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# The Quality of Primary Care in Rural China: Evidence from Mystery Patients

Sean Sylvia  
Harvard China Health Partnership  
Feb. 6, 2020



# UNC and Public Health in China



马海德 (George Hatem)



*UNC professors Gail Henderson and Myron Cohen working in China, c. 1980.*

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McGill University

**Kumi Smith**

University of Minnesota



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SICHUAN UNIVERSITY



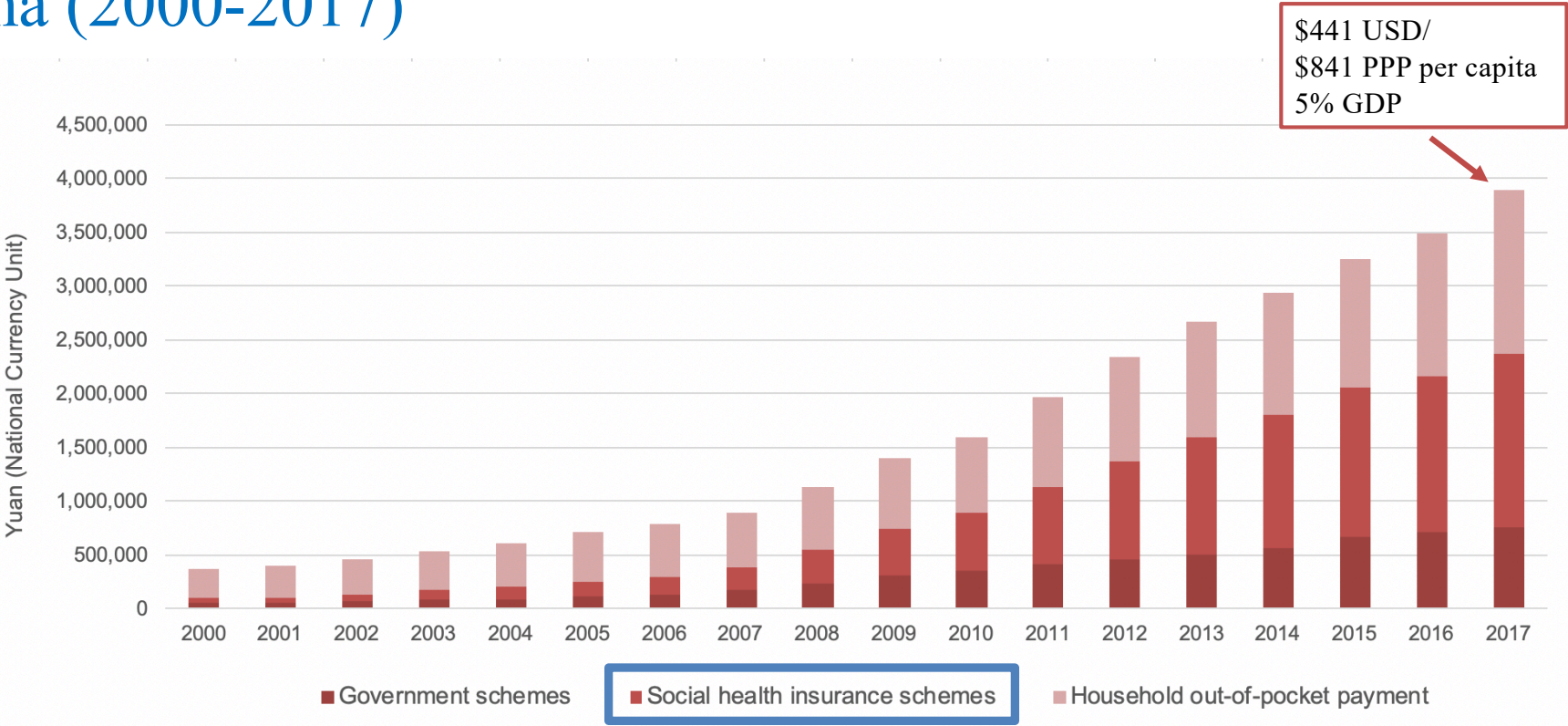
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International  
TB Centre**

# Social Insurance Expansion & the Rise of Health Spending in China (2000-2017)



Source: World Health Organization

# Impacts of Health Insurance Expansion in Rural Areas

- **Increased access & utilization** (You & Kobayashi 2009; Wagstaff, Lindelow, Jun, Ling, Chen, 2008)
- **Little impact on financial protection** (You & Kobayashi 2009)
  - Spending subsumed by price increases & quantity of healthcare (treatments/drugs/exams/etc.) (Wagstaff & Lindelow, 2008)
- **No evidence of impacts on objective health outcomes** (Chen & Jin 2012, others)

# Persistent dissatisfaction with health system

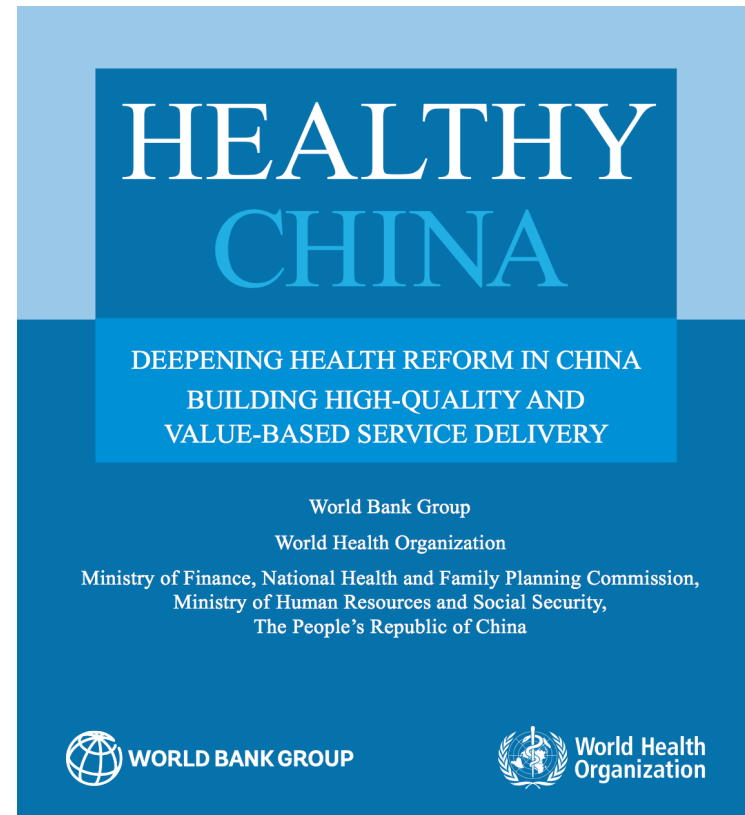
“Kan bing nan, Kan bing gui”

看病难，看病贵



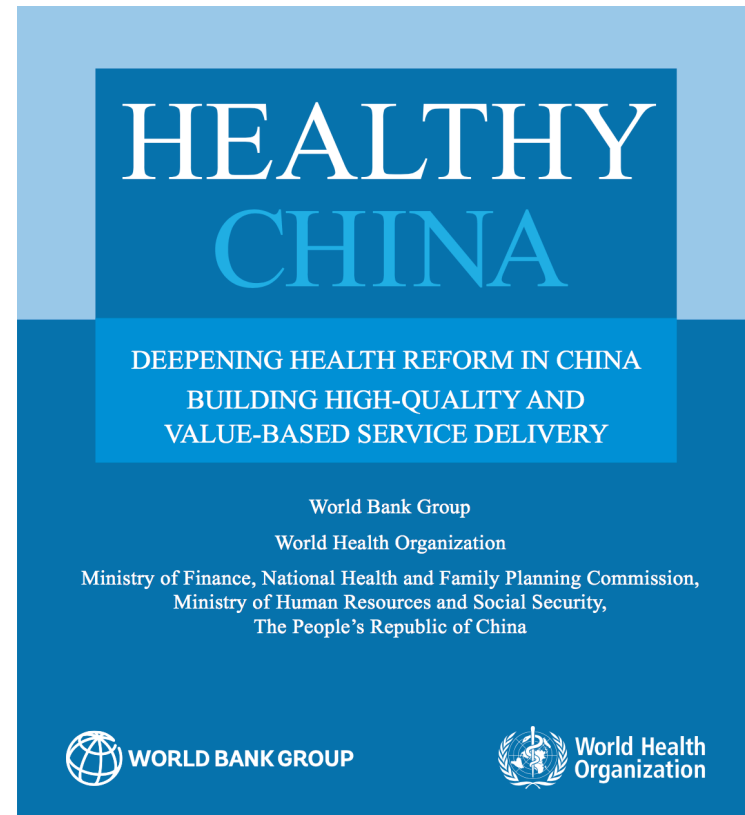
## New Wave of Healthcare Reforms (2009-Present)

- Initial insurance expansion **improved access & utilization, but remaining wide dissatisfaction with quality of care**
- Ambitious set of reforms starting in 2009
  - Now “Healthy China 2030”
- **Focus:** Improving quality and efficiency of health system
  - Address “fragmentation”, incentives for unnecessary care and waste
  - Move toward gatekeeping model encouraging first contact with grassroots providers



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- **Focus:** Improving quality and efficiency of health system
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  - Move toward gatekeeping model encouraging first contact with grassroots providers
- **Success depends heavily on quality of primary care providers/determinants of quality, but little objective evidence**





# This Study

## 1. Direct evidence on the quality of rural primary care

- Audit study to assess quality across 21 counties, 210 townships in 3 provinces
- Individuals recruited from local communities and extensively trained to visit providers presenting standard set of symptoms for 3 common diseases
- 1,077 interactions with providers
- Providers do not know that this is not a real patient

## 2. Assess role of knowledge vs. incentives in explaining quality

- Clinical vignettes identical to patient scripts to assess knowledge

## 3. Specific evidence tied to policy proposals

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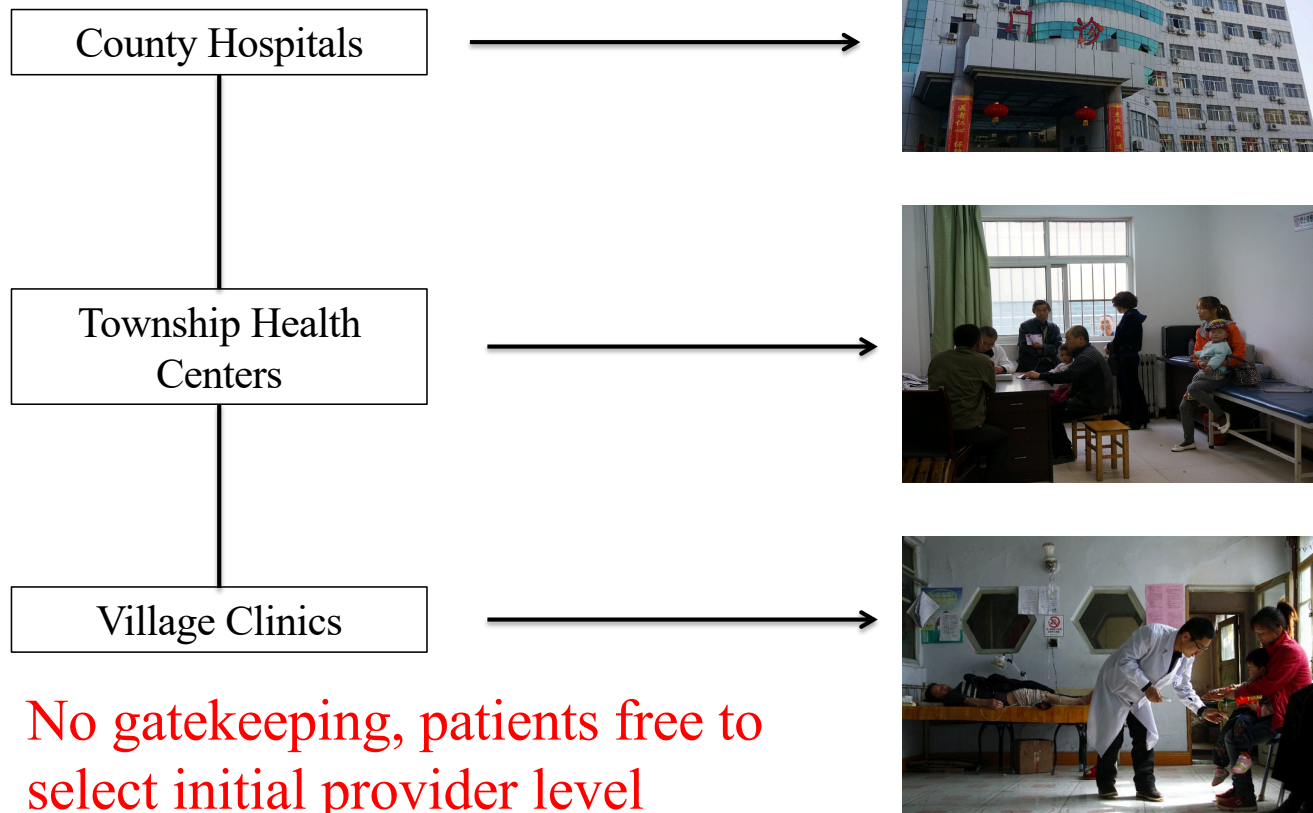
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# Outline

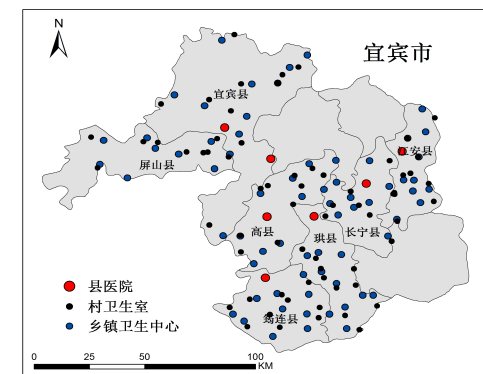
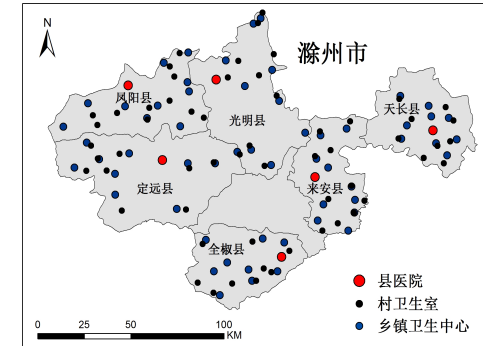
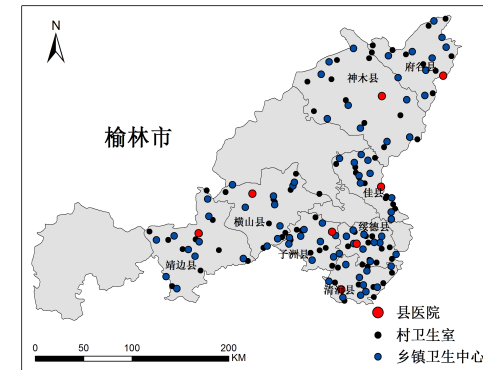
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2. The Quality of Care in Rural China
3. Three Applications:
  - A. Referral Systems and TB Detection
  - B. Drivers of Inappropriate Antibiotic Prescriptions
  - C. Physician Employment Contracts and Care Quality

# Setting: Primary care physicians in three tiers of the rural health system



# Sample

- Random sample of 439 facilities
  - 21 counties
  - 3 prefectures
  - Sichuan, Shaanxi, Anhui provinces
- 209 health systems
  - 21 county hospitals
  - 209 township health centers
  - 209 village clinics



# Data Collection/Protocol

## **Data collection in 3 waves:**

1. Facility & doctor survey (June 2015)
  - Informed consent from providers for SP visits “at some point in next 6 months”
2. Standardized patient visits (August 2015)
3. Clinical vignettes & detection survey (September 2015)

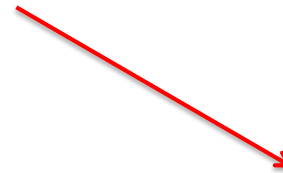
## Aside: Challenges with existing tools

Quality Measure	Measures knowledge?	Measures Practice?	Accounts for Case-Mix?	Accounts for patient-mix?	Hawthorne Effects?	Illnesses Covered/Other limitations
Clinical Vignettes	Yes	No	Yes	Yes	measures the maximum provider knows to do	All
Patient Exit Interviews	No	Yes	No	No	No	<ul style="list-style-type: none"> <li>• Patient recall often poor</li> </ul>
Clinical Observation	No	Yes	No	No	Yes	<ul style="list-style-type: none"> <li>• “Serious” illnesses rare</li> <li>• Observer does not know true illness, incorrect diagnoses frequent</li> </ul>
Chart abstraction	No	Yes	No	No	No	Same as clinical observation, plus: <ul style="list-style-type: none"> <li>• Poor records, particularly in resource poor settings</li> </ul>



# Standardized Patients

- Actor recruited from local community
- Intensively trained to consistently present disease case to doctors
- Concealed device records interaction
- **Doctors DO NOT know they are being tested**



# Disease Case Scripts

## 3 Standardized Disease Cases

- **Diarrhea:** “Doctor, my child has been suffering from diarrhea”
  - Ding ShiFang, female, 30 years old, two children Li Na (6) and Li Le (2) [also male version of script]
- **Unstable Angina:** “Doctor, recently I’ve been having some chest pain”
  - Wang Jun Qiang, Male, 45 years old, born in the year of the dog, 2 children: Wang Li and Wang Tao
- **Tuberculosis:** “Doctor, I have a cough that is not getting better and some fever too”
  - Zhao Qiang, Male, 35 years old, born in the year of the monkey [also female version of script]
- Detailed history, symptoms



# Training the SPs



Illustration Video (from Pilot)  
Dysentery case

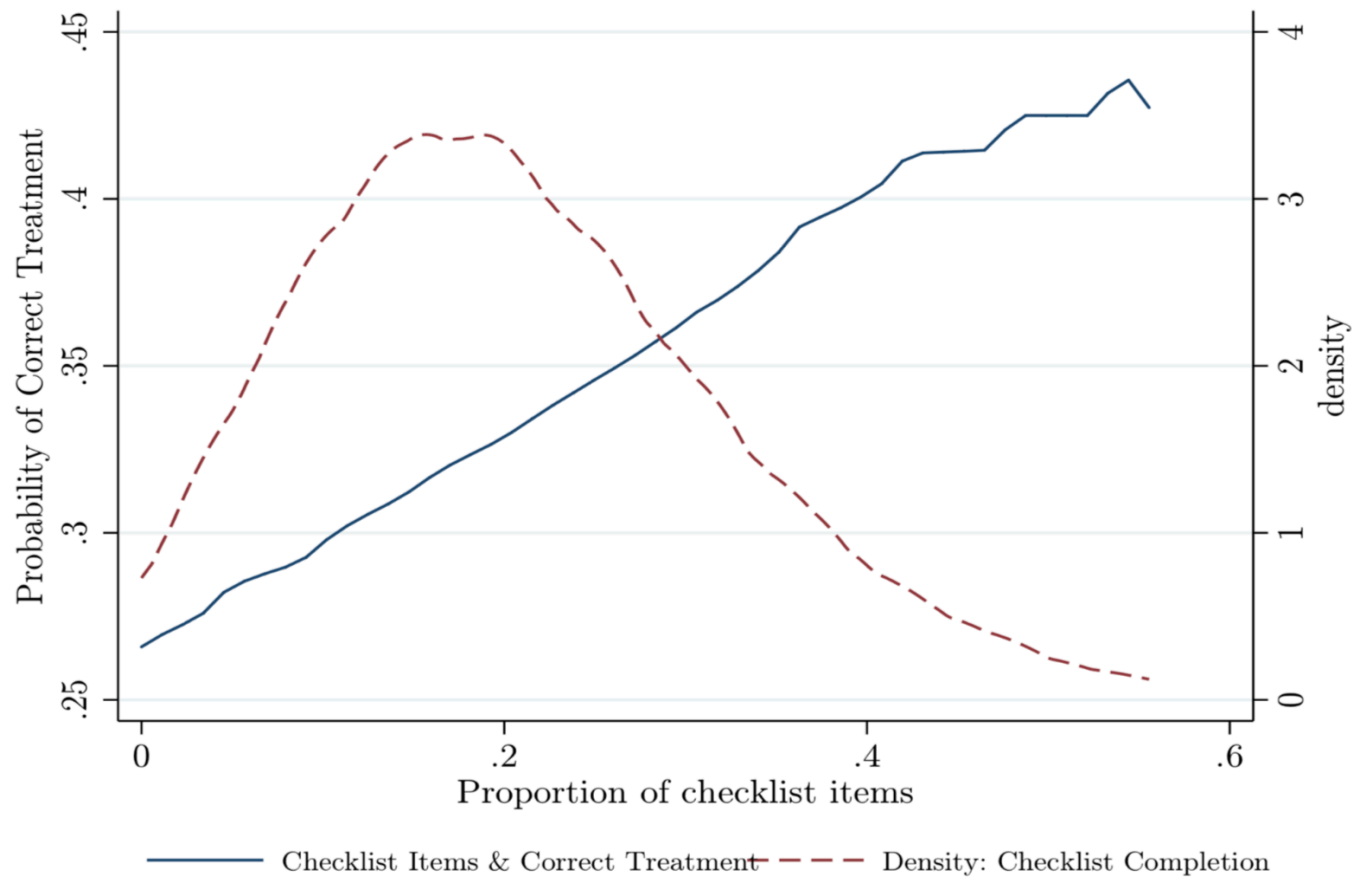


# SP Quality Measures

## Two main measures of provider quality:

1. **Process Quality:** Adherence to **checklist of essential questions and exams** that providers should complete for each patient (National & WHO standards)
  - Highly correlated with correct diagnosis/treatment
2. **Treatment:** Appropriate drugs, referral; correct/partially correct, unnecessary, potentially harmful

Additional information collected on timing of interactions, patient loads, other details



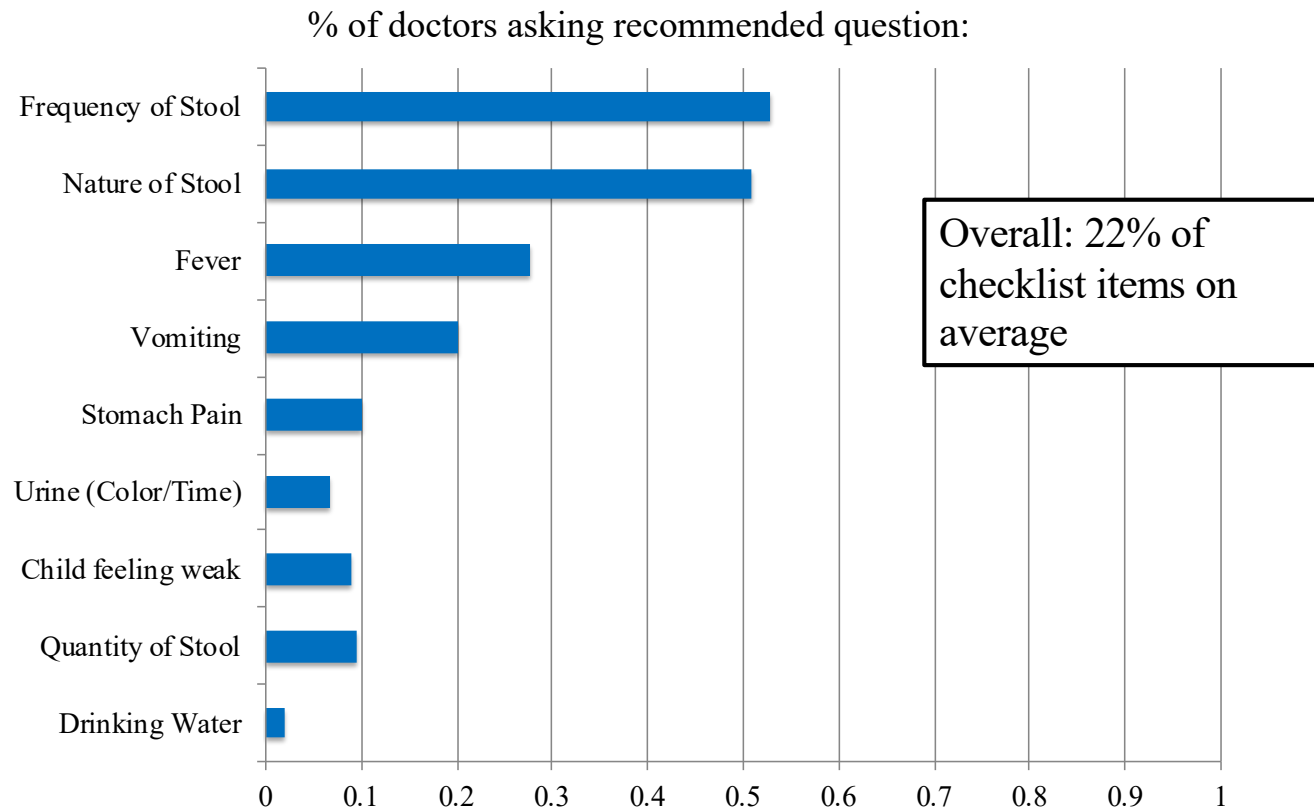


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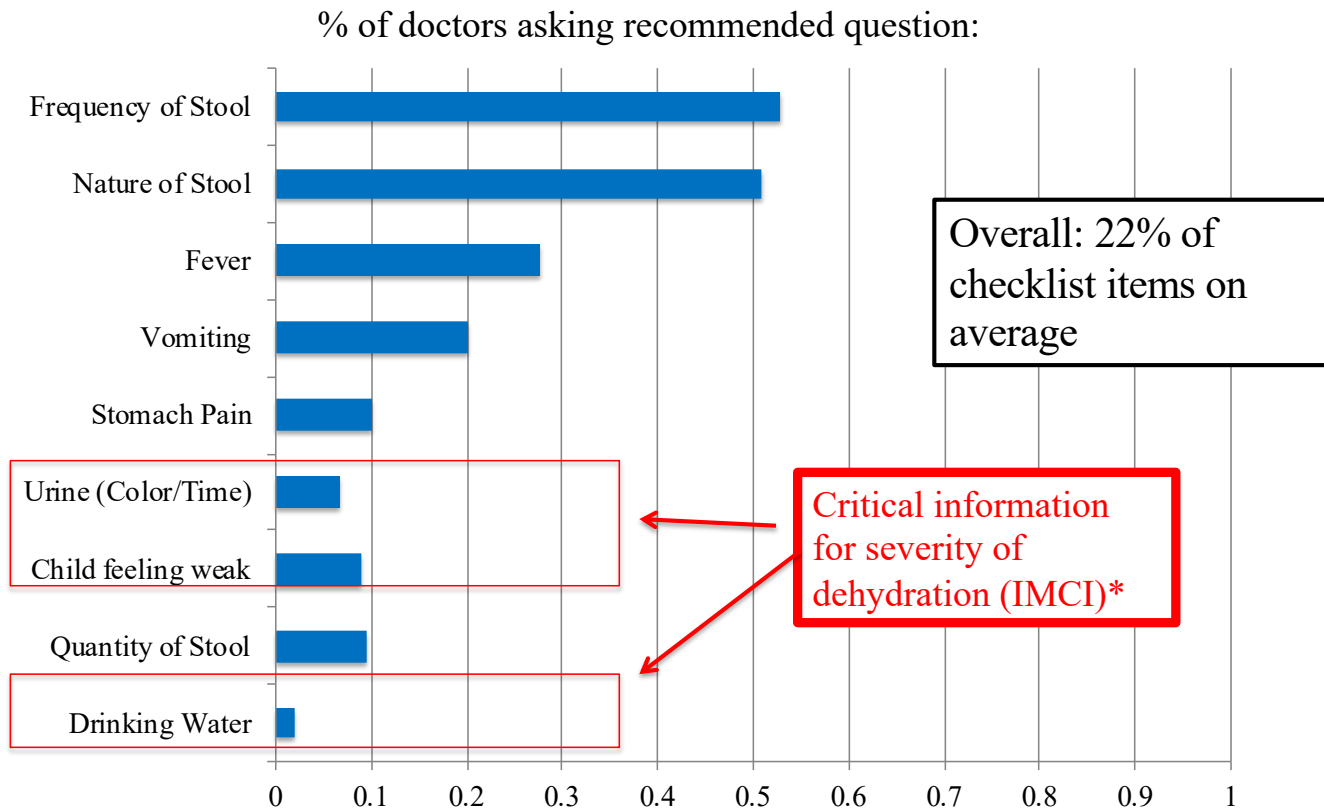
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# Results: Process (Diarrhea)



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\*IMCI = Integrated Management of Childhood Illnesses (WHO)

# Treatment

- Required treatment and unnecessary treatment are not mutually exclusive
- 77% gave any treatment (drugs)
  - 19% gave correct or partly correct treatment
    - Oral Rehydration Salts (or instructions to hydrate) +/- Zinc +/- unnecessary
- Unnecessary/potentially harmful drugs
- Conditional on prescription:
  - 39% gave antibiotics;
  - 91% gave anti-diarrhea drugs

China IMCI  
Chapter for  
Diarrhea

## 医院患儿管理

(袖珍本)

儿童常见病管理指南

第5章 腹泻	
5.1 腹泻患儿	114
5.2 急性腹泻	115
5.2.1 重度脱水	116
5.2.2 有些脱水	120
5.2.3 无脱水	124
5.3 迁延性腹泻	127
5.3.1 重度迁延性腹泻	127
5.3.2 迁延性腹泻(非重度)	131
5.4 痢疾	133

本章为出生后1周到5岁腹泻患儿的管理规程,包括急性腹泻(重度脱水、有些脱水或无脱水)、迁延性腹泻和痢疾的规程。在第7.2中对重度营养不良患儿的评估作了描述。治疗腹泻患儿的三个基本要点是治疗脱水、补锌和继续喂养。

不应该常规使用抗生素。抗生素只对脓血便(可能是痢疾)、合并重度脱水的疑似霍乱和其他严重的非肠道感

113

染(如肺炎)的患儿有效。很少推荐驱虫药。不应该给急性、迁延性腹泻或痢疾的小婴儿服用止泻药和止吐药;这些药物不能预防脱水或改善营养状况,有些还有危险的、甚至致命的副作用。

What is the source of poor quality;  
lack of knowledge or incentives?

# Main components of quality

## 1. Competence/Knowledge

- Doctor knowledge on how to correctly diagnose and treat patients

## 2. Low or misdirected effort

- Doctors know how to correctly diagnose and treat patients, but may face weak or misaligned incentives

# Measuring Knowledge: Clinical Vignettes

- 2 enumerators, 1 in role of patient, other records
- Doctors presented same disease cases as SP
- Evaluated on same standard as SP
- **Doctors KNOW they are being tested**



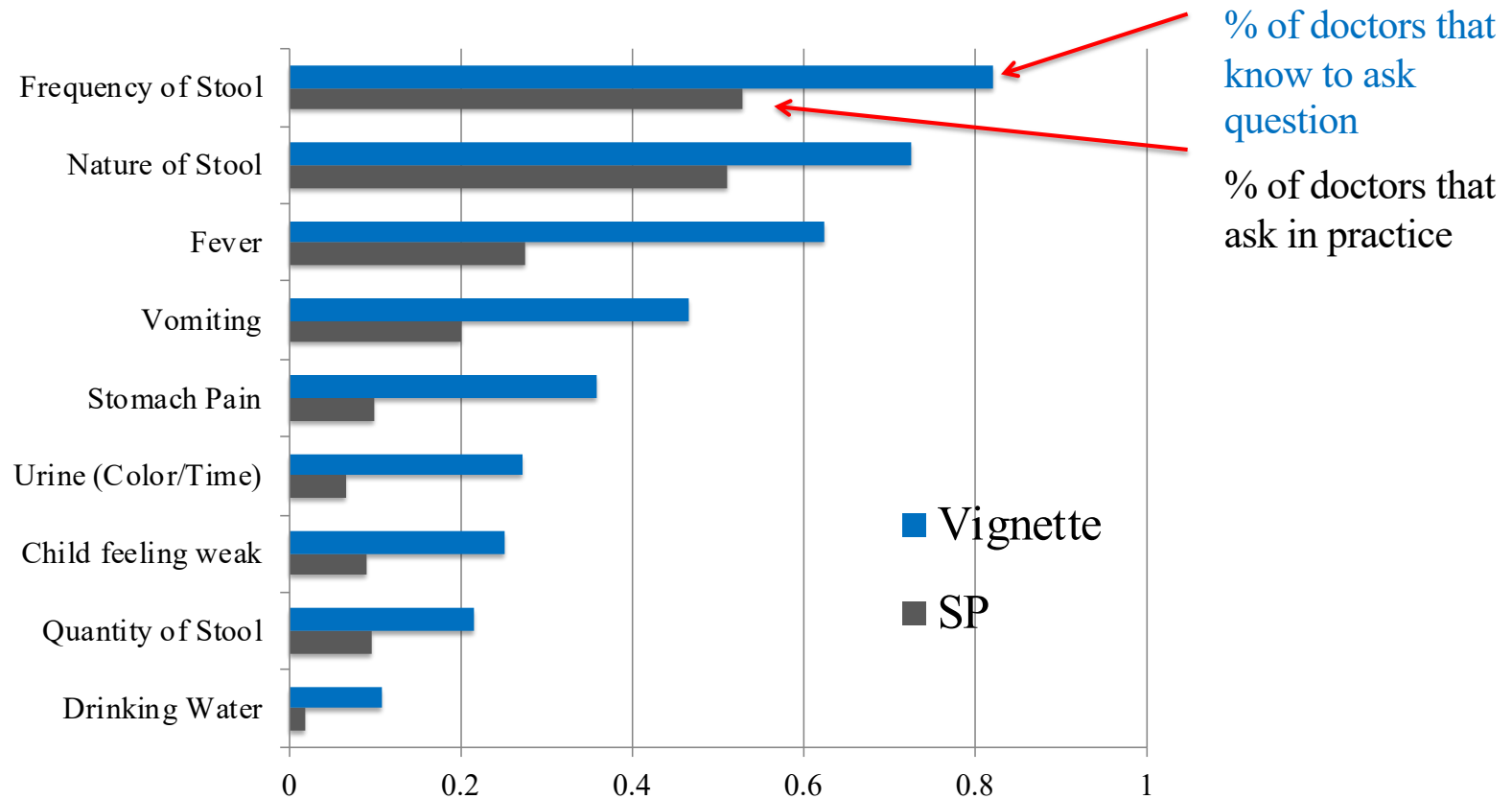


# The Know-Do Gap

“Know-Do Gap” =  
What doctors know to do (Vignettes) – What they do in  
practice (SP)

# Results: Process “Know-Do Gap”

## Township: Diarrhea Case



# Know-Do Gap in THCs: Diarrhea

	Diarrhea		
	SP	Vignette	P-value
<b>% recommended questions and examination performed (WHO Standard)</b>	<b>0.218</b>	<b>0.347</b>	<b>&lt;0.001</b>
<b>(Partly) Correct treatment</b>	<b>0.147</b>	<b>0.4</b>	<b>&lt;0.001</b>
Gave ORS	0.038	0.278	<0.001
Gave salt water	0.114	0.122	0.865

40% correct treatment in vignette (Know)  
 vs  
 14.7% correct in SP visits (Do)

# Outline

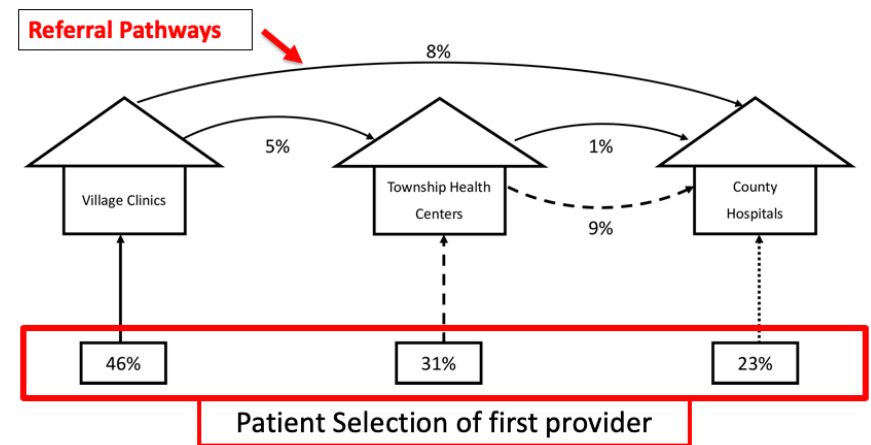
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# Application 1: TB detection

- Major progress against TB in China from better treatment of diagnosed patients
- But ~90% of TB cases are undiagnosed, in poor rural areas

## Our Study:

- Are rural clinicians able to correctly manage a patient with textbook symptoms of TB?
- Findings: Accounting for referrals, about 43% of these patients correctly managed
- **Gatekeeping from village would reduce to 16%**



## Application 2: Drivers of “Inappropriate” Antibiotic Prescriptions

- Widespread overuse of antibiotics in rural clinics
- Predominant explanation: Incentives to sell drugs
- **medically unnecessary  $\neq$  inappropriate**

### Our study:

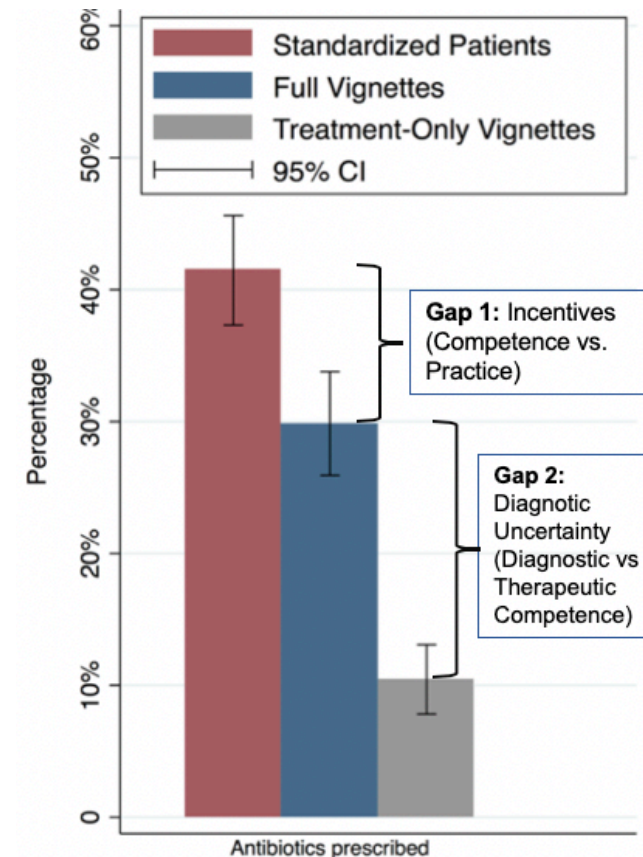
- Used SPs paired with vignettes to estimate % from incentives vs ‘*diagnostic uncertainty*’
- Results: **Diagnostic uncertainty major driver**
- Suggest policy focus on improving diagnostics

J Antimicrob Chemother 2019; 74: 256–263  
doi:10.1093/jac/dky390 Advance Access publication 4 October 2018

Journal of  
Antimicrobial  
Chemotherapy

### Diagnostic ability and inappropriate antibiotic prescriptions: a quasi-experimental study of primary care providers in rural China

Hao Xue<sup>1</sup>, Yaojiang Shi<sup>2</sup>, Lei Huang<sup>2</sup>, Hongmei Yi<sup>3</sup>, Huan Zhou<sup>4\*</sup>, Chengchao Zhou<sup>5</sup>, Sarah Kotb<sup>6</sup>, Joseph D. Tucker<sup>7,8</sup> and Sean Y. Sylvia<sup>9</sup>



## Application 3:

### Fixed-term vs. Civil Service Doctor Contracts

- Since 1949, public health facilities staffed through head-count quota system for civil service posts (编制体制)
  - Civil service positions with their public service unit (typically county health bureaus for public physicians in rural areas)
  - Salary tied to seniority, little possibility of dismissal
- Calls to reform bianzhi system
  - Weakens incentives (desirable in public service?)
  - Misallocation in labor market
- Mixed hiring in rural township hospitals
  - About 22% of personnel at township health centers are employed 'beyond quota' nationally **on fixed-term contracts**

# HEALTHY CHINA

DEEPENING HEALTH REFORM IN CHINA  
BUILDING HIGH-QUALITY AND  
VALUE-BASED SERVICE DELIVERY

World Bank Group

World Health Organization

Ministry of Finance, National Health and Family Planning Commission,  
Ministry of Human Resources and Social Security,  
The People's Republic of China



**Core Action Area 4: Reform the headcount quota system so as to enable a more flexible health labor market and efficient health workforce management.** The headcount quota system leads to inefficiencies in the management of the Chinese health workforce, and should be replaced with different HR management policies that are consistent with broad health sector reform trends including increasing hospital autonomy, increasing health labor market mobility and performance/results based financing policy. Chinese government is aware of this issue and is taking action to reform the system. The reform would require at least four sets



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- How does performance of civil service docs compare to fixed-term (“contract”) docs?
- What is effect of contract status on under/over provision of care?

# Comparison of Contract & Civil Service Providers

	<i>Civil Service Physicians</i>	<i>Physicians with Fixed-term Contracts</i>	<i>Difference (2)-(1)</i>
(1) Provider age (years)	43.507 (9.552)	42.442 (11.564)	-1.065 (1.273)
(2) Male Provider (1/0)	0.863 (0.345)	0.831 (0.377)	-0.032 (0.045)
(3) Education, upper secondary or higher (1/0)	0.676 (0.469)	0.416 (0.496)	-0.261*** (0.060)
(4) Medical education: vocational college or higher (1/0) <sup>a</sup>	0.667 (0.472)	0.416 (0.496)	-0.251*** (0.061)
(5) Provider has a Practicing Physician Certificate (1/0)	0.676 (0.469)	0.364 (0.484)	-0.313*** (0.060)
(6) Provider is a rural household resident (Hukou) (1/0)	0.261 (0.440)	0.727 (0.448)	0.466*** (0.056)
(7) Years of working at this facility (years)	13.150 (10.911)	9.260 (10.423)	-3.891*** (1.379)
(8) Provider monthly income (1,000 RMB)	3.420 (1.123)	3.055 (0.981)	-0.365*** (0.140)
(9) Average IRT score from clinical vignettes (normalized) <sup>b</sup>	-0.024 (1.101)	-0.129 (1.015)	-0.105 (0.139)
(10) Prosocial score (normalized)	0.041 (0.959)	-0.047 (1.171)	-0.088 (0.128)
(11) Intrinsic score (normalized)	-0.001 (1.011)	0.124 (0.943)	0.126 (0.127)

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Lower levels of education and certification

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Rural hukou

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Less time at  
facility

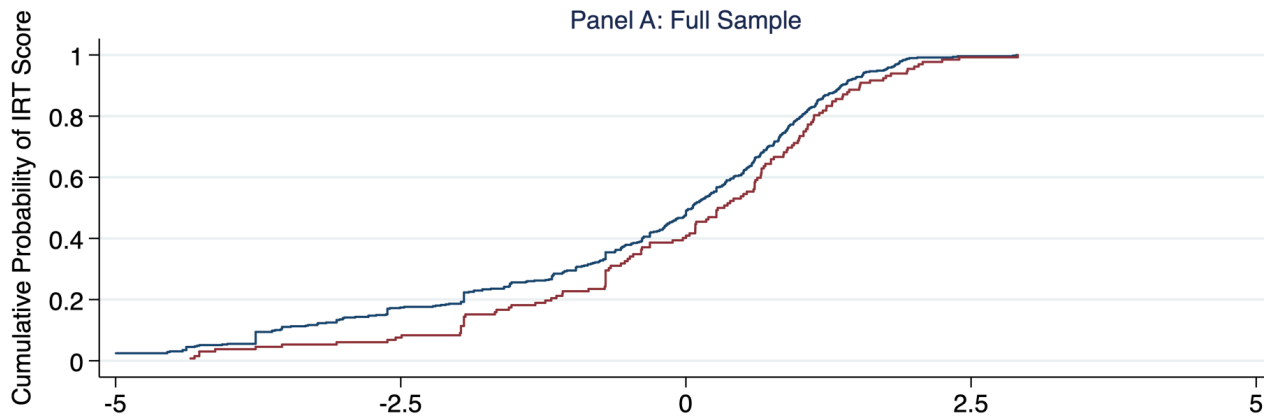
But 9+ years on  
average

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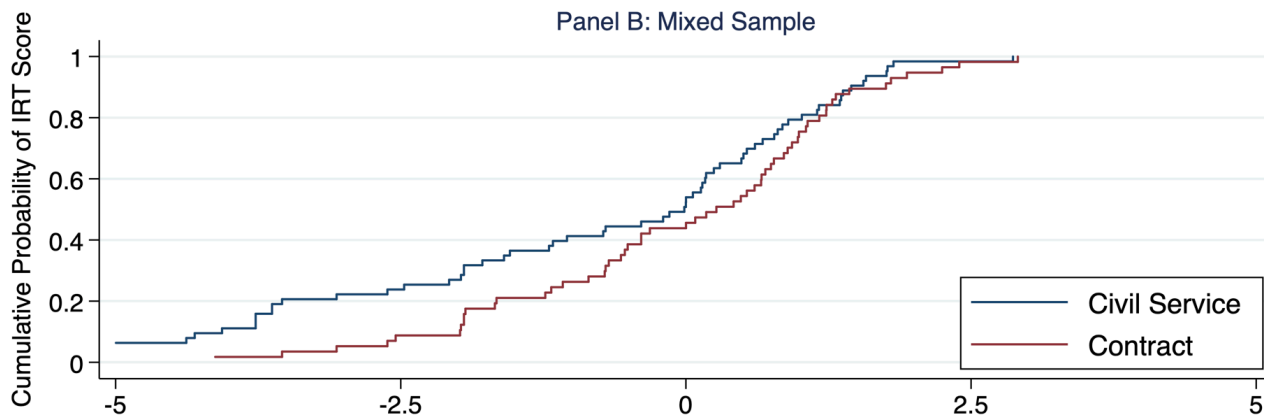
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(7) Years of working at this facility (years)	13.150 (10.911)	9.260 (10.423)	-3.891*** (1.379)
(8) Provider monthly income (1,000 RMB)	3.420 (1.123)	3.055 (0.981)	-0.365*** (0.140)
(9) Average IRT score from clinical vignettes (normalized) <sup>b</sup>	-0.024 (1.101)	-0.129 (1.015)	-0.105 (0.139)
(10) Prosocial score (normalized)	0.041 (0.959)	-0.047 (1.171)	-0.088 (0.128)
(11) Intrinsic score (normalized)	-0.001 (1.011)	0.124 (0.943)	0.126 (0.127)

Make about  
10% in total  
income

# Quality of Care: Process Quality



Full sample



Facilities  
with both  
types only

## Empirical Approach

Standardized Patient and Facility Fixed-Effects:

$$\theta_{i(csd)f} = \alpha + \beta_1 \text{FixedTerm}_{df} + X'_{df}\gamma + \delta_s + \delta_c + \delta_f + \varepsilon_{i(scd)f}$$

Quality of care in interaction  $i$   
between standardized patient  $s$   
presenting case  $c$  and a provider  
 $d$  in facility  $f$

SP outcomes address bias from  
case and patient mix



## Empirical Approach

Standardized Patient and Facility Fixed-Effects:

$$\theta_{i(csd)f} = \alpha + \beta_1 \boxed{FixedTerm_{df}} + X'_{df}\gamma + \delta_s + \delta_c + \delta_f + \varepsilon_{i(scd)f}$$

↑  
Dummy variable equal to 1 if  
the provider is a fixed-term  
provider; 0 for civil service

## Empirical Approach

Standardized Patient and Facility Fixed-Effects:

$$\theta_{i(csd)f} = \alpha + \beta_1 FixedTerm_{df} + X'_{df}\gamma + \delta_s + \delta_c + \delta_f + \varepsilon_{i(scd)f}$$

Estimates the difference  
between fixed-term and civil  
service providers

## Empirical Approach

Standardized Patient and Facility Fixed-Effects:

$$\theta_{i(csd)f} = \alpha + \beta_1 FixedTerm_{df} + X'_{df}\gamma + \delta_s + \delta_c + \delta_f + \varepsilon_{i(scd)f}$$

Vector of provider characteristics

Excluded for 'as-is' estimates;  
included to get closer to effect of  
contract status

## Empirical Approach

Standardized Patient and Facility Fixed-Effects:

$$\theta_{i(csd)f} = \alpha + \beta_1 \text{FixedTerm}_{df} + X'_{df} \gamma + \delta_s + \delta_c + \delta_f + \varepsilon_{i(scd)f}$$

SP and disease case fixed effects

## Empirical Approach

Standardized Patient and Facility Fixed-Effects:

$$\theta_{i(csd)f} = \alpha + \beta_1 FixedTerm_{df} + X'_{df}\gamma + \delta_s + \delta_c + \delta_f + \varepsilon_{i(scd)f}$$

Facility fixed effects

Address bias from physician  
sorting

## Empirical Approach

Standardized Patient and Facility Fixed-Effects:

$$\theta_{i(csd)f} = \alpha + \beta_1 FixedTerm_{df} + X'_{df}\gamma + \delta_s + \delta_c + \delta_f + \varepsilon_{i(scd)f}$$

Errors clustered at provider level

# Results: Process Quality

	(1)	(2)	(3)	(6)	(7)	(8)
(1) Fixed-term Contract (1/0)	0.327*** (0.117)	0.325*** (0.115)	0.526** (0.218)	0.569** (0.232)	0.457** (0.232)	0.470** (0.230)
(2) IRT score from vignettes					0.208*** (0.061)	0.211*** (0.061)
(3) Prosocial score						0.072 (0.087)
(4) Intrinsic score						-0.013 (0.087)
(5) Provider age (years)				-0.018** (0.008)	-0.010 (0.009)	-0.010 (0.009)
(6) Male provider (1/0)				0.015 (0.207)	0.055 (0.219)	0.054 (0.219)
(7) Medical education: vocational college or higher (1/0)				-0.008 (0.178)	-0.065 (0.178)	-0.060 (0.178)
(8) Provider has a Practicing Physician Certificate (1/0)				-0.099 (0.145)	-0.166 (0.144)	-0.184 (0.146)
(9) Provider is a rural household resident (Hukou) (1/0)				-0.194 (0.142)	-0.120 (0.150)	-0.120 (0.151)
(10) Facility characteristics	✓	✓				
(11) County fixed effects		✓				
(12) Facility fixed effects			✓	✓	✓	✓

# Results: Process Quality

	(1)	(2)	(3)	(6)	(7)	(8)
(1) Fixed-term Contract (1/0)	0.327*** (0.117)	0.325*** (0.115)	0.526** (0.218)	0.569** (0.232)	0.457** (0.232)	0.470** (0.230)
(2) IRT score from vignettes					0.208*** (0.061)	0.211*** (0.061)
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(9) Provider is a rural household resident (Hukou) (1/0)				-0.194 (0.142)	-0.120 (0.150)	-0.120 (0.151)
(10) Facility characteristics	✓	✓				
(11) County fixed effects		✓				
(12) Facility fixed effects			✓	✓	✓	✓



# Results: Process Quality

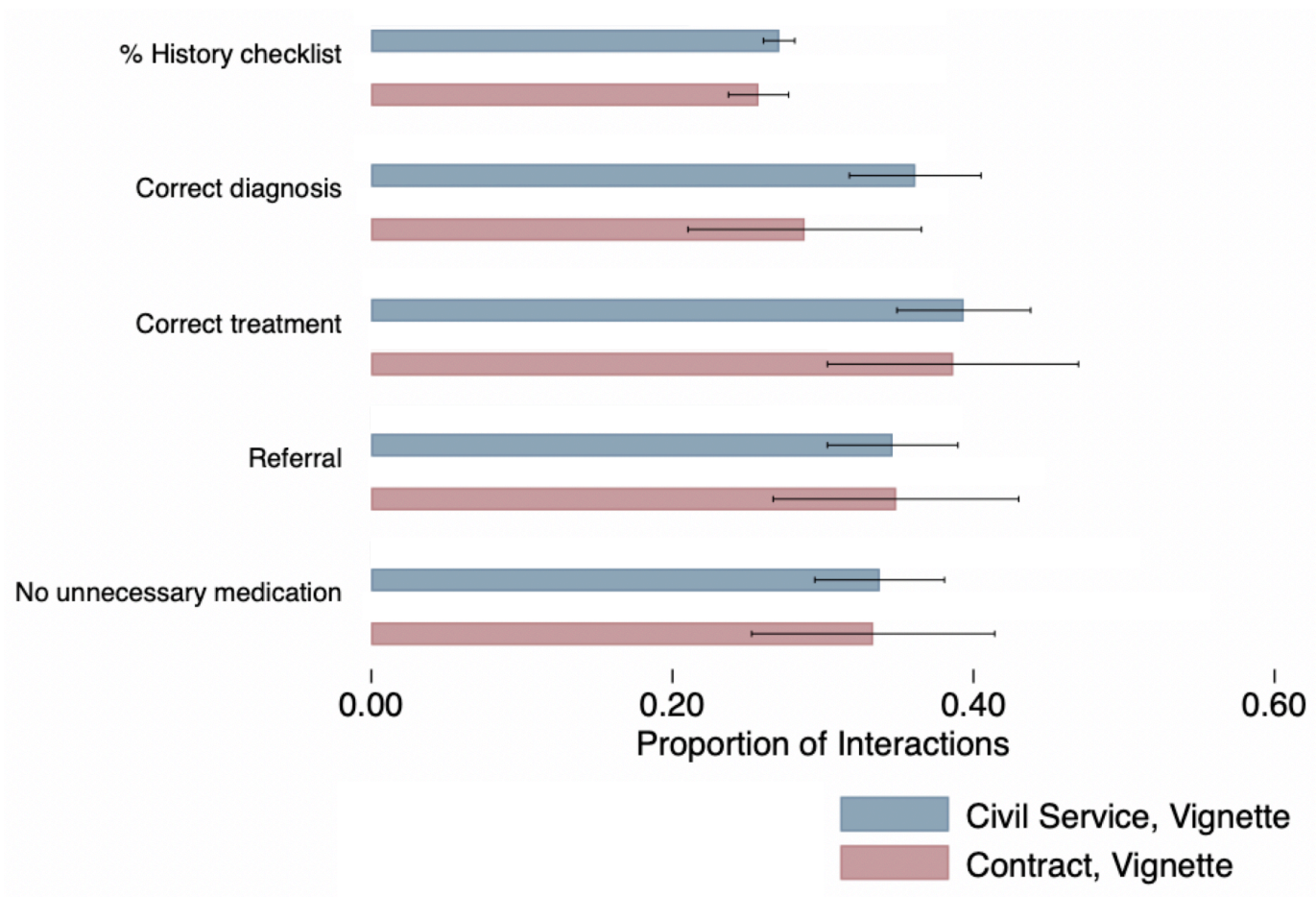
	(1)	(2)	(3)	(6)	(7)	(8)
(1) Fixed-term Contract (1/0)	0.327*** (0.117)	0.325*** (0.115)	0.526** (0.218)	0.569** (0.232)	0.457** (0.232)	0.470** (0.230)
(2) IRT score from vignettes					0.208*** (0.061)	0.211*** (0.061)
(3) Prosocial score						0.072 (0.087)
(4) Intrinsic score						-0.013 (0.087)
(5) Provider age (years)				-0.018** (0.008)	-0.010 (0.009)	-0.010 (0.009)
(6) Male provider (1/0)				0.015 (0.207)	0.055 (0.219)	0.054 (0.219)
(7) Medical education: vocational college or higher (1/0)				-0.008 (0.178)	-0.065 (0.178)	-0.060 (0.178)
(8) Provider has a Practicing Physician Certificate (1/0)				-0.099 (0.145)	-0.166 (0.144)	-0.184 (0.146)
(9) Provider is a rural household resident (Hukou) (1/0)				-0.194 (0.142)	-0.120 (0.150)	-0.120 (0.151)
(10) Facility characteristics	✓	✓				
(11) County fixed effects		✓				
(12) Facility fixed effects			✓	✓	✓	✓

## Results: Treatment

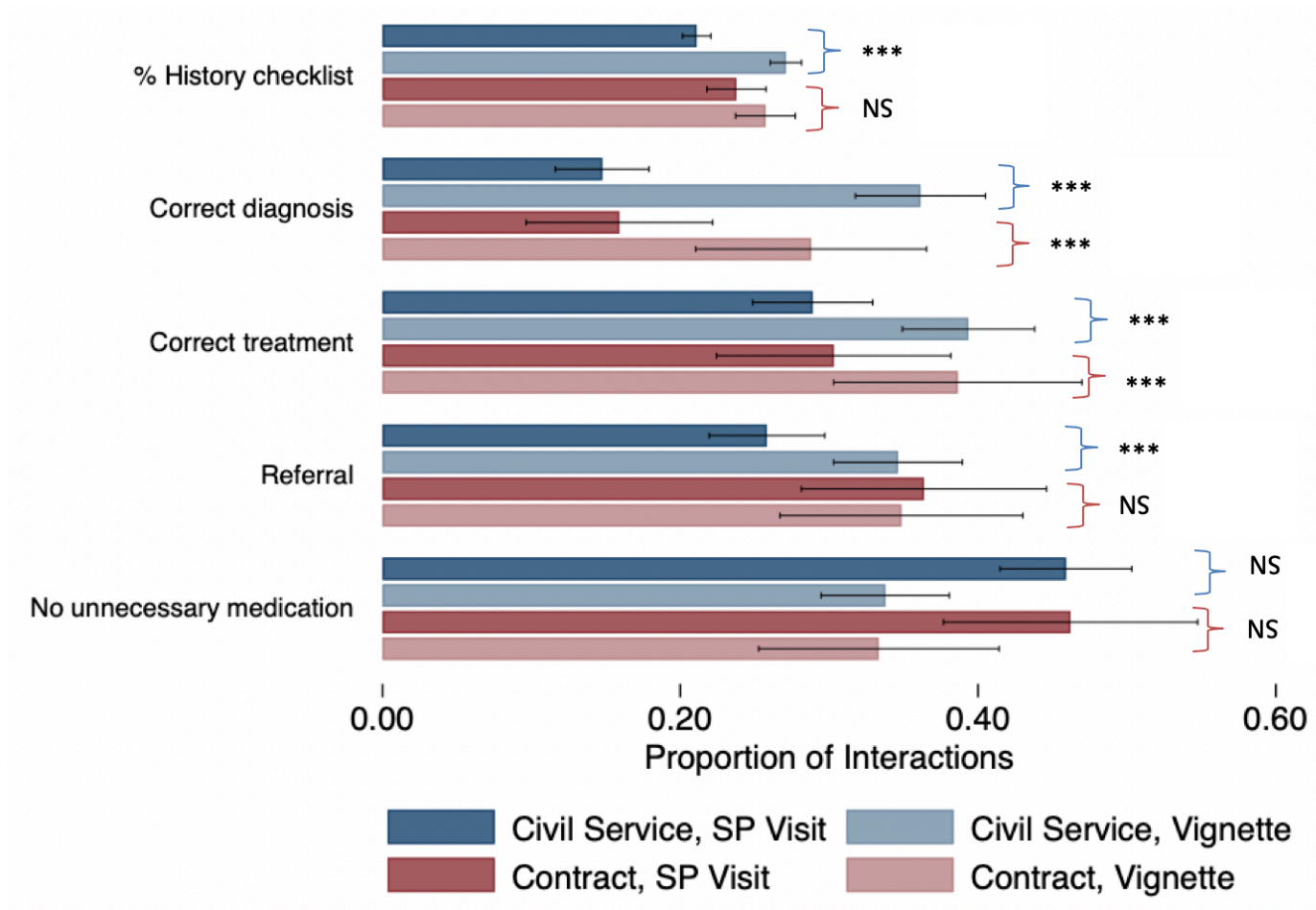
	<i>Without Provider Characteristics</i>			<i>With Provider Characteristics</i>		
	(1)	(2)	(3)	(4)	(5)	(6)
(1) Correct or partially treatment (1/0)	0.015 (0.050)	0.029 (0.050)	-0.073 (0.087)	0.014 (0.056)	0.023 (0.056)	-0.072 (0.104)
<i>Civil Service Mean</i>		0.389			0.385	
(2) Referral (1/0)	0.040 (0.050)	0.065 (0.047)	-0.070 (0.069)	0.094* (0.051)	0.115** (0.049)	-0.047 (0.076)
<i>Civil Service Mean</i>		0.258			0.247	
(3) Unnecessary/harmful medication (1/0)	-0.030 (0.052)	-0.046 (0.050)	-0.051 (0.086)	-0.110** (0.054)	-0.133** (0.053)	-0.142 (0.099)
<i>Civil Service Mean</i>		0.541			0.555	
(4) Total cost (RMB)	-2.421 (2.260)	-2.863 (2.324)	-2.469 (3.829)	-4.825* (2.838)	-5.210* (2.878)	-3.353 (5.000)
<i>Civil Service Mean</i>		18.327			18.778	
(5) Facility characteristics	✓	✓		✓	✓	
(6) Provider characteristics				✓	✓	✓
(7) County fixed effects		✓			✓	
(8) Facility fixed effects			✓			✓
(9) Number of observations		620			597	

- Differences in treatment not significant after controlling for facility fixed effects.
- No evidence that fixed-term contracts increase costs

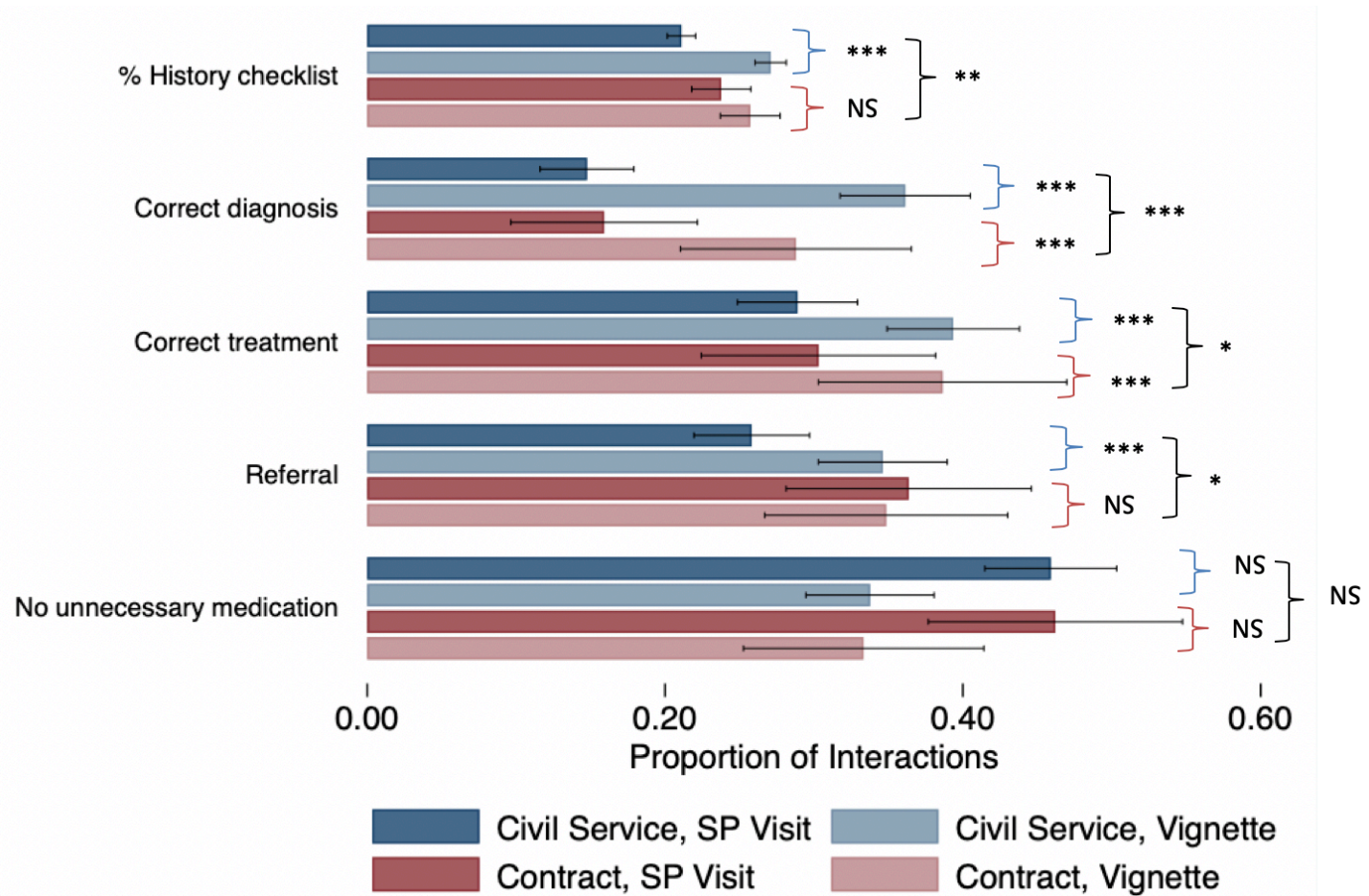
# Results: Know-Do Gaps (Knowledge Only)



# Results: Know-Do Gaps



# Results: Know-Do Gaps (Difference)



## Why Weaker Incentives?

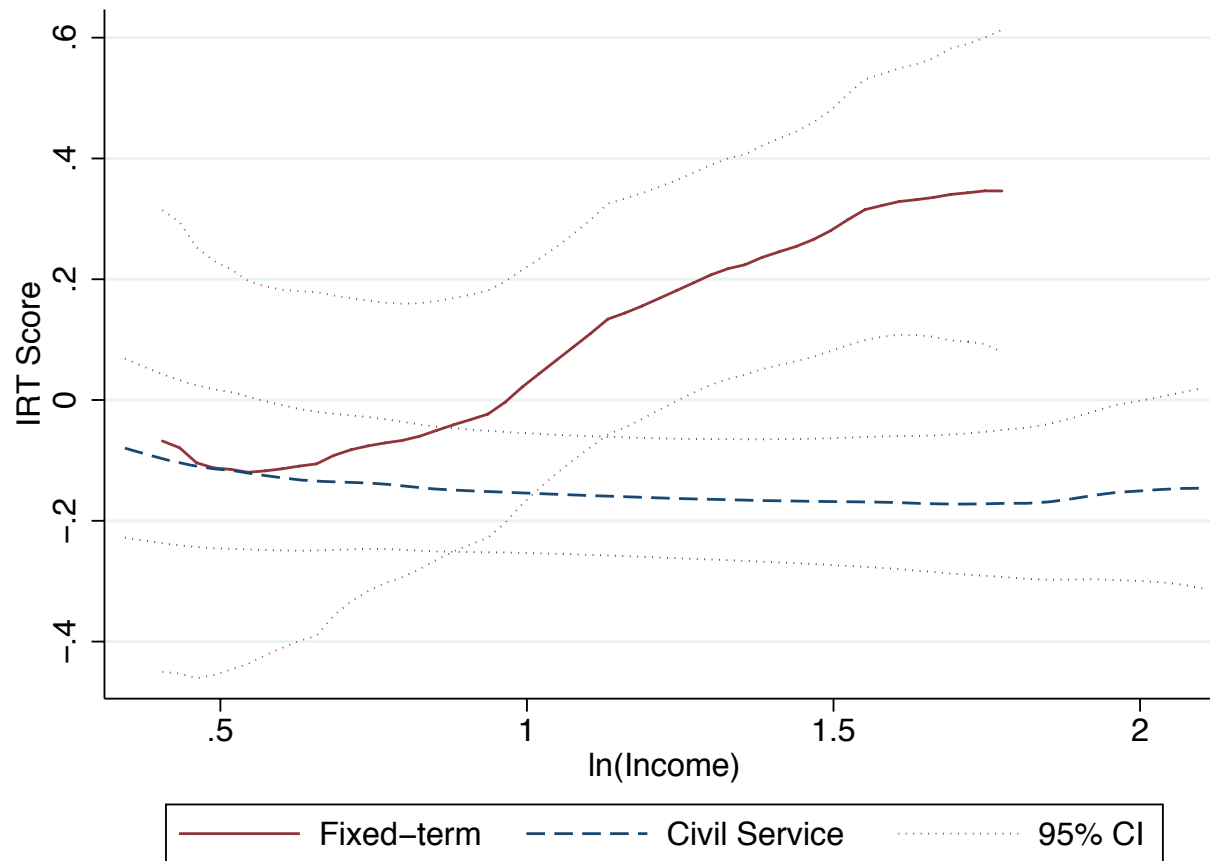
Civil service may face weaker incentives due to

1. Weaker career concerns: Low possibility of dismissal, seniority-based promotion
2. Misallocation in labor market: Limits to mobility

What characteristics are rewarded in labor market?

- Does pay reward clinical performance? In public sector?

# Wage Incentives? Correlation between Pay and Performance



## Wage Incentives? Correlation between Pay and Performance

		Dep. Var.: IRT-scaled score of process quality				
		(1)	(2)	(3)	(4)	(5)
(1)	ln(Physician Income)	-0.089 (0.164)	-0.118 (0.159)	-0.107 (0.168)	-0.017 (0.200)	-0.034 (0.201)
(2)	Fixed-term	-0.446 (0.372)	-0.486 (0.389)	-0.453 (0.379)	-0.307 (0.419)	-0.217 (0.419)
(3)	ln(Physician Income) * Fixed-term	0.632** (0.302)	0.670** (0.317)	0.639** (0.304)	0.520 (0.329)	0.466 (0.322)
(4)	<b>Correlation among fixed-term physicians (Row 1 + Row 3)</b>	<b>0.543** (0.245)</b>	<b>0.552** (0.268)</b>	<b>0.532** (0.264)</b>	<b>0.503* (0.2652)</b>	<b>0.433 (0.265)</b>
(5)	Physician characteristics		✓	✓	✓	✓
(6)	Facility characteristics			✓	✓	✓
(7)	City fixed effects				✓	
(8)	County fixed effects					✓
(9)	Number of observations	620			597	



## Summary

- Results support concerns that the *bianzhi* system weakens incentives and distorts labor market
  - Compared to fixed-term physicians in the same township health centers, physicians in *bianzhi* positions underperform on process
  - Due to stronger career (and possibly wage) incentives
  - No difference in treatment
  - No difference in costs, despite fixed-term likely having stronger incentives to generate revenue
- This analysis has important limitations, **more experimental work needed to understand causal effects of *bianzhi* reform**

# Other analyses

## 1. Quality of medical records

- Compare interaction recordings to clinic records
- BMJ Quality & Safety

## 2. Provider Communication Styles

- Machine learning algorithms to classify communication types

# Takeaways

1. Primary care quality and determinants critical for success of reforms
2. Growing evidence of deficits in quality of care
3. Not just competence, but incentives facing providers
4. Policy options for rural primary care?
  - Training? Recruitment? Pay Reform? Technology?

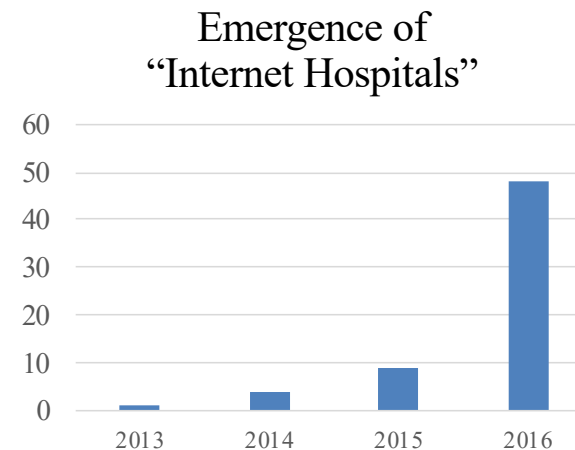
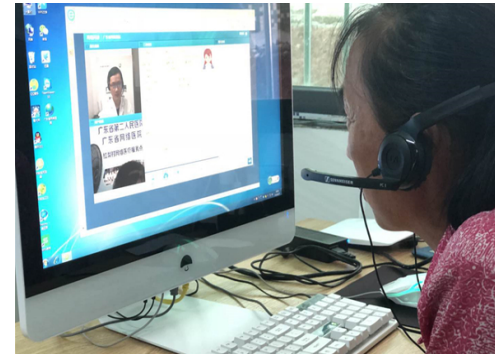
# More fundamental issues?

- Low pay
  - Civil servant base pay (around 3-4000 in county hospitals)
- Low social status
- Huge patient load (in county level/city)
  - 50-60 patients in one *half* day of work
- Disgruntled patients
  - 66% of doctors report having experienced violence (2018 CMDA Survey)
- 78% of doctors do not want children to go to medical school (2011 CMDA)



# Ongoing Studies

1. Using SPs to analyze HIV stigma in healthcare settings
  - NIH R34 grant
2. Randomized evaluation of village doctor training in Yunnan (with Red Cross)
3. Quality of “Direct to Consumer” (DTC) Telemedicine Services
4. Randomized Evaluation of Telemedicine Kiosks



Estimated. Adapted from: Xie X, Zhou W, Lin L, et al. Internet Hospitals in China: Cross-Sectional Survey. *J Med Internet Res.* 2017;19(7):e239.



("Wishing you good health")