and the Y6 - 'Whether or not wearing gauze mask is a measure of safe injections?' ( $P = 0.008$  and  $0.045$  respectively). However, none of the independent variables related statistically to the dependent variable Y1 - 'Could HIV be transmitted by unsafe injections?'; to Y3 - 'Could HBV be transmitted by unsafe injections?'; and to Y7 - 'Whether or not needle stick injury after use is in the category of unsafe injections?'

Multivariable logistic regression analysis revealed that the independent variable X3 (age) had entered into the logistic regression model of the dependent variable Y2; age (X3) and occupation (X4) entered into the model of Y5; and sex (X2) entered into the model of Y6 [Table 4]. All independent variables had not entered into the logistic regression models of the dependent variables Y1, Y3 and Y7 (data not shown in Table 4).

**Table 4: Logistic regression analysis results of factors influencing knowledge of safe injections in health workers**

Dependent variables*	Independent variables	$\beta$	$\chi^2$	P value	Odd ratio	95% CI†
Y2	Age: $\leq 30$	1.892	5.236	0.022	6.632	1.312, 33.526
	(X3) 31~	1.645	3.972	0.046	5.182	1.028, 26.130
	41~	0.750	0.696	0.404	2.118	0.363, 12.342
	51~				1.0	
Y5	Age: $\leq 30$	-2.310	6.652	0.01	0.099	0.017, 0.574
	(X3) 31~	-2.252	7.678	0.006	0.105	0.021, 0.517
	41~	-0.778	1.015	0.314	0.459	0.101, 2.086
	51~				1.0	
	Professional title: High grade	-1.871	1.589	0.207	0.154	0.008, 2.823
	(X4) Middle grade	-3.122	3.601	0.058	0.044	0.002, 1.108
Y6	Primary grade	-0.272	0.040	0.842	0.762	0.053, 11.043
	No				1.0	
	Sex: Male	1.269	7.097	0.008	3.556	1.398, 9.041
	(X2) Female				1.0	

\*Dependent variables Y1, Y3 and Y7 have not been listed in the table for lack of any significant independent variables associated with them. †95% CI represents 95% confidence interval.

### Survey on attitude and behavior of health workers with regard to injection practices

Seventy-nine doctors were asked about three major kinds of diseases cured by injection and three major kinds of drugs administered by injection in their medical practices. They reported that the most common diseases were infectious diseases (184), accounting for 78% of the overall 236 diseases cured by injecting; and wound and cardiovascular diseases, accounting for 4% (10) and 4% (9) respectively. The most common drugs for injecting were antibiotics, accounting for 60% (138/232); followed by antiviral drugs (13%, 31) and vitamins (10%, 23).

Out of the 79 investigated doctors, 23 (29%) would rather provide drugs to the cases with fever by injection, 26 (33%) by the oral route and 22 (28%) by both these ways simultaneously. Fifteen percent (12) of doctors thought they themselves had prescribed too many drugs for injection in the past, but 70% (55) hold the opposite view. Sixty-one percent (48) of 79 doctors thought

that the drugs administered by injection might be replaced in part by oral medication. Ninety-seven percent (77) of doctors thought that administration of injection had a faster and better effect compared to the oral route; only 3% (2) thought it had higher financial benefit.

A total of 67 injection providers were interviewed; they usually conducted 1-45 injections per day, with an average of 13.3 injections. All injection providers reported they had routinely examined the quality of single-use syringes and needles before use. Thirty-seven (55%) providers reported specific experience of needle stick injury in the past year, with an average of 2.4 injuries and it was severest in the district health units (4.7 injuries/person-year), followed by village clinics (2.4 injuries), township health centers (2 injuries) and community health stations (1.8 injuries).

## DISCUSSION

At present, injection service is a major method to administer drugs to the patients. Our results indicated that the injection rates in the inpatients and outpatients were about 100 and 52% respectively, with an average of 11 and 1.4 injections respectively. Field assessment also found a very high unnecessary injection rate (55%) in Jingzhou district, although it was lower than that of Tanzania (70%), Indonesia (82%) and Moscow (99%).<sup>[1]</sup> On the basis of the study results, an estimated overall number of unnecessary injections was 138,812 injections in Jingzhou district in 2004, an apparently inappropriate use of injections, a

matter that needs serious thinking. The reasons resulting in a high injection frequency and a high unnecessary injection rate could be very complex, including - 1) the majority of the doctors and patients believed, consistently, that injections had better efficiency compared to oral drugs,<sup>[8]</sup> 2) antibiotic and antiviral drugs were universally abused in medical practices and 3) an important reason could be that doctors sought higher financial benefits, although they did not express this viewpoint in the questionnaire. If unnecessary injections are avoided, not only would it decrease the administration of unsafe injections by over half, it would also reduce the transmission of blood-borne pathogens, save medical resources and reduce the economic burden of patients.

Study showed that all levels of health facilities in Jingzhou district had employed single-use plastic syringes and needles and highly effective disinfectants, such as iodophors and plutaral. Ninety-six percent of single-use syringes and needles after use had been unharmedly disposed through a procedure demanded by sterilization management law and it was similar to the study results of Shandong province in China<sup>[9]</sup> but was higher than that of India and Mongolia.<sup>[10-12]</sup> The overall rate of safe injection practices was 84% and it was higher than that (<70%) of 19 developing countries and 23% of Wulong county in China.<sup>[1,6]</sup> Wearing gauze mask was not regarded as a necessary factor for judging the injection safety in other literatures; however, when we regarded it as one of the factors, safe injection rate decreased to only 31%. In field evaluation,

we found that majority of injection providers did not wear gauze mask, especially in village clinics and it was a hidden danger to the injection safety in Jingzhou district.

Among the 28 unsafe injections found in field evaluation, 25 injections were conducted for the drug allergy test without sterilizing the skin and the rest were due to the inappropriate sterilization or the reuse of syringe. Many providers were worried that the color of iodophors and the allergic reaction to alcohol could influence the result and judgment of skin allergic test; hence they omitted the procedure of skin sterilization. In fact, iodophors and alcohol could not severely influence judgment of the result of skin allergic test because only in a few cases, allergic reaction to alcohol occurred and iodophors also could be faded by alcohol; therefore, to prepare the skin by using a disinfectant before drug skin allergic test is very necessary.

The study indicated that 55% of the injection providers had been injured by waste needles in the past year and the health workers were experiencing a high risk for being exposed to unsafe injection, as indicated by the other reports in developing countries.<sup>[10,12-14]</sup> Having violated operational procedures in the injection practices could be an important cause for injury to health workers. The injection providers should get themselves inoculated by available vaccine so that they can be protected from blood-borne pathogens, such as HBV.

The results indicated that over 80% of health workers had good knowledge about safe

injections and it was similar to other reports<sup>[9-12]</sup> but was better than that of Nigeria.<sup>[15]</sup> The logistic regression analysis showed that sex, age and professional title of health workers were important factors influencing their having knowledge of safe injections. Table 4 revealed that the younger the medical worker, the better his / her knowledge of safe injections, which could be because the youngsters had more chances for studying, better memory and greater interest in acquiring new knowledge. Theoretically, knowledge level with respect to safe injections should be in direct proportion to the professional title of health workers; however, the analysis of results suggested that the knowledge about safe injections among medical workers with middle grades of professional titles was better than that of those with high grades of professional titles and its association with the latter was very limited.

In order to reduce the injection frequency and improve the quality of injections, the following measures should be taken in Jingzhou district:

1. More training camps for medical workers should be conducted to improve their knowledge level regarding injection safety.
2. Choosing reasonable cure measures was vigorously advocated, viz, rational use of drugs and oral medication based on the patient's conditions and controlling the abuse of antibiotics.
3. Health workers themselves should enhance the protective measures and follow strictly technologically sound rules in the injection practices to avoid injuring the providers and/or other people.

4. The government should invest much capital in the rural health work for improving the equipments and work conditions of the injection services.
5. Health authorities should enhance management of injection practices and medical wastes across all levels of health care facilities, according to laws.
6. Health care facilities should use auto-disable syringes and avoid the reuse of single-use plastic syringes and needles in the preventive and therapeutic injections.

During the investigation of health care facilities, a part of village clinics and community health stations did not provide available prescriptions of the outpatients and this could have resulted in a selection bias in the analysis of these prescriptions. The factors influencing the frequency and quality of injection practices and knowledge of the injection safety among health workers could be complicated;<sup>[9]</sup> however, this study only investigated and analyzed limited factors. A deep and elaborate study about injection safety should include more information such as the accomplishments of health workers, government investment, management level of health facility, sociologic and economic factors, etc, in the future.

## CONCLUSION

In general, the prevalence of injections was very high at all levels of health care facilities in Jingzhou district, Hubei province, China. Although single-use syringes and needles had been extensively used and had been unharmedly disposed, the quality of injection practices should be further improved. To

develop an educational program on the subject safe injections for improving the knowledge level of medical workers and enhance the management and the quality of injection services is very necessary.

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