EVALUATION OF HOSPITAL PROCEDURES AND PHYSICIANS' BEHAVIOR ON PREVENTION OF RESPIRATORY INFECTIONS IN HOSPITALS IN INNER MONGOLIA; A CROSS-SECTIONAL STUDY USING UNANNOUNCED STANDARDIZED PATIENTS

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ABSTRACT

Background: *Nowadays, COVID-19 disease shot up world-wide which threat the global health, especially healthcare workers and patients in hospitals. The prevention of respiratory infections diseases (RID) is key to hospital-safety management. This study was to use unannounced standardized patients (USPs) to evaluate RID prevention in hospitals.*

Methods: *19 USPs observed both hospital and physicians' performance in 2 outpatient departments and an emergency department in 10 hospitals within 3 cities: Ordos, Baotou, and Hohhot, of Inner Mongolia.*

Results: *The average scores of four items of hospital procedure was lower in Ordos than others. Ordos was the worst in ratings for items of provision of resources for hand hygiene and giving mask on request among the three cities and Hohhot got the highest scores. There existed a linear-quadratic relationship between scores at the hospital level and the physicians' behavior by GEE model. Jaccard similarity coefficient showed that agreement among observers on hospital level was better than that of the physicians' behavior with coefficients being 0.74 (SD=0.24) and 0.50 (SD=0.23), respectively.*

Conclusions: *The quality of RID prevention was found insufficient in both domains in sample hospitals. The USP method is a useful tool in measuring health and medical care performance at both hospital and personnel levels.*

Keywords: *Respiratory tract infections, prevention and control, unannounced standardized patient, health care assessment, Inner Mongolia.*

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Introduction

The World Health Organization (WHO) considers safety as one of the six dimensions of quality of health care. It indicates that health care should be delivered with minimum risks and harm to service users(1). Respiratory infectious diseases (RIDs) can be nosocomial infectious events(2). Thus, prevention and control strategies to avoid the spread of the infections within hospital environments are key actions in reducing nosocomial epidemics and protecting both patients and healthcare workers (HCWs) from the diseases. Hospitals, especially at the tertiary level, take primary responsibility to receive and treat patients suffering from such acutely contagious infectious diseases like SARS, MERS, and COVID-19. During the 2003 Severe Acute Respiratory Syndromes (SARS) epidemic in China, Inner Mongolia was one of the most affected provinces(3) when the virus spread rapidly from the south to other parts of the country(4). In early 2020, the cases of COVID-19 disease shot up in China, and most countries around the globe are currently suffering from this virus. In Inner Mongolia, there have been 76 confirmed cases and one death from COVID-19. Furthermore, it also remains true that Inner Mongolian has the third-highest prevalence of TB among the provinces in China(5).

The outpatient (OPD) and emergency departments (ED) are the main gateways for patients to enter hospitals. While the number of patients seeking care in hospitals is increasing, outbreaks may have an increased opportunity to surface without efficient core infection prevention and control strategies through formal initiation of infection prevention programs at the hospital entrances(6). Thus, respiratory infectious disease (RID) prevention procedures of disease triage, protection of disease spread, and proper air ventilation at OPDs and EDs are essential.

There are some RID prevention guidelines for OPDs and EDs from WHO and the National Center for Disease Control and Prevention (CDC)(7-10). The guidelines include two main components to consider; hospital communication to patients, and the procedures of HCWs in advising and leading the patients towards cleanliness and protection of others.

In assessing the hospital and personnel performance, a set of evaluation methods such as chart abstraction, patient rating, and clinic vignettes has been used. Each of the techniques has its flaws. An unannounced standardized patient (USP) is a standardized, simulated patient (SP) that a healthy person simulates the symptoms of a disease.

Researchers conduct an unannounced random survey after getting informed consent from the study population(11, 12), which are hospitals and their personnel. USPs can evaluate hospitals and personnel performance, by simulating a realistic patient's practice, especially if the USPs are in local people. This method has been considered a tool more intimate to a gold standard for evaluating healthcare providers in many domains such as communication between health workers and patients, and the quality of care in hospitals. The objective of our study was to use USPs to evaluate hospital procedures and physician behavior toward RID prevention in OPDs and EDs of hospitals in Inner Mongolia. To explore the procedures conducted in the hospital by HCWs and their practice in ensuring safety, we used a set of trained unannounced standardized patients to observe working physicians' behaviors toward prevention of respiratory infections in 3 clinics of 10 public hospitals in 3 cities of Inner Mongolia.

Materials and methods

We conducted a cross-sectional survey from December 2017 to May 2018 in three large cities of Inner Mongolia, including Hohhot, the capital city of Inner Mongolia; Baotou, an industrial center; and Ordos, a fast-growing city in terms of economic development. There were ten general tertiary hospitals in these three cities: 3 in Hohhot, 5 in Baotou, and 2 in Ordos. We trained nineteen USPs and scheduled them randomly to visit the respiratory OPDs, ear-nose-throat (ENT) OPDs, and EDs in the 10 study hospitals. These three clinics were purposively selected because most of the patients treated in these clinics had respiratory infections.

USPs selection and training

The USP trainers selected were from Inner Mongolia People hospital. The USP trainers evaluated the performance and memory ability of the USP candidates through some professional texts, and they 19 USPs were selected for our study. All USPs were students from Inner Mongolia Medical University, third year or higher. The USPs were instructed to simulate the cough symptoms of tuberculosis (TB) and influenza (flu). Two scenarios were created for USPs to observe the department procedures and physicians' behaviors in OPDs and EDs.

USP candidates were invited to participate in a training course at the Inner Mongolia People Hospital. The USP trainers evaluated the performance and memory ability of the candidates. At the end of the course, 19 USPs passed all the tests and were recruited into the study. The USPs were able to simulate the cough symptoms of tuberculosis (TB) and influenza (flu). They were able to observe department procedures and physicians' behaviors in OPDs and EDs. USPs were asked to perform two tasks. Task one instructed USPs to observe hospital procedures, and task two had USPs describe the physicians' practices. The USPs simulating TB were instructed to note that they had been coughing for 2-3 weeks but had neither shortness of breath nor other symptoms. The USP simulating flu pretended that they felt sick and had suffered with a cough for a few days. They reported that they had no history of traveling and took no previous medicine or visited any doctors.

USP observations and checklist development

The four items of hospital signage and posters (hospital performance) observed by USPs were as follows:

• Warnings of symptoms of respiratory infection;

• Directives to cover mouths/noses when coughing or sneezing;

• Instructions to use tissues when coughing/sneezing and provision of receptacles for disposing of used tissues;

• Provision of facilities for hand washing or disinfection and instructions to use them for those who have been in contact with respiratory secretions. In the checklist, these four dimensions were as binary answers, where 'yes' meant the hospital had signage and/or posters showing a clear message and 'no' meant there was no message displayed or it was not clear.

There were six items to evaluate the physicians' behavior during a consultation with the USP, including:

• Providing tissues to the USPs and apprising them of the location of non-touch receptacles for disposal of tissues;

• Instructing USPs about the location of handwashing facilities;

• Offering a mask without request;

• Giving a mask on request;

• Encouraging the USP to keep a safety distance from other patients;

• Providing a consulting/examination room with adequate air ventilation in the consulting/examination room. These six dimensions were rated as yes or no, where 'yes' meant physicians conducted, and 'no' said they did not.

Hospital visits

First, the researchers visited all the study hospitals and explained the aims and procedures of the study prior to obtaining informed consent from the hospital administrators. USPs' visits occurred randomly about 3-4 weeks later.

USPs entered the hospital and queued up to register using their identification cards, mixing in with real patients. Immediately after registering, the USPs went to one of the 3 study clinics recommended by the healthcare staff at the registration desk. Then, while waiting for their consultation, the USPs observed whether the clinic had signage and/or posters on cough etiquette and good respiratory hygiene. After the doctor's visit, the USPs then completed the two checklists assessing the hospital's signage and posters and the physician's behavior.

Statistics analysis

Each USP coded the checklist at the end of the day. The Epi-data software was used to do double-entry of the data. We used R version 3.5.1 for all statistical analysis[13]. The outcome of our study was the same as the two domains mentioned above.

A random-effects linear mixed model was used to determine the effects of the cities and clinics on the hospital's signage and physician's behavior. We used the geeglm function from the geepack package[14] for R to estimate the parameters of a generalized linear estimation equation model with a possible unknown correlation between two outcomes.

The gee formula and options were as follows:

physician score ~ hospital score, id=interaction(city+clinic+hospital), corstr("exchangeable"),

where physician and hospital scores were the average scores of the two domains, id took the interaction of city, clinic, and hospital into account, and the correlation structure was set to "exchangeable" that meant the two score variables were exchangeable. For each clinic, the standardized physician behavior scores (ranging from 0 to 1) on the six items mentioned above for physicians working in the same clinic were modeled against the standardized hospital signage and posters scores on the four elements of this category.

In solving the linear mixed effect model, the lme4 package[15] was used for R.

The general linear mixed effect (lme) formula was: score ~ clinic + city + (1|hospital), where clinic represented the 3 clinical department settings, city represented the 3 cities in this study, and the intercept for each hospital was set to 1. The hospital score was obtained by aggregating the mean scores of the four hospital items by clinic, hospital, and city. Since a median of 1 USP evaluated departments in each hospital in this study, there was a low chance that two or more USPs were evaluating the same OPD. The physician score was obtained by aggregating the mean scores of a physician assessed by the four performance items by clinic, hospital, and city. An average of 4 USPs evaluated the hospital departments in each hospital in this study.

In an attempt to reduce bias, a large pool of USPs was used and a few of them were assigned to visit one physician and clinic. Jaccard similarity coefficient[14] was used to detect if the similarity and clustering of the ratings among USPs happened.

Results

A total of 77 physicians, 30 males, and 47 females, were observed by 19 (6 male and 13 female) USPs. Four USPs simulated cough symptoms of TB and one USP simulated symptoms of flu. The other 14 USPs mimicked both TB and flu cough symptoms. USP visited the hospitals randomly, and none of them visited all the ten hospitals. We planned to have each of the physicians and the outpatient settings observed by at least two different USPs.

However, the distribution of the visits was as follows: 13 physicians visited by 1 USP, 51 by 2, 9 by 3, 3 by 4, and 1 by 6, resulting in 160 assessments of the 77 physicians. Four clinics were visited by 3 USPs or less. Some physicians working in EDs also looked after patients in the other OPDs within the same hospital. And they might have been observed more than once. Seven of the 10 hospitals (75%; 95% CI: 35% - 93%) had hospital performance scores greater than 0.7. Thirty-one out of 81 (38%, 95% CI: 28% - 50%) behavioral observations on the 77 physicians (four were observed more than once) had behavior scores greater than 0.4. The details of the scores by clinic, hospital, and city are shown as tables A1, A2 in Appendix A.

Hospital performance

The results showed that hospital clinics in Hohhot and Baotou had higher average scores than those in Ordos. The domain with the most top scores was the communication to patients on significant symptoms of respiratory infection followed by the provision of facilities for handwashing or disinfection and recommend using them for those who contacted with respiratory secretions. From the multivariate linear mixed-effects model, the estimated mean scores for the four hospital domains by city using Hohhot as the reference group are shown in Table 1. We fixed the intercept across the hospitals and allowed the estimated slopes to vary within the same hospital-quality item and the average score. Clinics in Ordos had significantly lower scores for all four domains as well as for the average combined rating. In general, Baotou had lower scores than Hohhot, and the H4 (provision of facilities for handwashing or disinfection and instructions for their use) dimension reached a statistically significant level.

Domain	City†	Estimate	95% CI	P-value
Average score	Baotou	-0.096	-0.262, 0.072	0.245
	Ordos	-0.781	-0.996, -0.566	<0.001
H1	Baotou	-0.102	-0.211, 0.009	0.072
	Ordos	-0.962	-1.105, -0.819	<0.001
H2	Baotou	-0.059	-0.298, 0.181	0.605
	Ordos	-0.744	-1.055, -0.436	<0.001
H3	Baotou	0.015	-0.169, 0.197	0.861
	Ordos	-0.478	-0.729, -0.232	<0.001
H4	Baotou	-0.234	-0.450, -0.017	0.041
	Ordos	-0.929	-1.207, -0.652	<0.001

Table 1: Average scores of hospital performance display by linear mixed-effects model.

†Reference city = Hohhot. CI: Confidence interval. Domains: H1 = warnings of symptoms of respiratory infection, H2 = directives to cover mouths/noses when coughing or sneezing, H3 = instructions to use tissues when coughing/sneezing and provision of receptacles for disposing of used tissues, H4 = provision of facilities for hand washing or disinfection and instructions for their use.

Physicians' behavior

The multivariate linear mixed-effects model of the scores for the six physicians' behavior items by city using Hohhot as the reference group is shown in Table 2. The clinics in Ordos had much lower estimated scores for all six domains, as well as the average rating. In Ordos and Baotou, the provision on resources for hand hygiene (P2) and giving tissue/surgical mask on request (P4) scores were rated significantly lower than in Hohhot. Ordos also had substantially lower scores for examination rooms located in the place with proper ventilation (P6) compared to Hohhot. Other behaviors were not statistically different among the three cities.

Domain	City†	Estimate	95% CI	P-value
Average score	Baotou	-0.090	-0.163, -0.014	0.015
	Ordos	-0.192	-0.293, -0.093	<0.001
P1	Baotou	-0.104	-0.293, 0.086	0.283
	Ordos	-0.089	-0.353, 0.174	0.502
P2	Baotou	-0.248	-0.413, -0.089	0.004
	Ordos	-0.390	-0.618, -0.160	0.001
P3	Baotou	-0.013	-0.057, 0.030	0.541
	Ordos	-0.027	-0.086, 0.032	0.357
P4	Baotou	-0.193	-0.376, -0.009	0.041
	Ordos	-0.330	-0.585, -0.075	0.012
P5	Baotou	-0.033	-0.111, 0.045	0.397
	Ordos	-0.076	-0.184, 0.032	0.165
P6	Baotou	0.050	-0.097, 0.197	0.472
	Ordos	-0.239	-0.428, -0.047	0.024

Table 2: Average scores of physicians' behavior by linear mixed model.

†Reference city = Hohhot. CI: Confidence interval. Domains: P1 = providing tissues to the USPs and apprising them of the location of non-touch receptacles for disposal of tissues, P2 = instructing USPs about the location of handwashing facilities, P3 = offering a mask without request, P4 = giving a mask on request, P5 = encouraging the USP to keep a safety distance from other patients, P6 = providing a consulting/examination room with adequate air ventilation in the consulting/examination room.

Correlationship of hospital sinage and posters and physicians' behavior

The plot in Figure 1 shows a non-linear relationship between the physicians' behavior scores and hospital performance scores stratified by cities. The average physician scores in all but two clinics in Hohhot were below 0.6. All clinics in Hohhot had average hospital scores higher than 0.5, and there was a negative correlation between the two levels of measurement. In Baotou, there was a slightly positive correlation with a large variation in scores for both levels of measurement. Almost all clinics in Ordos scored poorly in the level of hospital performance, and they also had the lowest physician behavior scores among the three cities. Table 3 shows the results of fitting a GEE model to explore the relationship between physicians' behavior scores and hospital performance scores. There was a significant positive and a linear-quadratic relationship between the two variables, and the relationship differed in each city as shown in Figure 1.

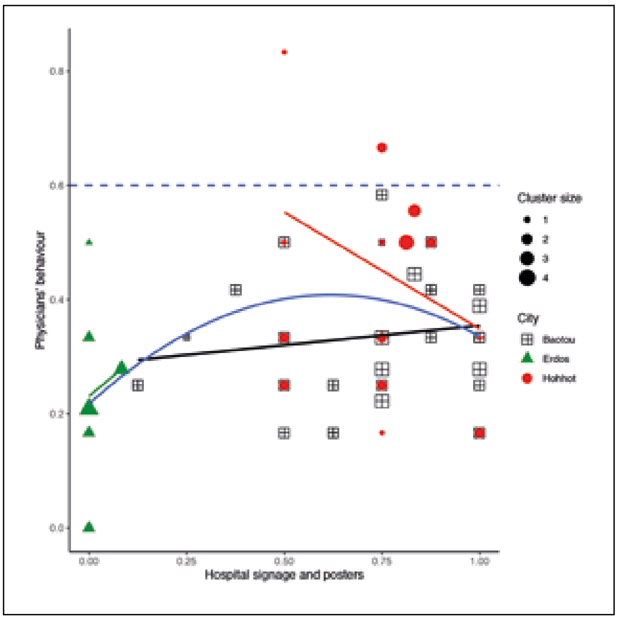

Figure 1: The scatterplot of average physicians' behavior scores and average hospital performance scores for each clinic stratified by city (represented by different shapes and colors). The size of the symbols is proportional to the number of USPs visited each clinic. The horizontal dashed line represents a score of 0.6. The solid curved line represents the non-linear relationship between the two variables.

Model	Estimate	95% CI	P-value
Intercept	0.217	0.172, 0.261	<0.001
Hospital score	0.585	0.211, 0.960	0.002
(Hospital score)^2	-0.468	-0.848, -0.089	0.015

Table 3: GEE model associating physician's behavior score and hospital performance score.

USP's similarity

Figure 2 shows heat maps for the ratings of the USPs on hospital performance (2a) and physician behavior (2b). The similarity among USPs on hospital performance was 0.74 (SD=0.24), which was higher than that on the physicians' behavior, which was 0.50 (SD=0.23). Four USPs (numbers 16-18 and 20) visited only one clinic, and their results were analyzed together with the 15 other USPs.

The analysis of Jaccard similarity scores showed high clustering in ratings of hospital dimensions among USPs (Figure 2a). In Figure 2b, four USPs (numbers 17-20) clustered in their ratings of physicians' behavior, as shown in the upper left corner. However, some clustering of the ratings also existed among the other USPs who visited more than one physician in different hospital clinics.

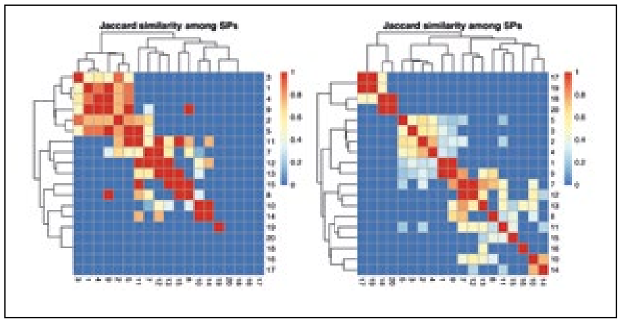

Figure 2: Jaccard similarity matrix of ratings among unannounced standardized patients (USPs) on the two levels of measurement: a) hospital performance and b) physician behavior. Clustering among USPs is evident in both maps.

Discussion

In summary, there were 160 assessments of those 77 physicians. 30 males, and 47 females, were observed by 19 USPs. The quality of health care at both hospital and physician levels in the city of Ordos was the poorest among the three study cities (Tables 1 and 2). Although Ordos is a fast-growing city in terms of economic development, it has a much slower growth of infrastructure, including health and medical services. Baotou is an old industrial city with well-developed health and medical care infrastructure, while Hohhot is the most developed city, being the capital city of Inner Mongolia. The difference in human resources and the financial status of public hospitals might influence the outcomes in different cities(16). However, resources alone might not show a linear correlation with the increase in the scores as other socioeconomic factors can also influence the quality of health care.

Among the dimension of hospital performance, higher scores were found for communication between physicians and patients on significant symptoms of respiratory infection in most hospitals in Hohhot and Baotou compared to those in Ordos. The provision of facilities for hand washing or disinfection and instructions to use thereof after having been in contact with respiratory secretions was rated as good. Hospitals with few resources would likely have lower performance in this domain than hospitals with high resources(17). We found a linear-quadratic relationship between the hospital performance scores and physician behavior scores, as demonstrated in Table 3. It is likely that in big and well-equipped governmental hospitals, signage and posters are well displayed. As the hospitals developed, the crowded and busy clinics might prevent an efficient contact between the doctors and patients.

Medical resources brought by economic expansion have been too concentrated and not conducive to the protection of patients' rights and interests and the improvement of the doctor-patient relationship. Some suggested that healthcare workers' behaviors were dependent on policy rules and also affected by local normative practices, individual practices, and the professional society to which they belonged. Personal experience was highly valued amongst health care workers and used to override a policy(18). As the behaviors were often individualized among physicians working in the same hospital environment and administration, the abilities and cognition in safety management among physicians might differ. In this study, one of the hospitals in Hohhot was engaged in an international project on respiratory infection disease prevention and control. A few large hospitals in Hohhot could conduct studies to improve their practice. This differential ability of hospitals according to the socioeconomic development may partly explain the difference in hospital and also the physicians' behavior scores. Some researchers found that different types of health care settings influenced the patient's participation in safety-related behaviors(19). According to statistics reported by WHO in March 2020(20), epidemic of COVID-19 in late 2019 and early 2020, It is remarkable that there were only 75 confirmed cases (including 1 death case) in Inner Mongolia. There was no report of HCW infection in Inner Mongolia. The statistics shows that the epidemic control was well prepared and managed than the SARS epidemic. It is likely that the local government and hospitals of Inner Mongolia responded promptly and rapidly as a result of previous SARS epidemic and even we found some weaknesses in the RID prevention procedures. Even the awareness of RID prevention measures was deteriorated for a while, the rapidity of the response to prevention protocols is essential to limit the disease epidemic in the province. We predict much better results if the study would have conducted after the COVID-19 epidemic in Inner Mongolia.

Conditions were affecting the USP's hospital visit plans that made the distribution of hospitals, outpatient settings, and physicians observed in the results different from the plan. However, most physicians were visited by two or more USPs, and only four clinics were visited by 3 USPs or less. The results of the study were acceptable to evaluate the hospital communication and measures of respiratory disease prevention among physicians.

Even though the practice of USPs was standardized, they had their own opinions on hospital performance and physicians' behavior. Such variation in human observation is unavoidable. The similarity among USPs on hospital performance was evident. As the USPs were trained to portray symptoms of influenza or tuberculosis, and they were trained to vary their symptoms in different visits. The Jaccard similarity coefficient on the physicians' behavior was lower than that on hospital performance even though the standard deviations of both scores were similar. Clusters in dimensions were evident in making opinions on both hospital performance and physicians' behavior among USPs (Fig. 2). This observation confirms that for the USP method of assessing hospital quality, one needs a pool of USPs large enough to have some variation among them to overcome the clustering effect. The strong attempt to normalize their observation and record practice is good for standardization of data collection in a study, but researchers should allow some deviation in individual observation and opinion of USPs. A post-hoc discussion with the group of USPs to bring in some new observations and ideas might have been missed at the design and training stages. This is a good strategy to synthesize variations in ideas and make the whole team of USPs more consistent. A barrier to the use of USPs is the cost as it is more expensive compared to other methods such as chart abstraction and clinic vignette(21). The main costs of the method are in training the USPs, supplying their wages, and traveling and accommodation costs of the team during the hospital visit period. To date, the USP method has been used to evaluate the quality of diagnoses in hospitals(22), quality of care(23), communication ability between health care workers and patients(24), and the quality of counseling among pharmacists(25). To our knowledge, this is the first study to use the USP method to assess the prevention procedures of respiratory disease spread in hospital settings in China.

Conclusions

There was inadequacy in both domains among the three cities. The hospitals in Ordos scored the worst in both hospital level and physicians' behavior. The relationship with the hospital signage and posters and the physicians' behavior was linear quadratic and the three cities influenced the relationship. This study displays the USP method as a useful tool in measuring health and medical care performance at both hospital and personnel levels and in providing valuable supplemental information to self-reported outcome assessments of prevention strategies. We suggest hospitals in Inner Mongolia, especially in Ordos, are in need of the health resource on respiratory infectious diseases prevention.

Appendix A

Table A1 shows that clinics in hospitals in Hohhot had high average scores while hospitals in Ordos had the lowest scores.

The domain which usually produced the high score was the communication to patients on important symptoms of respiratory infection followed by the practice of instructing of and providing facilities for hand wash or disinfection after having been in contact with respiratory secretions. The distribution of the scores of the four items by clinic, hospital and city is shown separately in the Figure A1.

	Clinic	Hospital*	City	H1	H2	H3	H4	Average score
1	RES	H1	Hohhot	1	0.714	0.5711	1	0.821
2	Emergency	H1	Hohhot	1	0.667	0.333	1	0.75
3	ENT	H1	Hohhot	1	0.75	0.25	1	0.75
4	RES	H2	Hohhot	1	0.833	0.333	0.667	0.708
5	Emergency	H2	Hohhot	0.857	1	0.571	1	0.857
6	ENT	H2	Hohhot	1	1	0.833	1	0.958
7	RES	H3	Hohhot	1	0.667	0.556	1	0.806
8	Emergency	H3	Hohhot	1	1	0	1	0.75
9	ENT	H3	Hohhot	1	0.667	0.667	0.833	0.792
10	RES	B1	Baotou	0.833	0.5	0.333	0.5	0.542
11	Emergency	B1	Baotou	0.667	0.333	0.1667	0.333	0.375
12	ENT	B1	Baotou	0.667	0.333	0.1667	0.333	0.375
13	RES	B2	Baotou	0.8	0.8	0.8	0.8	0.8
14	Emergency	B2	Baotou	1	1	0.571	1	0.893
15	ENT	B2	Baotou	1	0.8333	0.5	0.833	0.792
16	RES	B3	Baotou	0.714	0.5711	0.429	0.571	0.572
17	Emergency	B3	Baotou	1	1	0.75	1	0.938
18	ENT	B3	Baotou	1	0.714	0.714	0.714	0.786
19	RES	B4	Baotou	1	0.8	0.6	0.8	0.8
20	Emergency	B4	Baotou	1	0.667	0.5	0.667	0.708
21	ENT	B4	Baotou	1	0.75	0.5	0.75	0.75
22	RES	B5	Baotou	1	0.857	0.429	0.857	0.786
23	Emergency	B5	Baotou	1	1	0.833	1	0.958
24	ENT	B5	Baotou	0.833	0.833	0.5	0.833	0.75
25	RES	E1**	Ordos	0.143	0	0	0	0.0357
26	ENT	E1**	Ordos	0	0	0	0	0
27	RES	E2	Ordos	0	0	0	0	0
28	Emergency	E2	Ordos	0	0	0	0	0
29	ENT	E2	Ordos	0	0	0	0	0

Table A1: Average score for the four items of the hospital signage and poster evaluated by USPs by clinics.

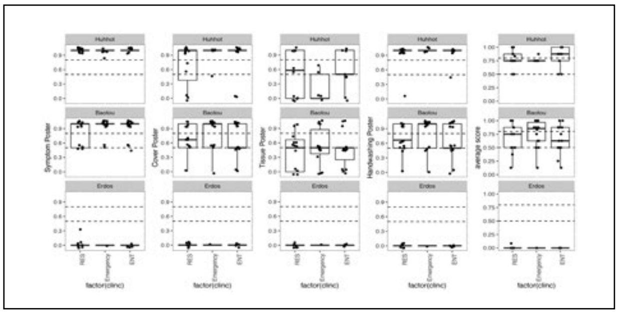

Figure A1: Hospital signage and posters vary among different cities.

Table A2 shows that among a total of 81 physicians working in Hohhot had high scores on average while those who were practicing in Ordos had the lowest scores. The worst two items which usually produced the lowest scores were the offering masks (P3) and the suggestion to stay away from other patients as possible after knowing your cough symptoms (P5).

	Physician*	Hospital	Clinic	City	P1	P2	P3	P4	P5	P6
1	H1A	H1	Respiratory	Hohhot	0	0	0	1	0	1
2	H1B	H1	Respiratory	Hohhot	1	1	0	1	0	1
3	H1C	H1	Respiratory	Hohhot	0.667	0.667	0	0.333	0.5	1
4	H1D2	H1	Respiratory	Hohhot	0	1	0	1	0	1
5	H1E	H1	Respiratory	Hohhot	0	0	0	0	0	1
6	H2A	H2	Respiratory	Hohhot	1	1	0	1	0	1
7	H2B	H2	Respiratory	Hohhot	1	0	0	0	0	1
8	H2C1	H2	Respiratory	Hohhot	0.5	0.5	0	0.5	0	1
9	H3A	H3	Respiratory	Hohhot	0	0	0	0	0	1
10	H3B	H3	Respiratory	Hohhot	0	0	0	1	0	1
11	H3C	H3	Respiratory	Hohhot	0	0	0	0.5	0	1
12	H3D	H3	Respiratory	Hohhot	0.5	0.5	0	0.75	0	1
13	H1D2	H1	Emergency	Hohhot	0.5	0.5	0	1	0	1
14	H1F	H1	Emergency	Hohhot	1	1	0	0	0	1
15	H2D	H2	Emergency	Hohhot	0.5	0.667	0.167	0.4	0.4	1
16	H2C1	H2	Emergency	Hohhot	1	0	0	0	0	1
17	H3E	H3	Emergency	Hohhot	0	1	0	1	0	1
18	H1E	H1	ENT	Hohhot	0	0	0	0.5	0	1
19	H1F	H1	ENT	Hohhot	1	1	0	1	0	1
20	H1G	H1	ENT	Hohhot	1	1	0	1	1	1
21	H2E	H2	ENT	Hohhot	0	0	0	1	0	0
22	H2F	H2	ENT	Hohhot	0	0.5	0	0	0	1
23	H2G	H2	ENT	Hohhot	1	1	0.5	0	0	1
24	H3F	H3	ENT	Hohhot	0.5	0	0	0	0	1
25	H3G	H3	ENT	Hohhot	0	0	0	0.5	0	1
26	H3H	H3	ENT	Hohhot	1	0.5	0	0.5	0	1
27	B1A	B1	Respiratory	Baotou	0	0	0	0.5	0	1
28	B1B	B1	Respiratory	Baotou	0.5	0.5	0	0.5	0.5	1
29	B1C	B1	Respiratory	Baotou	0.5	0	0	0	0	1
30	B2A	B2	Respiratory	Baotou	0	0	0	0	0	1
31	B2B	B2	Respiratory	Baotou	0.3333	0	0	0.333	0	1
32	B3A	B3	Respiratory	Baotou	1	0.5	0	0	0	1
33	B3B	B3	Respiratory	Baotou	0.333	0	0	0.333	0	1
34	B3C	B3	Respiratory	Baotou	0.5	0	0	0	0	1
35	B4A	B4	Respiratory	Baotou	0.5	0.5	0	0.5	0	1
36	B4B	B4	Respiratory	Baotou	0	0	0	0.333	0	1
37	B5A	B5	Respiratory	Baotou	0.667	0	0	0.333	0	1
38	B5B	B5	Respiratory	Baotou	0.5	1	0	0.5	0.5	1
39	B5C	B5	Respiratory	Baotou	0.5	0.5	0.5	0.5	0	1
40	B1D	B1	Emergency	Baotou	0.5	0	0	0.5	0	1
41	B1F	B1	Emergency	Baotou	0.5	0.5	0	1	0	1
42	B1G	B1	Emergency	Baotou	0.5	0	0	0	0	1
#43	UNCODE	B2	Emergency	Baotou	1	1	0	0	0	1
44	B2C	B2	Emergency	Baotou	0.333	0.333	0	0.667	0	1
45	B2D	B2	Emergency	Baotou	0.667	0.667	0	0.333	0	1
46	B3D	B3	Emergency	Baotou	0.5	0.5	0	0.5	0	1
47	B3E3	B3	Emergency	Baotou	0	0	0	0	0	1
48	TYY	B3	Emergency	Baotou	0	0	0	0	0	1
49	BL	B4	Emergency	Baotou	0.5	0.5	0	1	0	1
50	ZT	B4	Emergency	Baotou	0	0	0	0	0	1
51	ZY	B4	Emergency	Baotou	0	0	0	0	0	1
52	H3	B5	Emergency	Baotou	0.5	0.5	0	0.5	0	1
53	LH	B5	Emergency	Baotou	0	0	0	0	0	1
54	ZJY	B5	Emergency	Baotou	0	0	0	1	0	1
55	FJB	B1	ENT	Baotou	0	0	0	0.5	0	1
56	W	B1	ENT	Baotou	0.5	0.5	0	0	0	1
57	ZDL	B1	ENT	Baotou	0.5	0	0	0	0	1
58	GYQ	B2	ENT	Baotou	0	0	0	1	0	1
59	WCF	B2	ENT	Baotou	1	0.5	0	0	0.5	1
60	YWS	B2	ENT	Baotou	0.5	0	0	0.5	0	1
61	H2Y	B3	ENT	Baotou	0.5	0.5	0	0.5	0	1
62	B3E3	B3	ENT	Baotou	0	0	0	1	0	1
63	B3F	B3	ENT	Baotou	1	0	0	0	0	1
64	B3G	B3	ENT	Baotou	0	0	0	0.5	0	1
65	B4C	B4	ENT	Baotou	0	0	0	0	0	1
66	B4D	B4	ENT	Baotou	0.5	0.5	0	0.5	0	1
67	B5D	B5	ENT	Baotou	0.5	0	0	0	0	1
68	B5E	B5	ENT	Baotou	0.5	0.5	0	0.5	0	1
69	B5F	B5	ENT	Baotou	0	0	0	0.5	0	1
70	E1A	E1	Respiratory	Ordos	0	0.667	0	0	0	1
71	E1B	E1	Respiratory	Ordos	1	0	0	1	0	1
72	E1C	E1	Respiratory	Ordos	0	0	0	0	0	1
73	E1D	E1	Respiratory	Ordos	0	0	0	0	0	1
74	E2A	E2	Respiratory	Ordos	1	0	0	1	0	1
75	E2B	E2	Respiratory	Ordos	0	0	0	0	0	0
76	E2C	E2	Respiratory	Ordos	0	0	0	0	0	1
77	GH3	E2	Emergency	Ordos	0	0	0	0.5	0	0
78	E1E	E1	ENT	Ordos	1	0	0	0	0	1
79	E2F	E1	ENT	Ordos	0.5	0	0	0	0	0.75
80	E2E	E2	ENT	Ordos	1	0	0	0	0	1
81	E2F	E2	ENT	Ordos	0	0	0	0	0	0

Table A2: Average score for the six items of the physicians' behavior among 77 physicians with 80 observations by clinics.

**The names of the physicians were encoded. #Record number 43 was excluded from the analysis because of the missing of characteristics variables. 1, 2, 3 These physicians appeared and evaluated in two clinics in the same hospital. The scores they received were different when evaluated at the different time and SP. The three pairs of observations were kept in the analysis.*

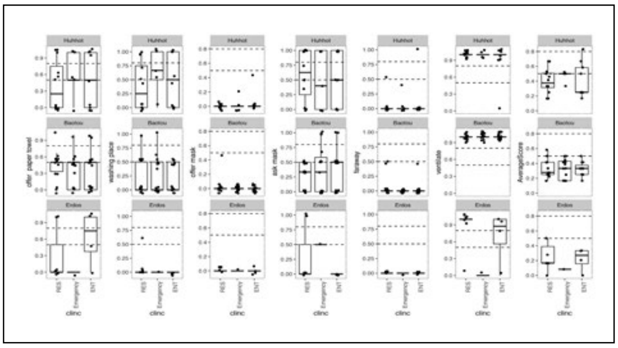

Figure A2: Physicians behavior mean scores vary among different cities.

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