

Senegal Country Profile

Service Delivery Indicators – Medical Vignettes



WORLD BANK GROUP

Acknowledgements

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- SDI Team

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The data used for this analysis can be found <https://github.com/worldbank/SDI-Health>. Additional documentation on the Service Delivery Indicators can be found <https://www.sdindicators.org/>.

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Demography Summary

SDI – Senegal

Demography Summary

Facility characteristics

Facilities were selected to provide a representative assessment of service delivery quality in public and private facilities located in rural and urban areas, where applicable.

Facilities were grouped into a common set of categories. Health posts were considered the lowest tier of health facility available, often staffed by a single individual and are without in-patient services. Health centers are larger, serving a greater population, but lack surgical services. Finally, hospitals are the top level of the health care system, typically able to provide all services an individual would seek.

Rural vs. Urban¹

Rural 96 (65%)

Urban 52 (35%)

Public vs. Private²

Public 148 (100%)

Private -

Facility Level³

Hospital -

Health Center 110 (74%)

Health Post 38 (26%)

¹ All data is present.

² All data is present.

³ All data is present.

Demography Summary

Provider characteristics

Multiple providers were selected within a particular facility to complete the vignette module of the SDI survey. If the facility only had a single provider, that provider completed the module.

A common set of categories for medical education and profession were applied to allow for better comparison among countries. Responses given as “other” were converted to missing values for the purposes of analysis for the level of medical training.

Rural vs. Urban¹

Rural 97 (65%)

Urban 53 (35%)

Public vs. Private²

Public 150 (100%)

Private -

Facility Level³

Hospital -

Health Center 112 (75%)

Health Post 38 (25%)

¹ All data is present.

² All data is present.

³ All data is present.

Profession⁴

Medical Officer -

Clinical Officer -

Nurse 107 (71%)

Other 43 (29%)

⁴ All data is present.

Medical Vignettes IRT Methodology

SDI – Senegal

Medical Vignettes IRT Methodology

Vignette Structure

The actor delivers the initial script and providers are asked to proceed as though the actor were a real patient.

The enumerator has pre-scripted responses providing:

- 1) answers to history questions the provider could ask;
- 2) descriptions of what the provider would observe for a given physical exam, and;
- 3) the results of a medical test the provider orders.

Providers are then asked to make a diagnosis and may offer treatment recommendations but are not required to.

Vignettes in different countries vary in the treatment options the enumerator can check off in the survey instrument.

Script of Opening Statement		Treatment (Correct if any one of the options is given, unless specified)
1. Child Diarrhea + Severe Dehydration	"I am a mother of a 13 month old boy. His name is Noel. My son has diarrhea."	IV fluid rehydration, nasogastric tube rehydration, or referral to another clinic if lower level facility.
2. Child Pneumonia	"I am the mother of this 5 year old girl. Her name is Sia. She has a cough."	Amoxicillin (or dosage), benzylpenicillin, or cotrimoxazole.
3. Tuberculosis	"My name is Bakari. I am 40 years old and I have been suffering from a fever and cough for some time."	Combination therapy (with or without correct dosage, drug names, and timing) or referral to TB clinic. Sputum test/ chest x-ray are allowed in cases where test results were not reported back to clinician.
4. Child Malaria + Anemia	"I am the mother of this 4-year old boy. His name is Sangeti. He has had a fever for some time. Now he is worse, so I have come to you for help."	Artemether-lumefantrine (with or without correct dosage), artemisinin combination therapy (with or without correct dosage), or artesunate-amodiaquine. Treatment must include zinc and folic acid supplements to be considered correct.
5. Pelvic Inflammatory Disease	"Hello doctor. The patient is a shy 34-year-old woman who is suffering from pain here [pointing your hand at the lower right abdomen] for 3 months."	Amoxicillin, ciprofloxacin, cotrimoxazole, metronidazole.

Medical Vignettes IRT Methodology

Inputs Derived From Vignettes

In a vignette, a provider's diagnostic behavior consists of the questions asked during history taking and the physical exams the provider performs.

Based on each individual's diagnostic behavior pattern across all vignettes, item response theory (IRT) estimates a "theta ability score" or "knowledge score" for each provider in the survey.

Module 3: Case Simulations				
Section G: Case Study Patient 5 ¹²				
Case study patient [enumerator reads]				
Good morning (afternoon) doctor. I am the mother of this 4-year-old boy. His name is Sangeti . He has had a fever now for some time. Now he is worse, so I have come to you for help.				
[All other information is provided only if the clinician asks!]				
	Question Asked	Enumerator Response	Yes = 1 No = 2	Notes/other questions
History Taking				
1.	Duration of fever	One week	<input type="checkbox"/>	
2.	Pattern of fever/Presence or history of fever	Some days fine, some days very sick	<input type="checkbox"/>	
3.	Shiver or sweat	Yes	<input type="checkbox"/>	
4.	Convulsions	No	<input type="checkbox"/>	
5.	Vomiting	Yes, sometimes	<input type="checkbox"/>	
6.	Appetite	He eats, but not as much as usual, and sometimes he will vomit	<input type="checkbox"/>	
7.	Diarrhoea	No	<input type="checkbox"/>	
8.	Cough	Yes	<input type="checkbox"/>	
9.	Severity of cough	Not severe	<input type="checkbox"/>	
10.	Difficulty in breathing	No difficulty in breathing	<input type="checkbox"/>	
11.	Type of cough (productive or dry)	The cough is dry	<input type="checkbox"/>	
12.	Type of medication given	I started to give him Paracetamol	<input type="checkbox"/>	
13.	Amount	One dose two days ago, one yesterday and one this morning	<input type="checkbox"/>	
14.	Vaccinations	He has taken all vaccinations.	<input type="checkbox"/>	
Physical Examination				
15.	Hands (palmar pallor)	The nail beds are pale	<input type="checkbox"/>	
16.	Tongue	The tongue is pale	<input type="checkbox"/>	
17.	Eyes, sunken?	The eyes are not sunken	<input type="checkbox"/>	
18.	Eyes, pale colour?	The eyes are pale	<input type="checkbox"/>	
19.	Responsiveness / general condition	He is awake but lethargic	<input type="checkbox"/>	
20.	Skin condition	The skin is normal	<input type="checkbox"/>	
21.	Temperature	Temperature is 37.6 degrees (Celsius)	<input type="checkbox"/>	
22.	Pulse	Pulse is 95 per minute	<input type="checkbox"/>	
23.	Neck stiffness	Neck is not stiff	<input type="checkbox"/>	
24.	Puffy face	Face is not puffy	<input type="checkbox"/>	

Medical Vignettes IRT Methodology

Generating Knowledge Scores

Item response theory fits a predicted relationship for each survey item between the knowledge score and the likelihood of completing the item correctly.

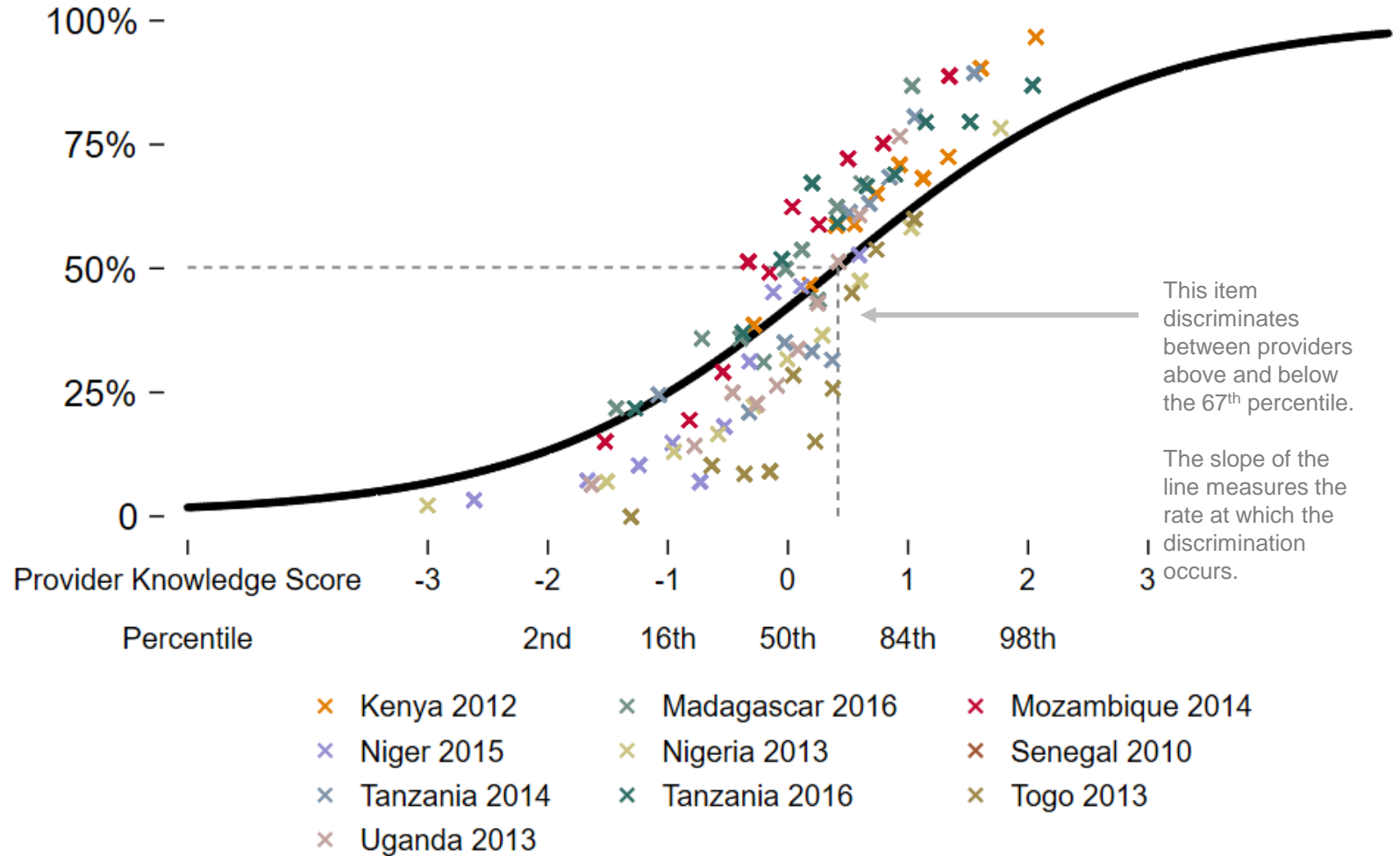
A given provider's knowledge score is predicted based on the parameters established for all questions and the provider's responses to those questions.

Using IRT, providers across slightly different surveys (completed in different countries) can be compared.

The predicted response curve and actual decile performance rates for a single item are illustrated here.

Diabetes Type 2

History: Urinary output



Diagnostic Knowledge Assessment

SDI – Senegal

Diagnostic Knowledge Assessment

Summary of Performance Across Vignettes

For each vignette, enumerators are only able to check off the questions and exams already listed in the survey instrument.

As a result, the “fraction of questions” and “fraction of exams”, rather than the raw number of questions and exams, are used in subsequent analysis.

	Child Diarrhea + Dehydration	Child Pneumonia	Tuberculosis	Child Malaria + Anemia	Pelvic Inflammatory Disease
Number Who Did Vignette	149	149	149	150	139
Did Not Do Vignette	1	1	1	0	11
History Taking					
Mean Questions Asked	3.9	2.6	3.4	3.5	2.1
Fraction of Available Questions	32.9%	32.2%	28.6%	25.2%	20.7%
Physical Examination					
Mean Exams Done	1.8	1.7	1.2	1.7	1.2
Fraction of Available Exams	19.8%	27.9%	23.8%	15.1%	24.0%

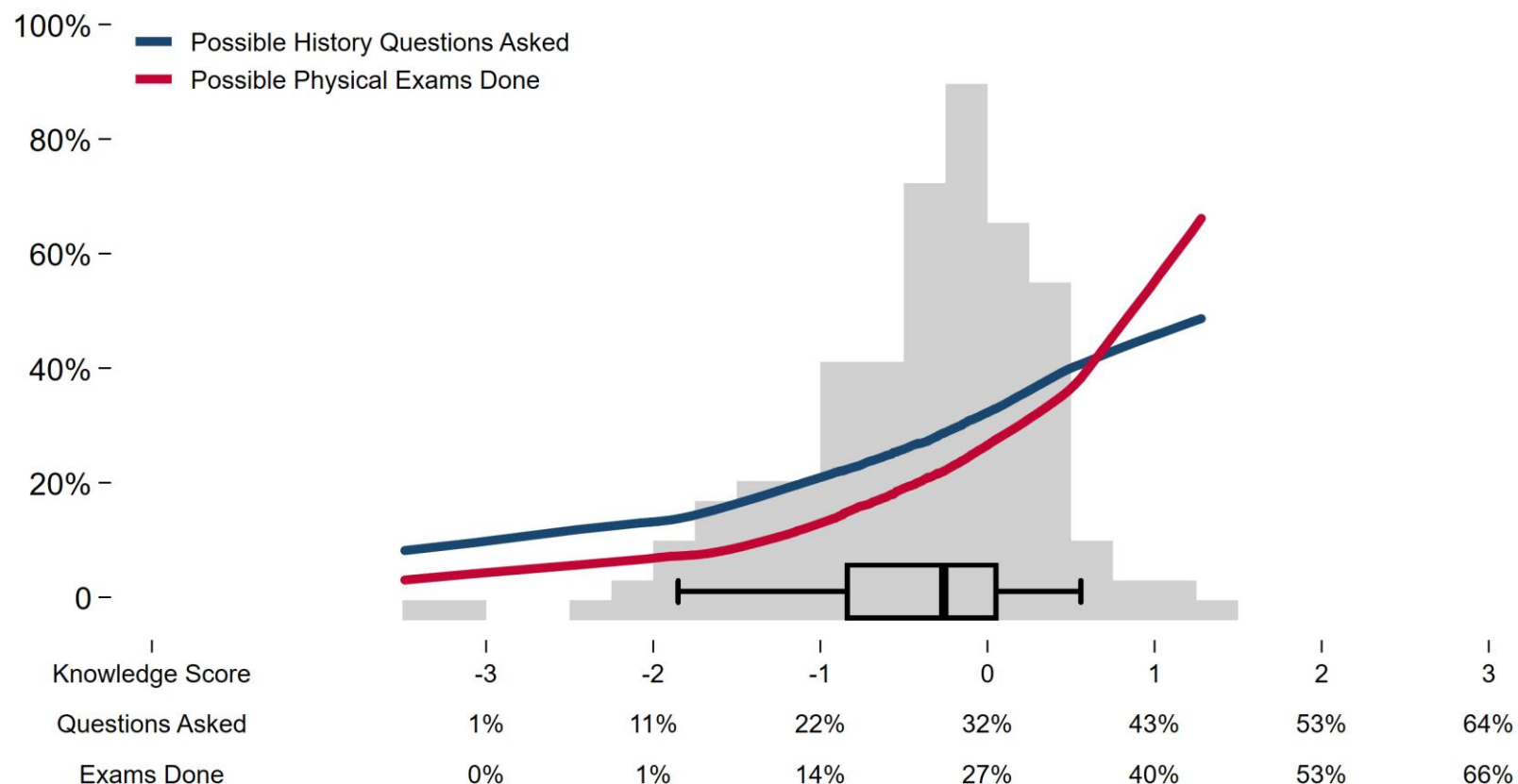
Diagnostic Knowledge Assessment

Knowledge Score Distribution and Measures of Effort

The distribution of knowledge scores obtained from IRT analysis is approximately normal.

The knowledge score is a good predictor of the fraction of history questions asked and physical exams done by providers.

The box plot shows the 5th, 25th, 50th, 75th, and 95th percentiles for reference.

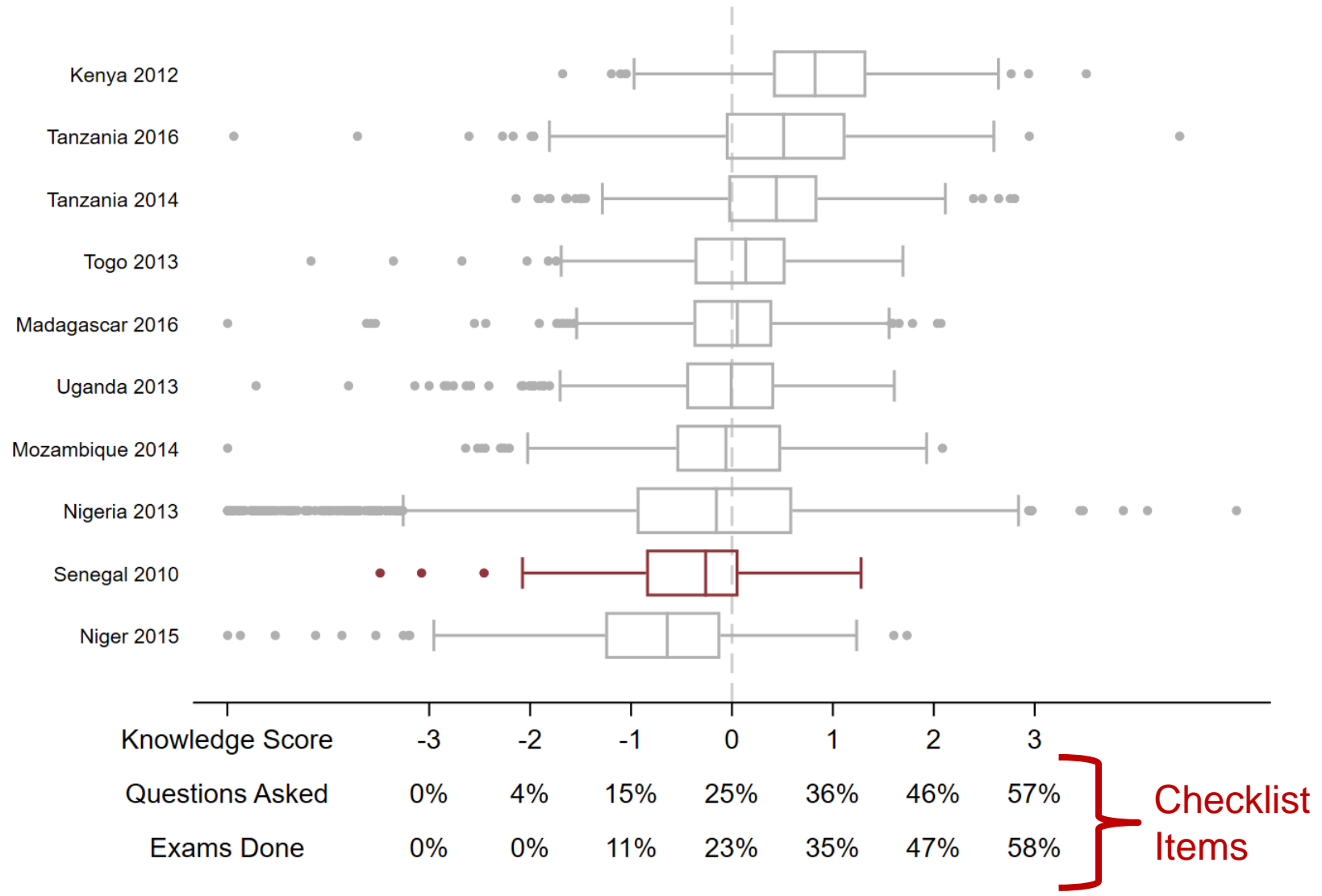


"Possible history questions asked" includes diarrhea+dehydration, malaria+anemia, pneumonia, tuberculosis, pelvic inflammatory disease vignettes.
 "Possible physical exams done" includes diarrhea+dehydration, malaria+anemia, pneumonia, tuberculosis, pelvic inflammatory disease vignettes.

Diagnostic Knowledge Assessment

Knowledge Score Distribution Compared to Other Countries

The boxplot shows the distribution of provider knowledge in Senegal as compared to the distribution of provider knowledge in other countries. The countries are ranked by their median knowledge score.



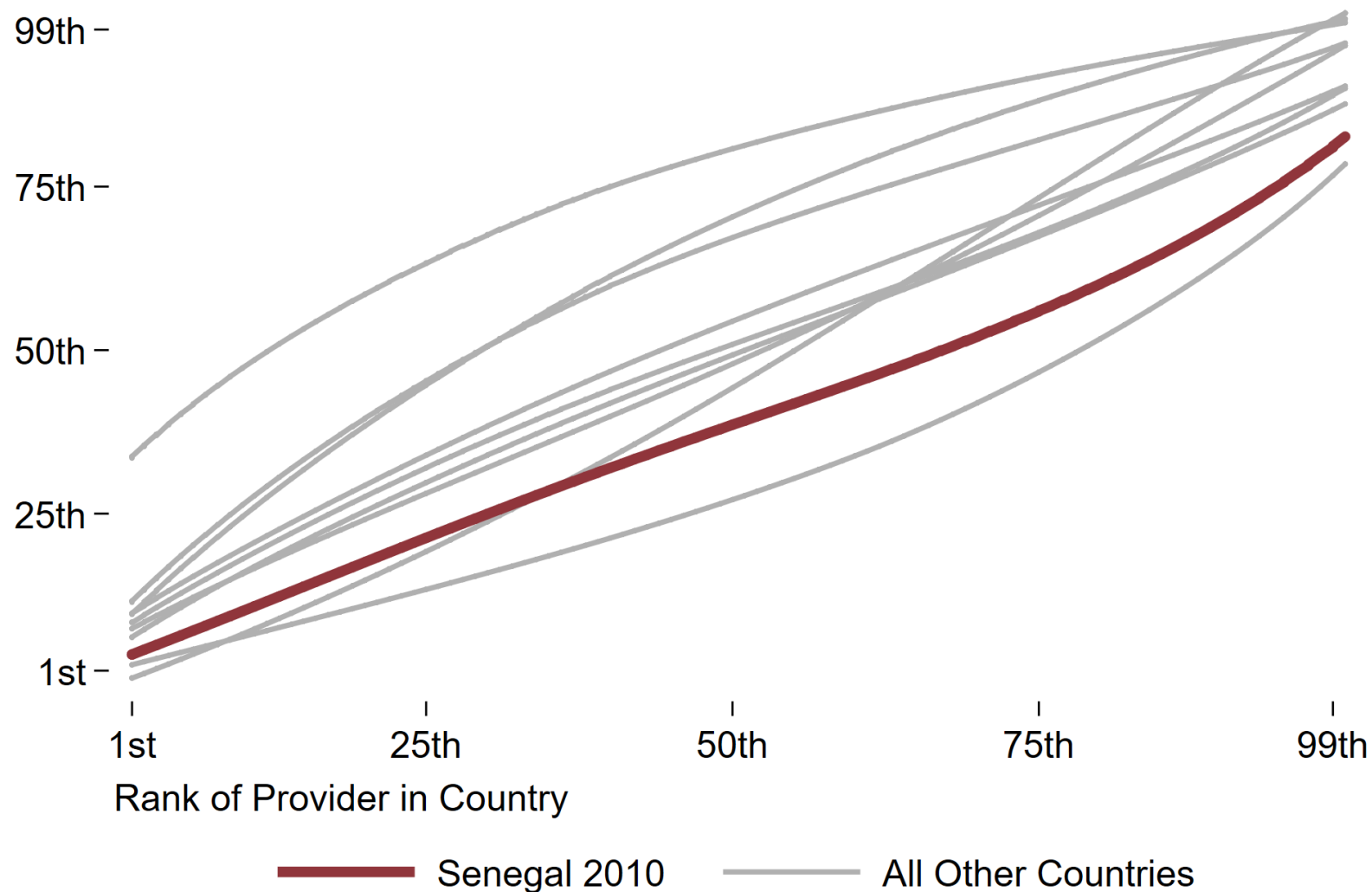
Diagnostic Knowledge Assessment

Providers' Percentile Ranking

In the following figure, one can see how the median provider in Senegal compares to the global distribution.

In addition, one can see where the median provider in the global distribution is in the Senegal rankings. In other words, is the median provider one of the best providers, one of the worst, or average.

Rank of Provider Overall



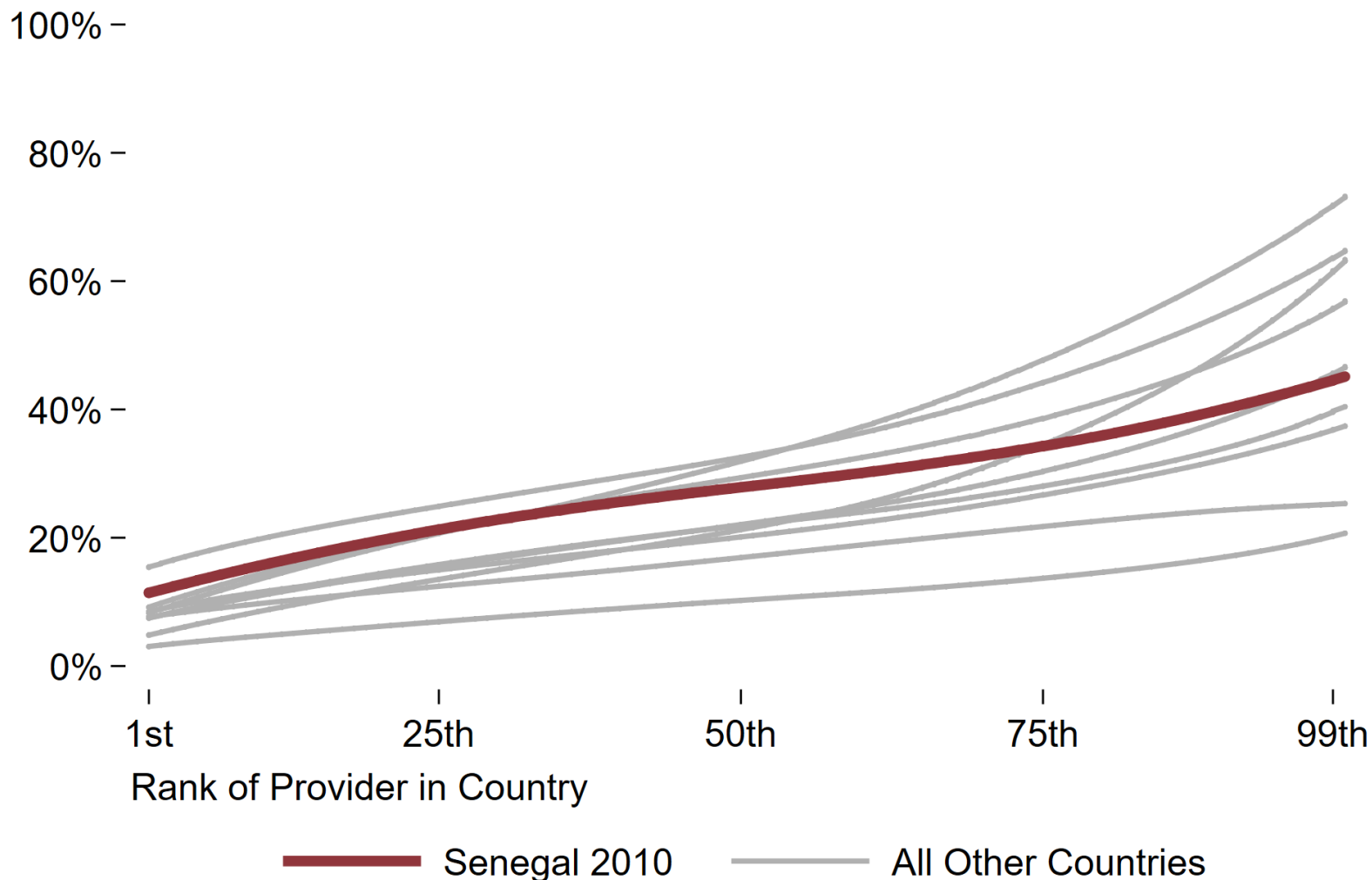
Diagnostic Knowledge Assessment

History Taking Behavior in Senegal Compared to Other Countries

Here, one can compare the most and least knowledgeable providers in Senegal to see whether the best performing providers ask more of the items on the history taking checklist.

In addition, the figure shows how the best and worst providers in Senegal compare to the best and worst providers in other countries with regard to how much of the history checklist they complete.

Fraction of Possible History Questions Asked



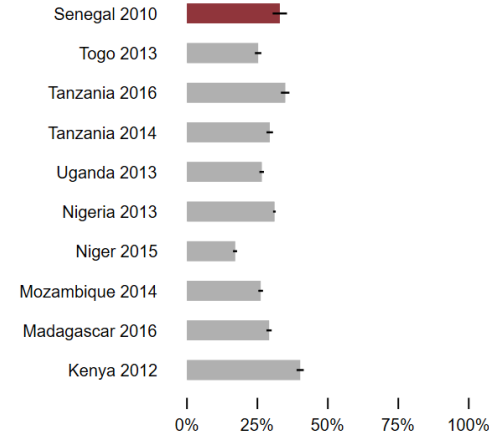
History questions include diarrhea+dehydration, malaria+anemia, pneumonia, tuberculosis, pelvic inflammatory disease vignettes.

Diagnostic Knowledge Assessment

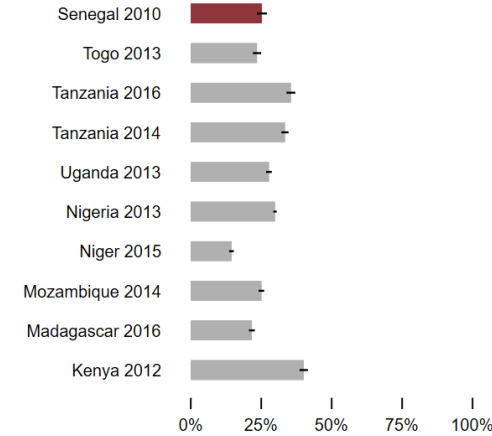
Vignette-Specific History Taking Behavior Compared to Other Countries

Fraction of Possible History Questions Asked

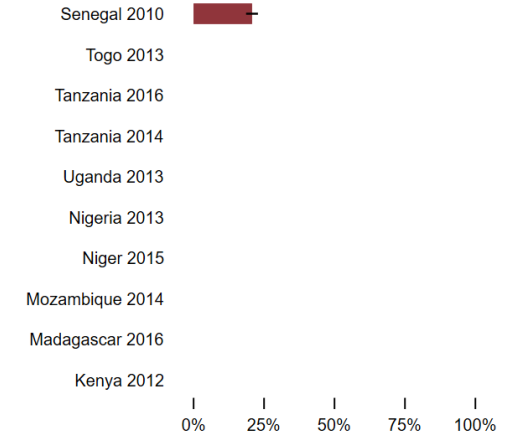
Diarrhea+Dehydration



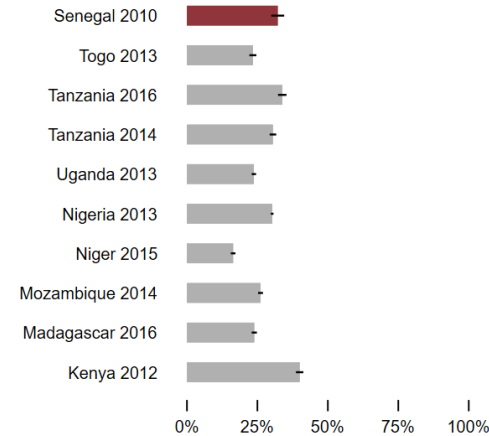
Malaria+Anemia



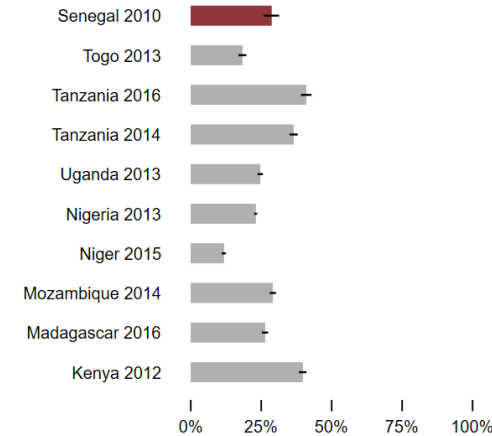
Pelvic Inflammatory Disease



Pneumonia



Tuberculosis

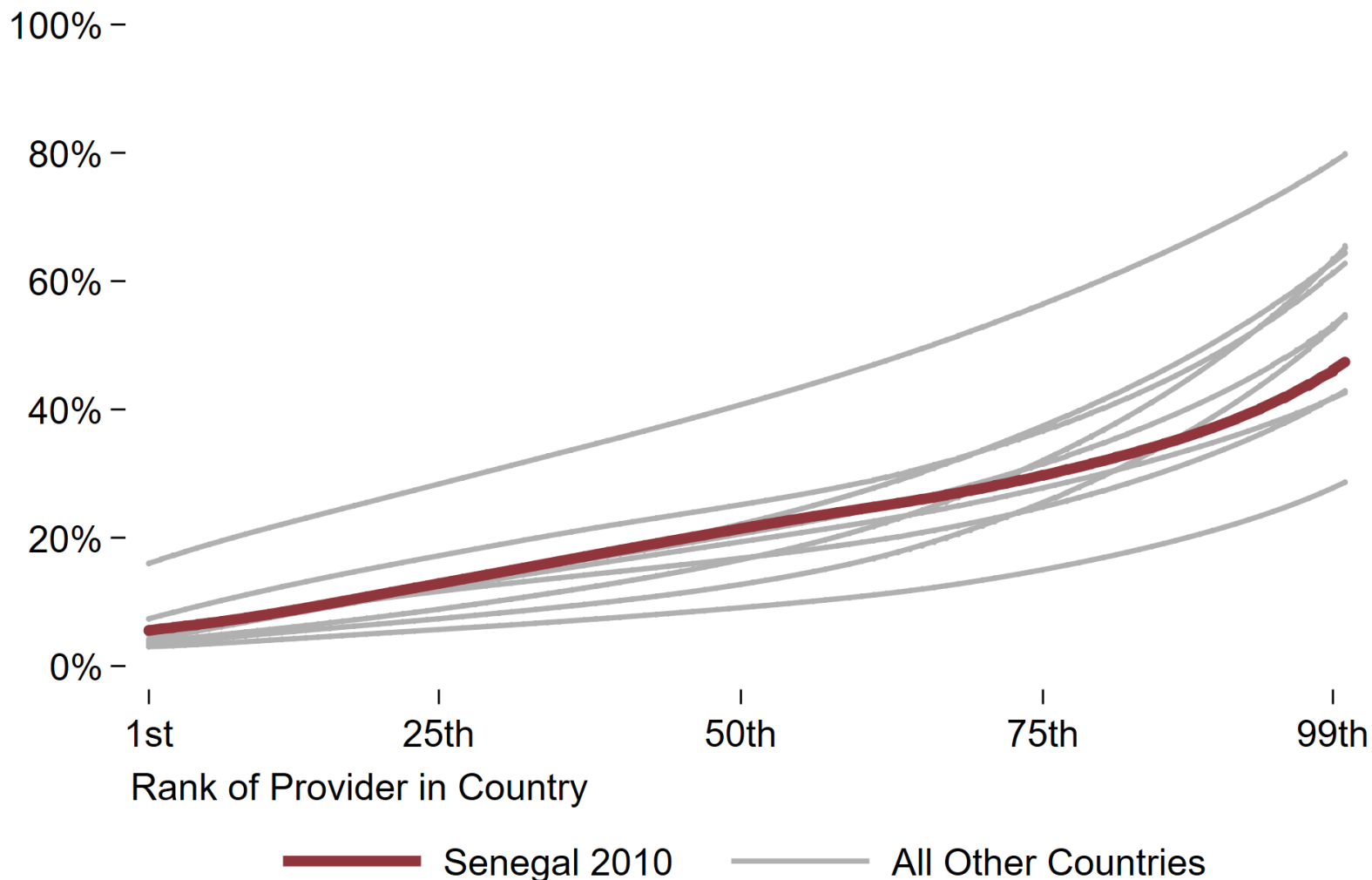


Diagnostic Knowledge Assessment

Physical Examination Behavior in Senegal Compared to Other Countries

As with history taking, the following figure allows one to compare physical examination choices across the spectrum of provider knowledge. This helps answer the question: do the best performing providers do more physical exams?

Fraction of Possible Physical Exams Done



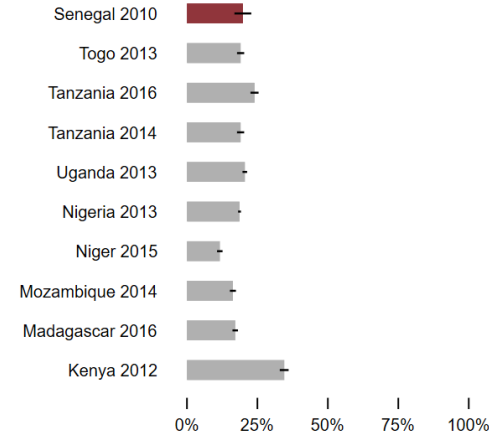
Physical exams include diarrhea+dehydration, malaria+anemia, pneumonia, tuberculosis, pelvic inflammatory disease vignettes.

Diagnostic Knowledge Assessment

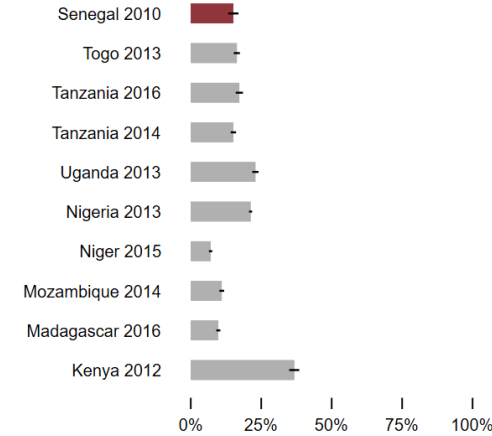
Vignette-Specific Physical Examination Behavior Compared to Other Countries

Fraction of Possible Physical Exams Done

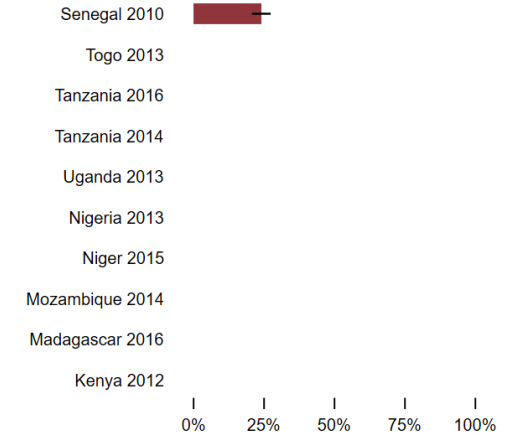
Diarrhea+Dehydration



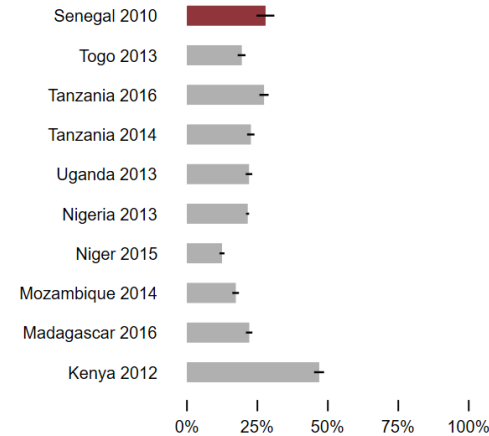
Malaria+Anemia



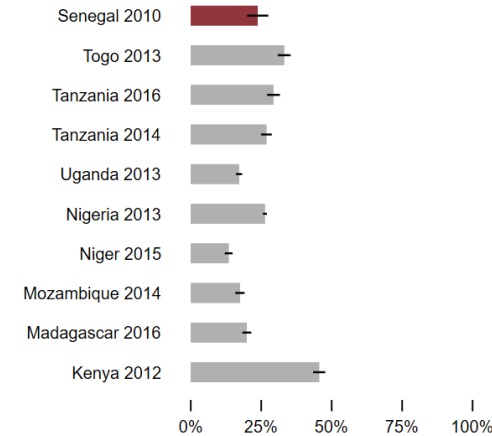
Pelvic Inflammatory Disease



Pneumonia



Tuberculosis



Diagnostic – Treatment Linkages

SDI – Senegal

Diagnostic – Treatment Linkages

Summary of Performance Across Vignettes

In the case of vignettes that presented comorbidities, a provider only received credit for a correct diagnosis when he or she specified each morbidity.

Correct management was decided by comparing the providers' choices to international guidelines as much as possible given that the presentation of treatment options varied from country to country.

Several vignettes listed antibiotics as a treatment option although prescribing antibiotics for the particular vignette go against clinical management guidelines. These were identified separately to see whether providers are doing more unnecessary treatment.

	Child Diarrhea + Dehydration	Child Pneumonia	Tuberculosis	Child Malaria + Anemia	Pelvic Inflammatory Disease
Number Who Did Vignette	149	149	149	150	139
Did Not Do Vignette	1	1	1	0	11
Identifying Condition Presented					
Correct Diagnosis	38 (25%)	89 (60%)	111 (74%)	1 (1%)	9 (6%)
Incorrect Diagnosis	111 (75%)	60 (40%)	48 (26%)	149 (99%)	130 (94%)
Prescribing Appropriate Treatment					
Correct Treatment	33 (22%)	96 (64%)	126 (85%)	2 (1%)	62 (45%)
Incorrect Treatment	116 (78%)	53 (36%)	23 (15%)	148 (99%)	77 (55%)
Inappropriate Antibiotics Usage					
Gave Incorrect Antibiotics	33 (22%)	n/a	23 (15%)	n/a	7 (5%)
Did Not Give Incorrect Antibiotics	116 (78%)	n/a	126 (85%)	n/a	132 (95%)
Ordering Tests					
Number of Tests Ordered	0.1	0.1	1.0	1.1	0.1

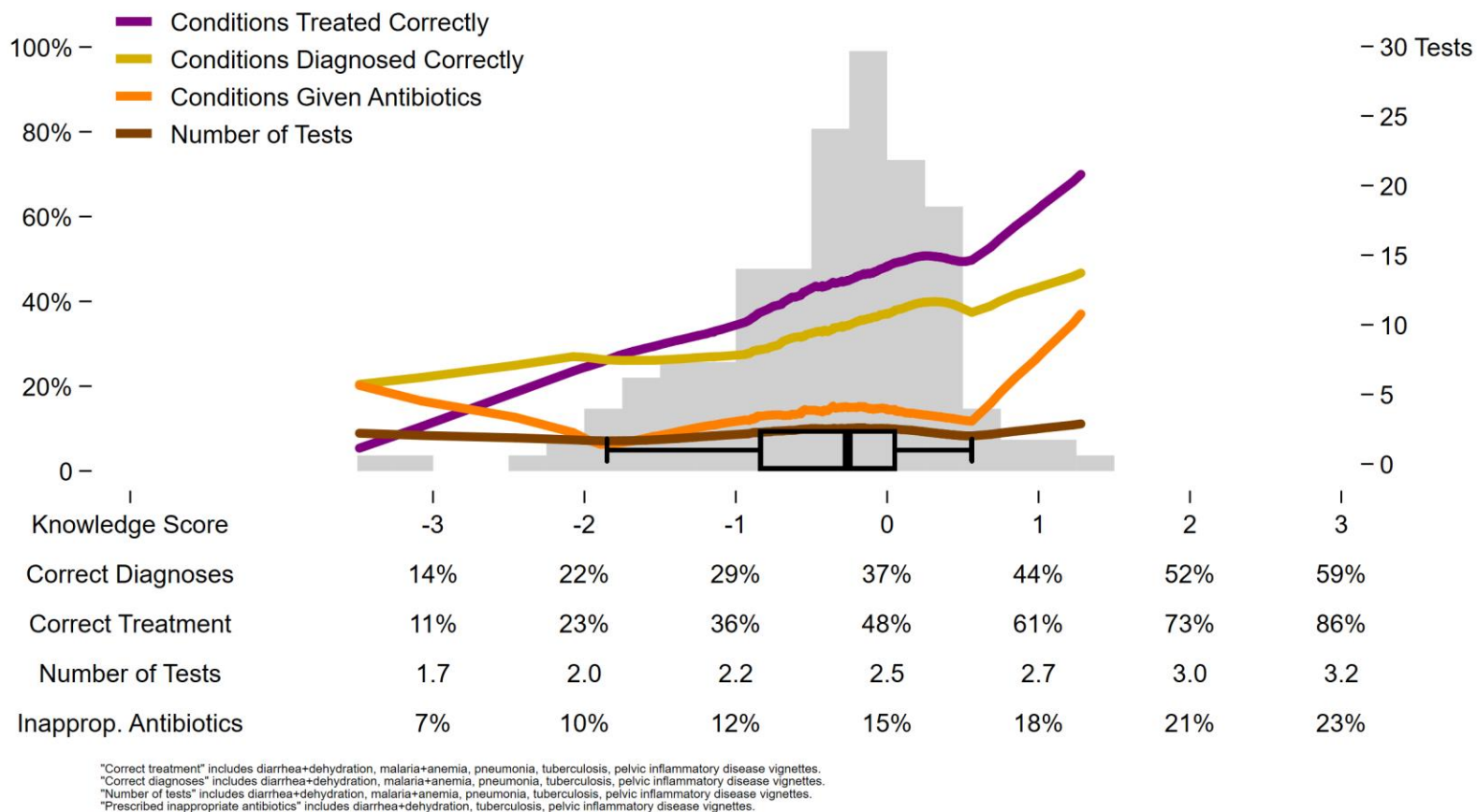
Diagnostic – Treatment Linkages

Knowledge Score Distribution and Measures of Quality

The knowledge score is a good predictor of the whether providers correctly treat the given conditions, correctly diagnose the given conditions, and order more tests.

The relationship between whether more knowledgeable providers also prescribe more inappropriate antibiotics is presented in the figure.

The box plot shows the 5th, 25th, 50th, 75th, and 95th percentiles for reference.

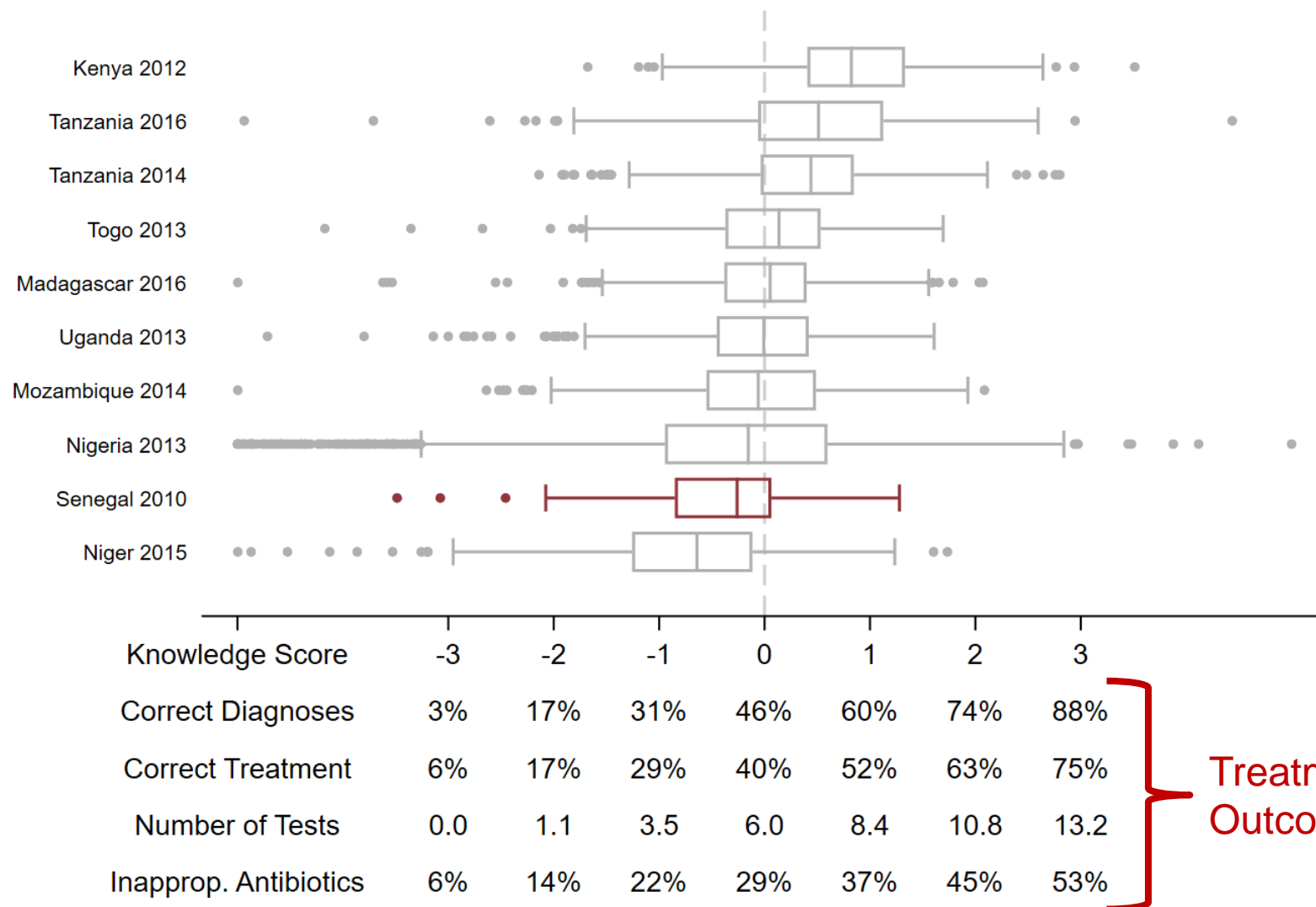


Diagnostic – Treatment Linkages

Knowledge Score Distribution Compared to Other Countries

Again, the distribution of provider knowledge in Senegal is compared to the distribution of provider knowledge in other countries. The countries are ranked by their median knowledge score.

From the figure, one can also see how many more diagnoses, treatments, and tests are ordered as a provider's knowledge score increases by one standard deviation.



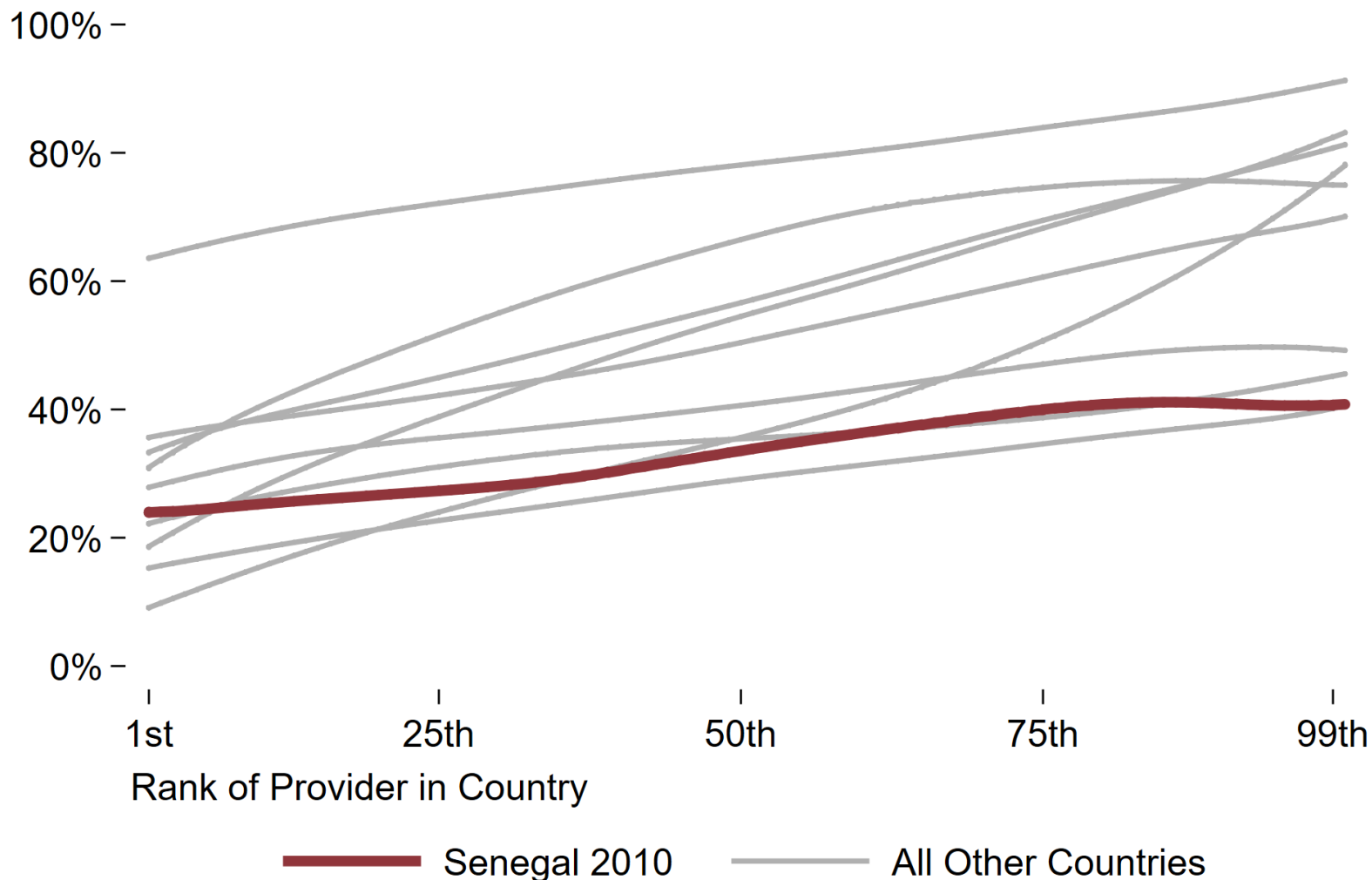
Diagnostic – Treatment Linkages

Diagnosis Behavior in Senegal Compared to Other Countries

In the figure, one can determine whether the best performing providers are able to diagnose more conditions correctly compared to the worst providers in Senegal.

The figure also shows how the diagnostic ability of the best providers in Senegal compares to that of the best providers in other countries.

Fraction of Conditions Diagnosed Correctly



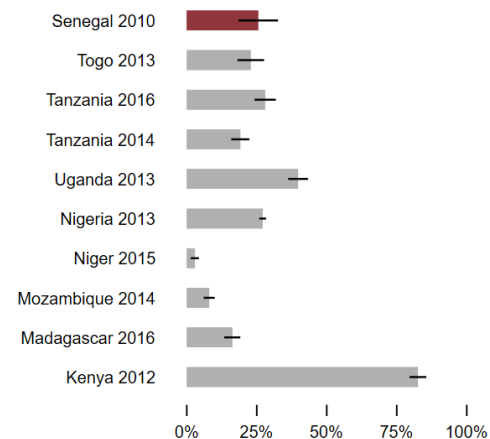
Correct diagnoses include diarrhea+dehydration, malaria+anemia, pneumonia, tuberculosis, pelvic inflammatory disease vignettes.

Diagnostic – Treatment Linkages

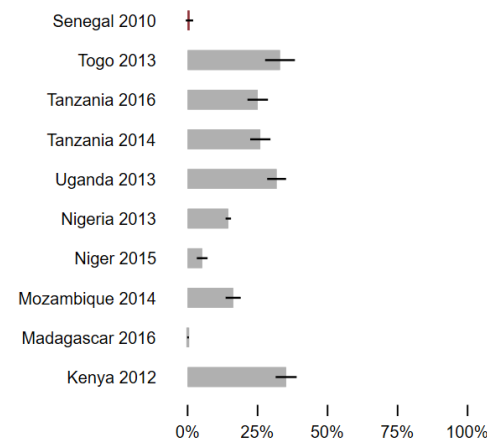
Vignette-Specific
Diagnosis Behavior
Compared to Other
Countries

Fraction Who Correctly Diagnosed Condition

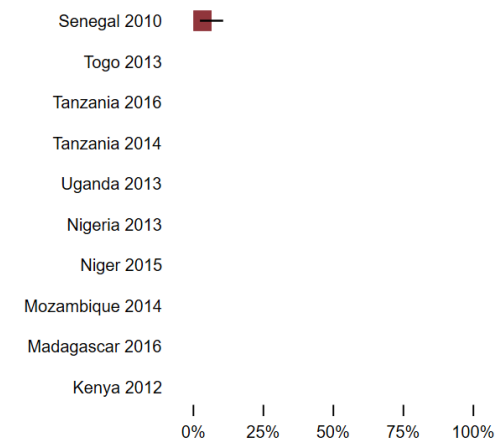
Diarrhea+Dehydration



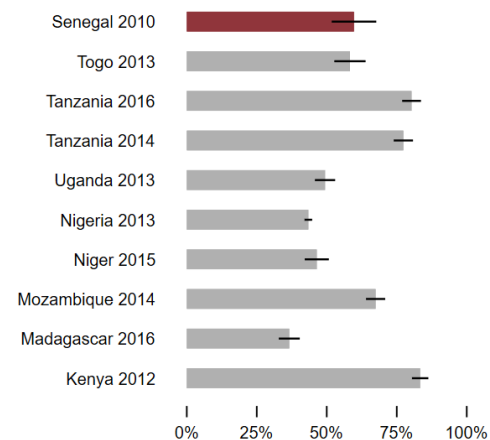
Malaria+Anemia



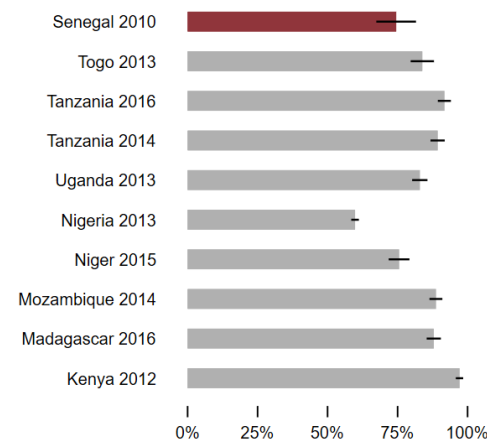
Pelvic Inflammatory Disease



Pneumonia



Tuberculosis



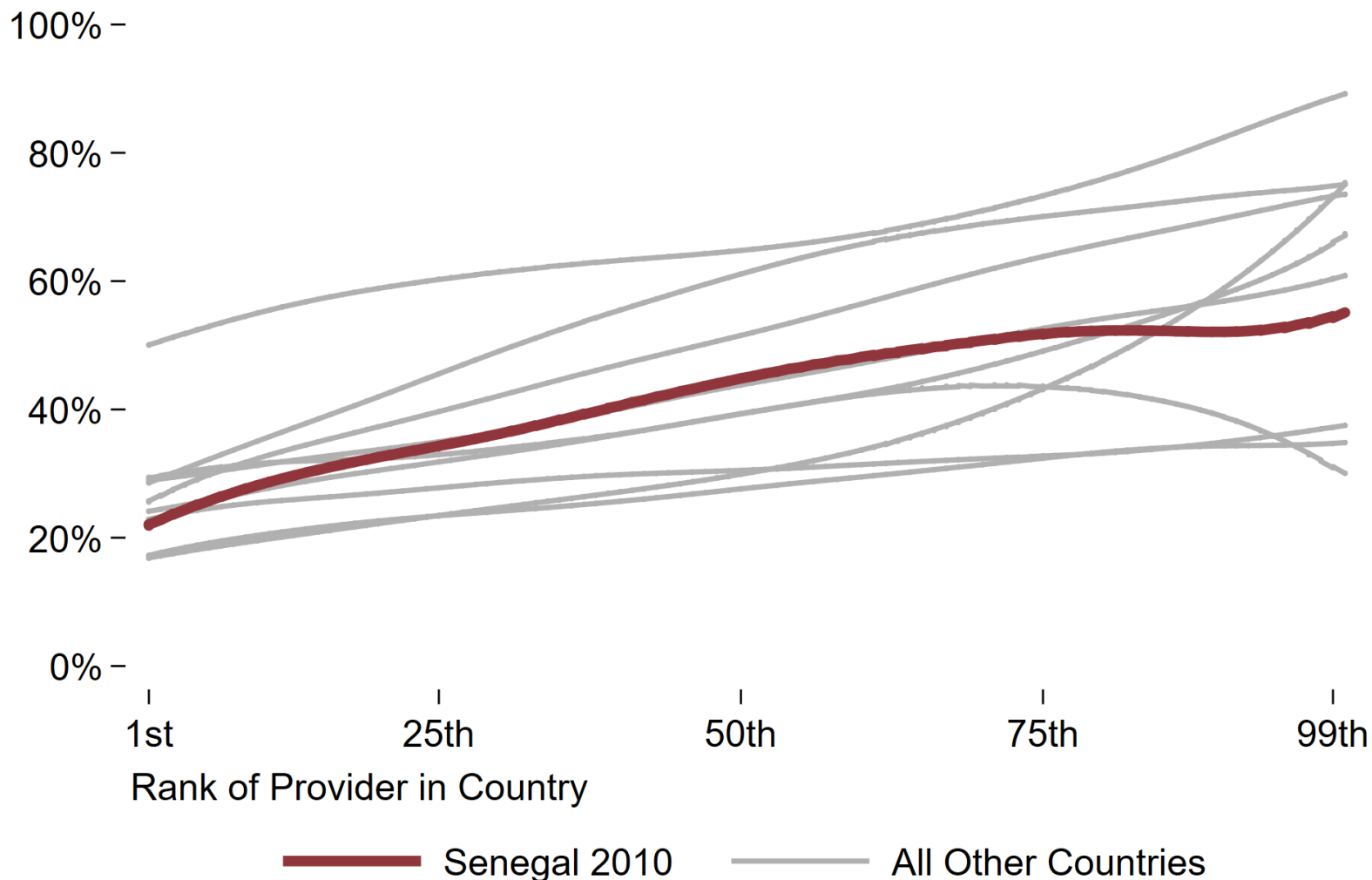
Diagnostic – Treatment Linkages

Treatment Behavior in Senegal Compared to Other Countries

Here, one can see how a provider's ability to manage the vignette conditions correctly changes as the provider's knowledge increases.

In addition, one can see whether the difference in treatment accuracy between the best and worst provider in Senegal is comparable to the differences observed in other countries.

Fraction of Conditions Treated Correctly



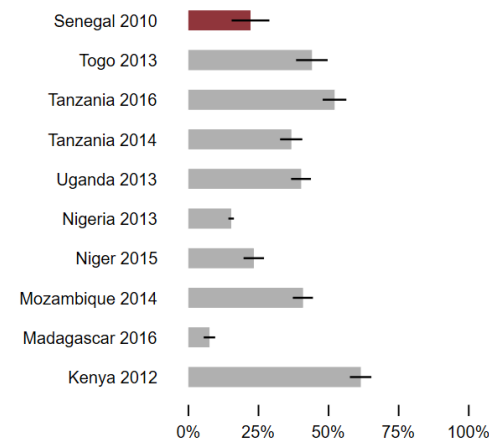
Correct treatments include diarrhea+dehydration, malaria+anemia, pneumonia, tuberculosis, pelvic inflammatory disease vignettes.

Diagnostic – Treatment Linkages

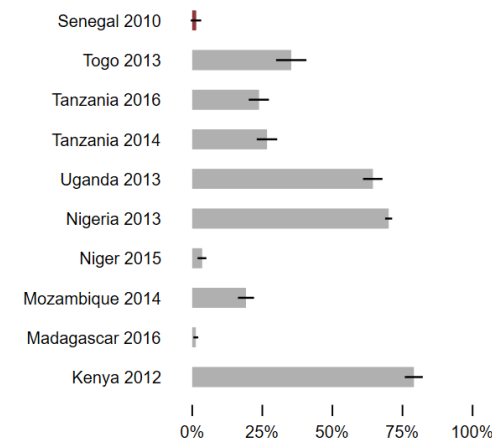
Vignette-Specific Treatment Behavior Compared to Other Countries

Fraction Who Correctly Treated Condition

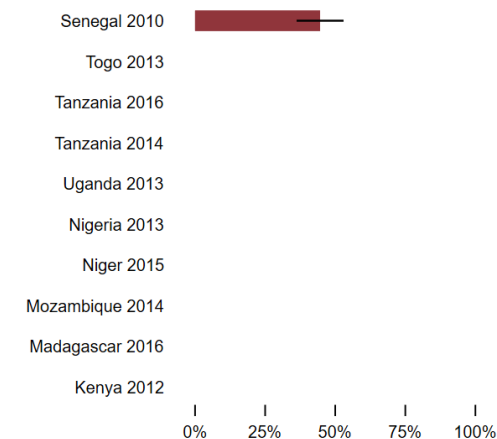
Diarrhea+Dehydration



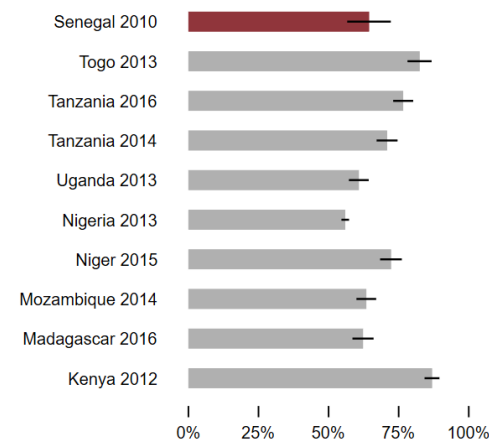
Malaria+Anemia



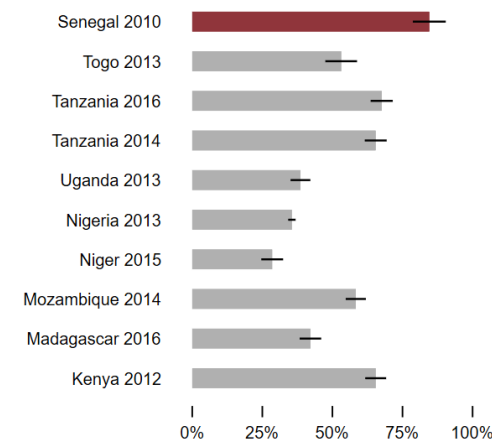
Pelvic Inflammatory Disease



Pneumonia



Tuberculosis



Diagnostic – Treatment Linkages

Test Ordering Behavior in Senegal Compared to Other Countries

In the figure, one is able to determine the average number of tests ordered by a given provider as he or she moved from the lowest rank in the country to the highest rank.

The figure also allows one to see how providers in Senegal compare to providers in other countries with regard to the number of tests they order, on average.

Number of Tests Done

30 Tests –

25 –

20 –

15 –

10 –

5 –

0 –

1st 25th 50th 75th 99th
Rank of Provider in Country

— Senegal 2010 — All Other Countries

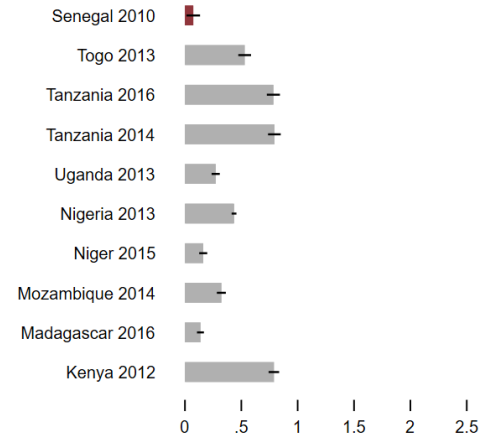
Tests include diarrhea+dehydration, malaria+anemia, pneumonia, tuberculosis, pelvic inflammatory disease vignettes.

Diagnostic – Treatment Linkages

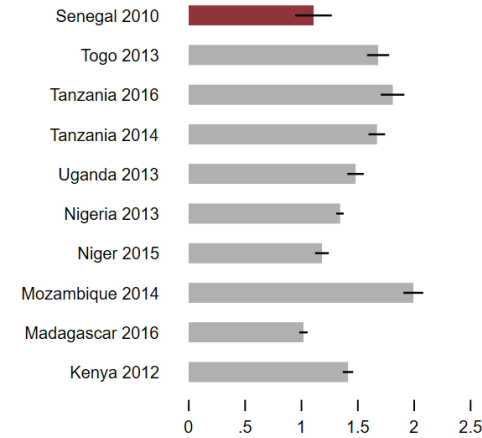
Vignette-Specific Test Ordering Behavior Compared to Other Countries

Number of Tests Done

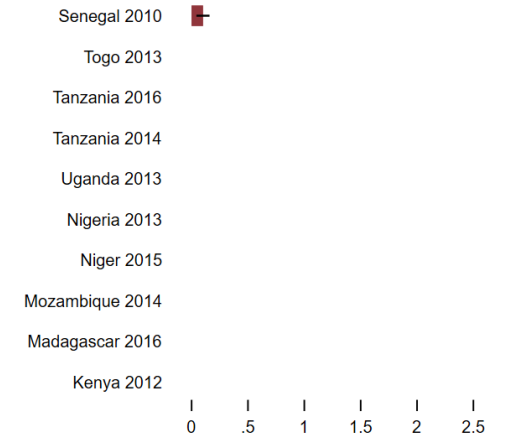
Diarrhea+Dehydration



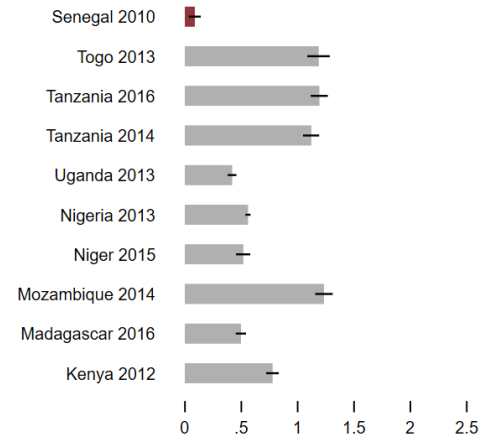
Malaria+Anemia



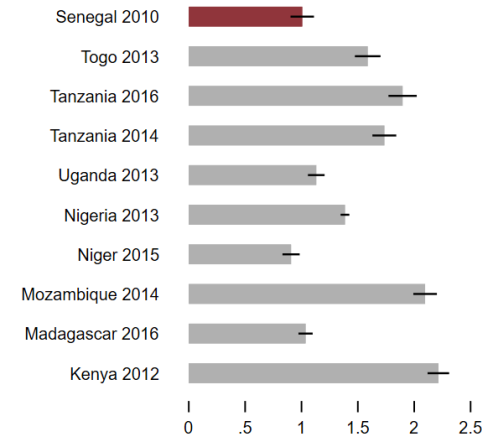
Pelvic Inflammatory Disease



Pneumonia



Tuberculosis



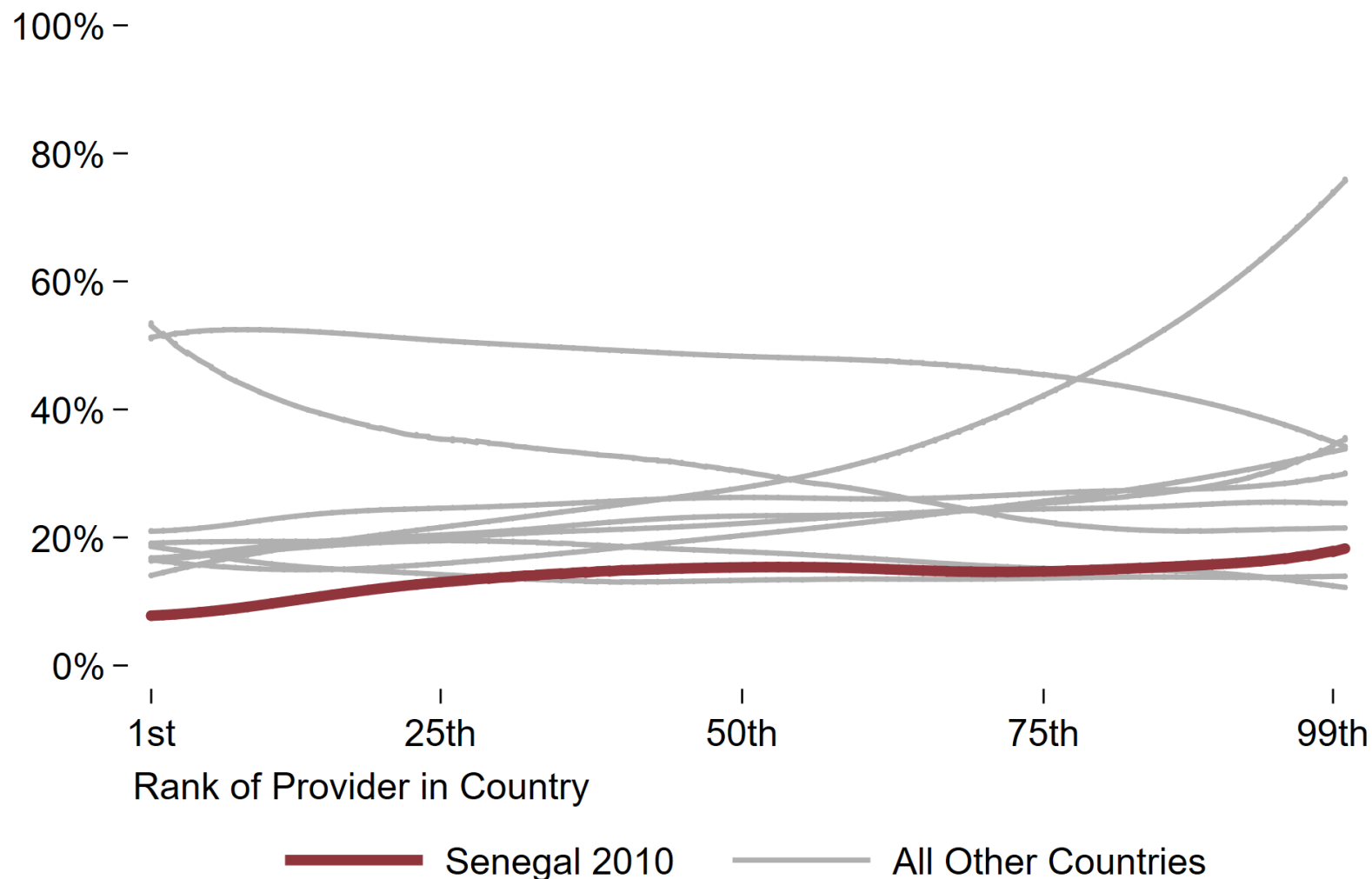
Diagnostic – Treatment Linkages

Antibiotic Prescription Behavior in Senegal Compared to Other Countries

Finally, it is important to determine whether more knowledgeable providers are then more likely to prescribe unnecessary antibiotics.

In the given figure, one can address that question, and additionally compare the antibiotics prescription behavior in Senegal to that in other countries across the knowledge spectrum.

Fraction of Conditions Given Inappropriate Antibiotics



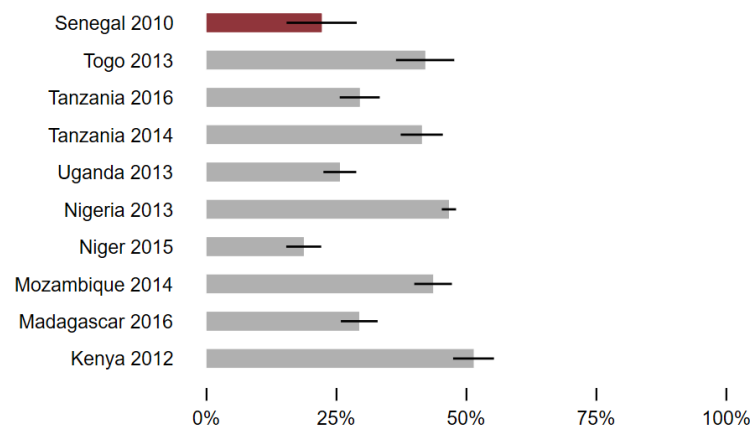
Inappropriate antibiotics include diarrhea+dehydration, pneumonia, tuberculosis, pelvic inflammatory disease vignettes.

Diagnostic – Treatment Linkages

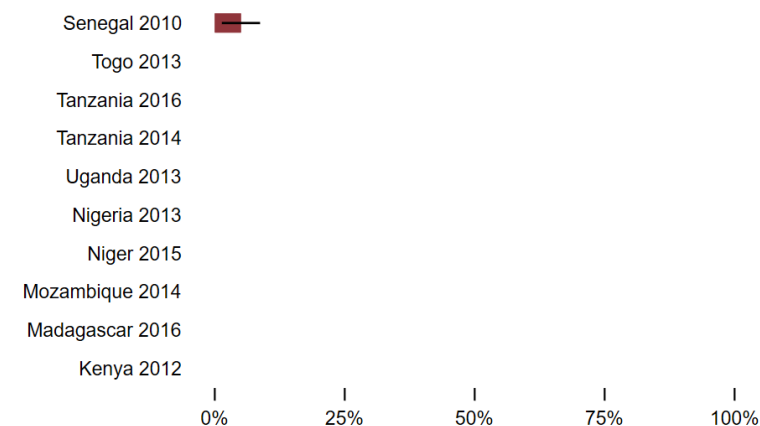
Vignette-Specific Antibiotic Prescription Behavior Compared to Other Countries

Fraction Who Prescribed Inappropriate Antibiotics

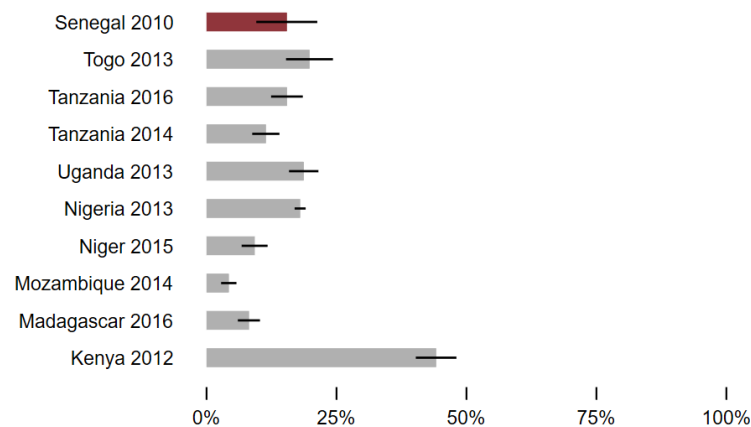
Diarrhea+Dehydration



Pelvic Inflammatory Disease



Tuberculosis



Demographic Variation in Diagnostics & Treatment

SDI – Senegal

Demographic Variation

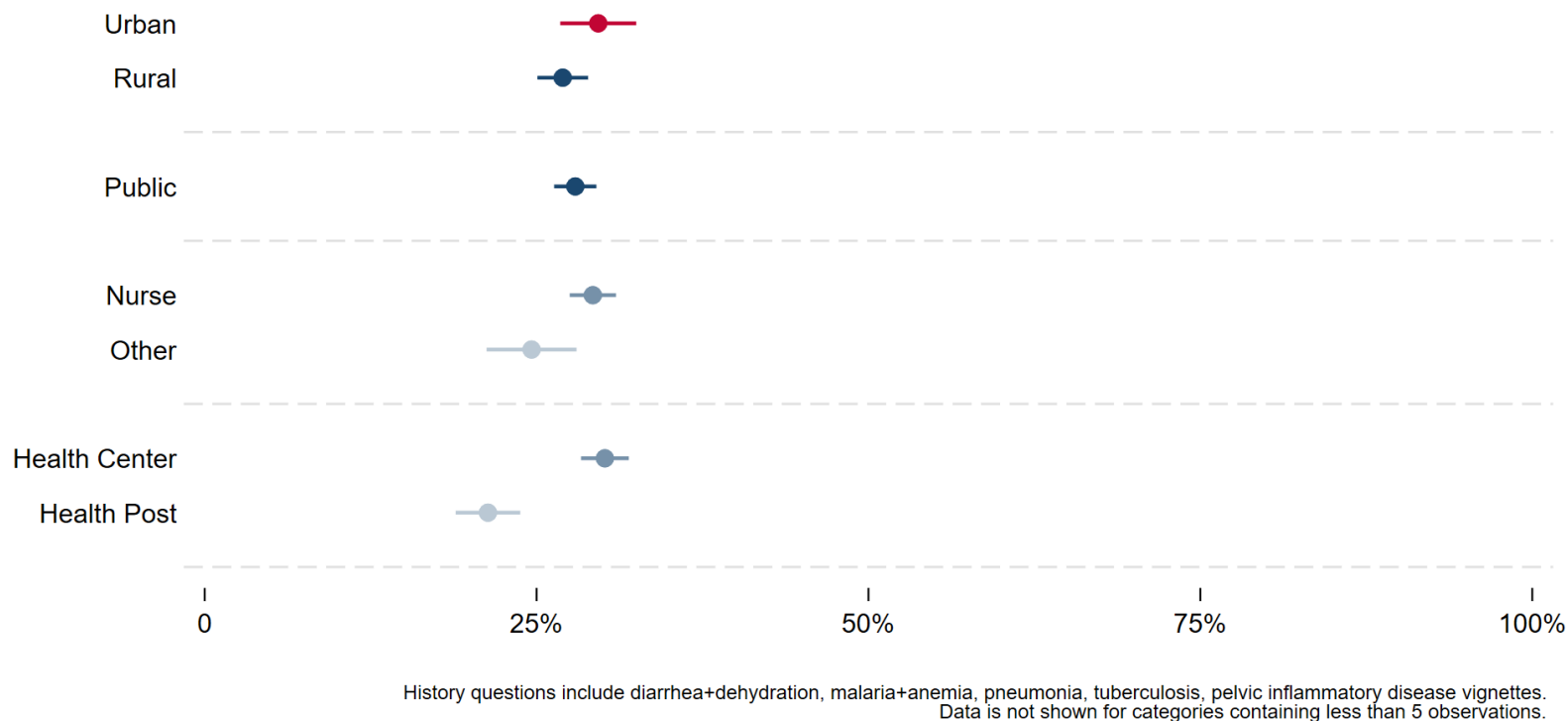
History Taking Behavior Across Different Provider Characteristics

In the figure, the variation among different groups of providers in the fraction of the history checklist completed is shown.

Thus, one can compare whether providers in one type of facility ask more or less questions. In addition, one can compare whether providers of different medical backgrounds ask more or less questions.

The mean values with a 95% confidence interval are shown.

Fraction of Possible History Questions Asked



Demographic Variation

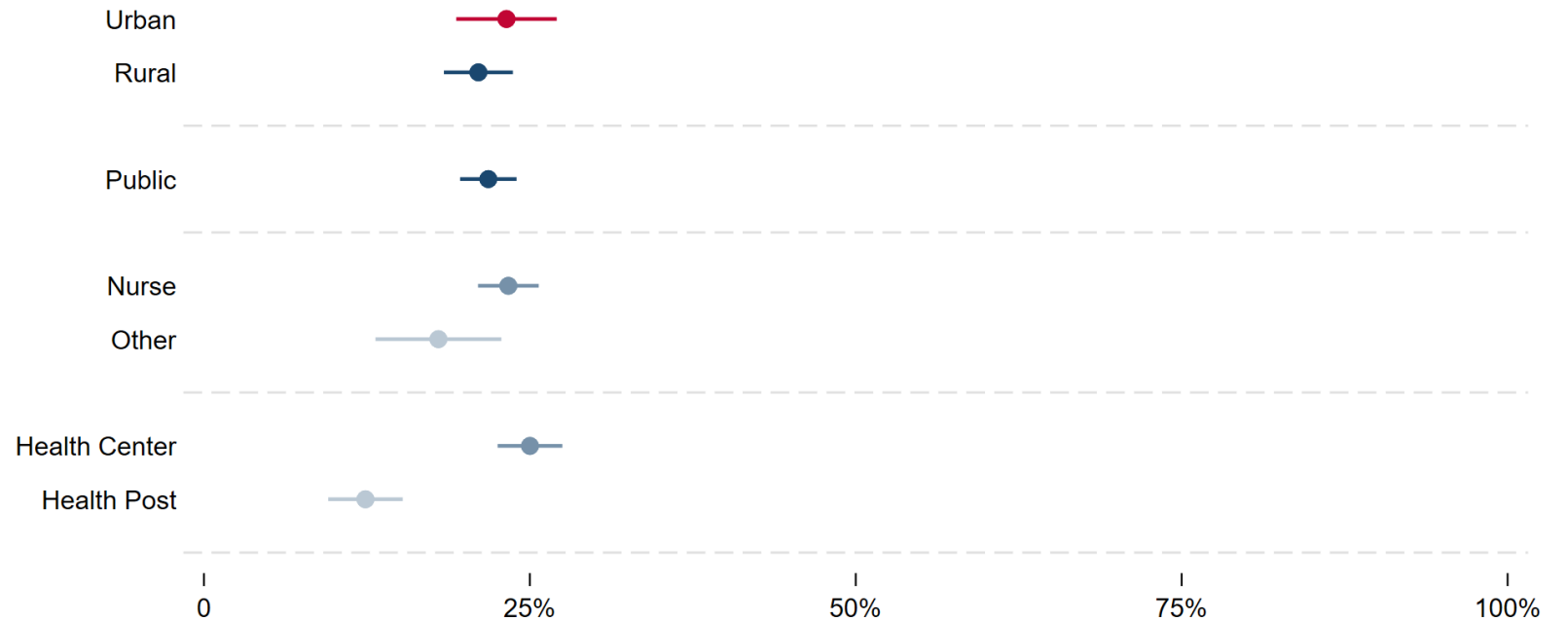
Physical Examination Behavior Across Different Provider Characteristics

Here, one can see whether providers in particular groups complete more physical examinations than others.

Specifically, providers who work in urban versus rural and public versus private are compared. In addition, providers who work in different tiers of the healthcare system are compared. Finally, providers with different medical backgrounds are compared to see if those with more training perform more exams than their less-trained colleagues.

The mean values with a 95% confidence interval are shown.

Fraction of Possible Physical Exams Done



Physical exams include diarrhea+dehydration, malaria+anemia, pneumonia, tuberculosis, pelvic inflammatory disease vignettes.
Data is not shown for categories containing less than 5 observations.

Demographic Variation

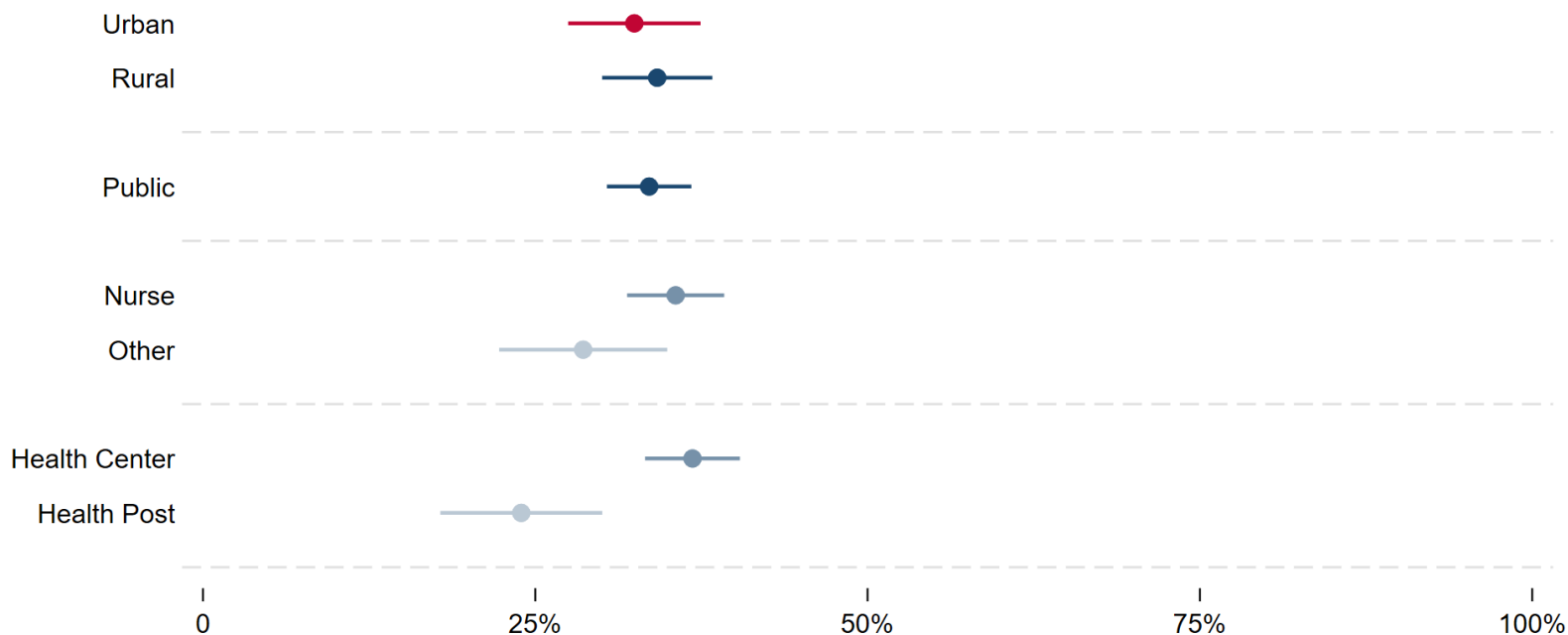
Diagnosis Behavior Across Different Provider Characteristics

Among other categorizations, the figure shows whether doctors diagnose more conditions accurately as compared to nurses.

In addition, the figure shows whether providers in urban settings are able to identify more of the vignette conditions compared to rural providers.

The mean values with a 95% confidence interval are shown.

Fraction of Conditions Diagnosed Correctly



Correct diagnoses include diarrhea+dehydration, malaria+anemia, pneumonia, tuberculosis, pelvic inflammatory disease vignettes.
Data is not shown for categories containing less than 5 observations.

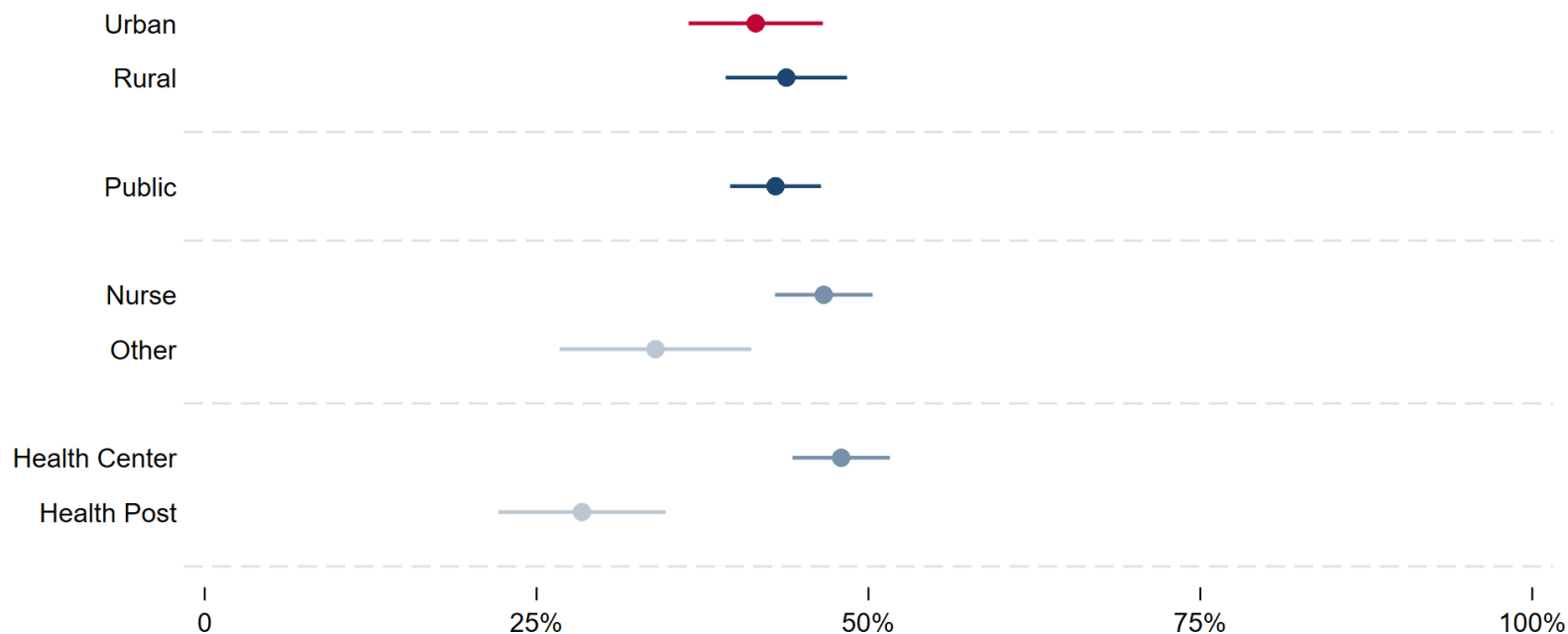
Demographic Variation

Treatment Behavior Across Different Provider Characteristics

Here, one can see whether a provider's ability to correctly management the clinical conditions varies when comparing different subsets of providers: urban versus rural, doctors versus nurses, public versus private, for example.

The mean values with a 95% confidence interval are shown.

Fraction of Conditions Treated Correctly



Correct treatment include diarrhea+dehydration, malaria+anemia, pneumonia, tuberculosis, pelvic inflammatory disease vignettes.
Data is not shown for categories containing less than 5 observations.

Demographic Variation

Test Ordering Behavior Across Different Provider Characteristics

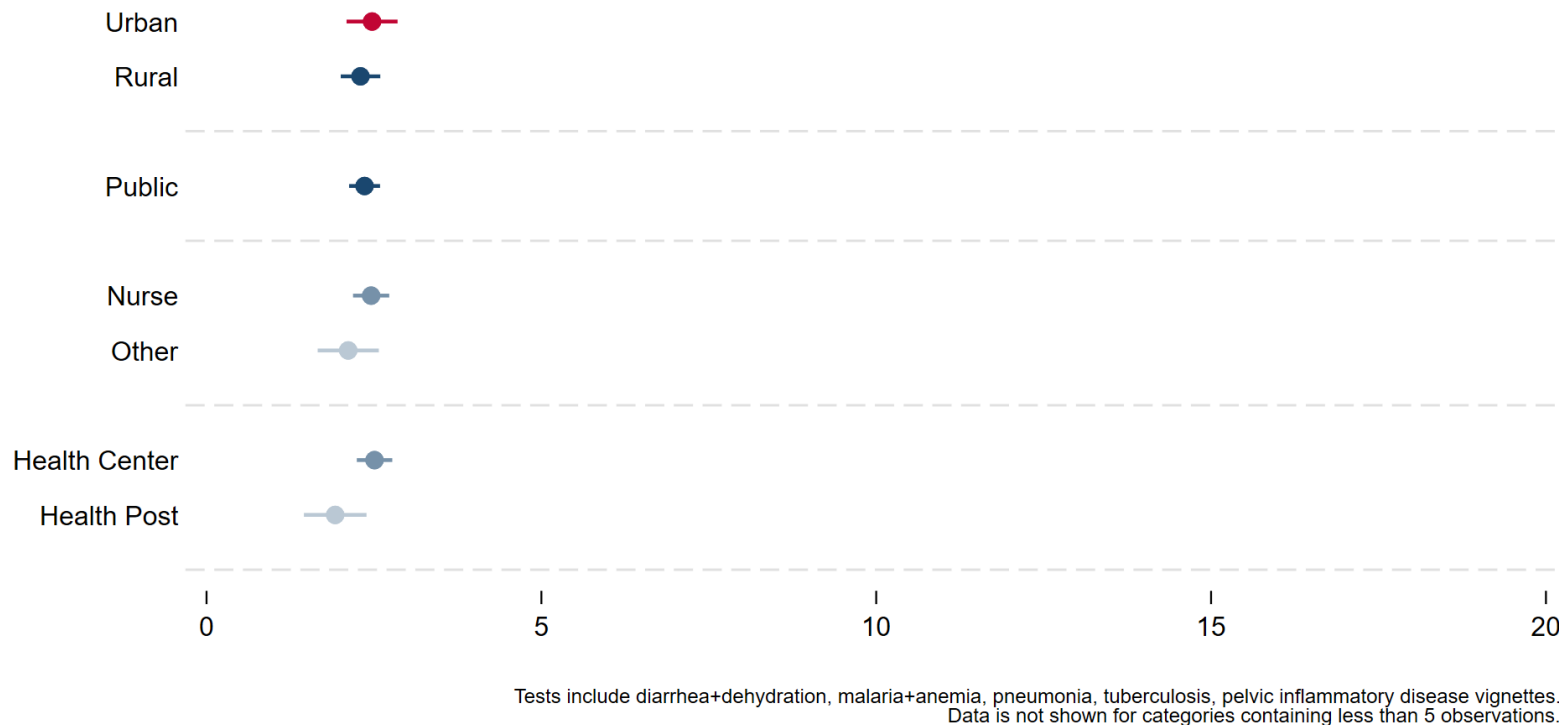
In addition, we can see whether practices around ordering tests change when comparing different types of providers.

For instance, do providers who work in health centers order more tests than those in health posts?

Or, do providers in private facilities order more tests than those in public facilities?

The mean values with a 95% confidence interval are shown.

Number of Tests Done



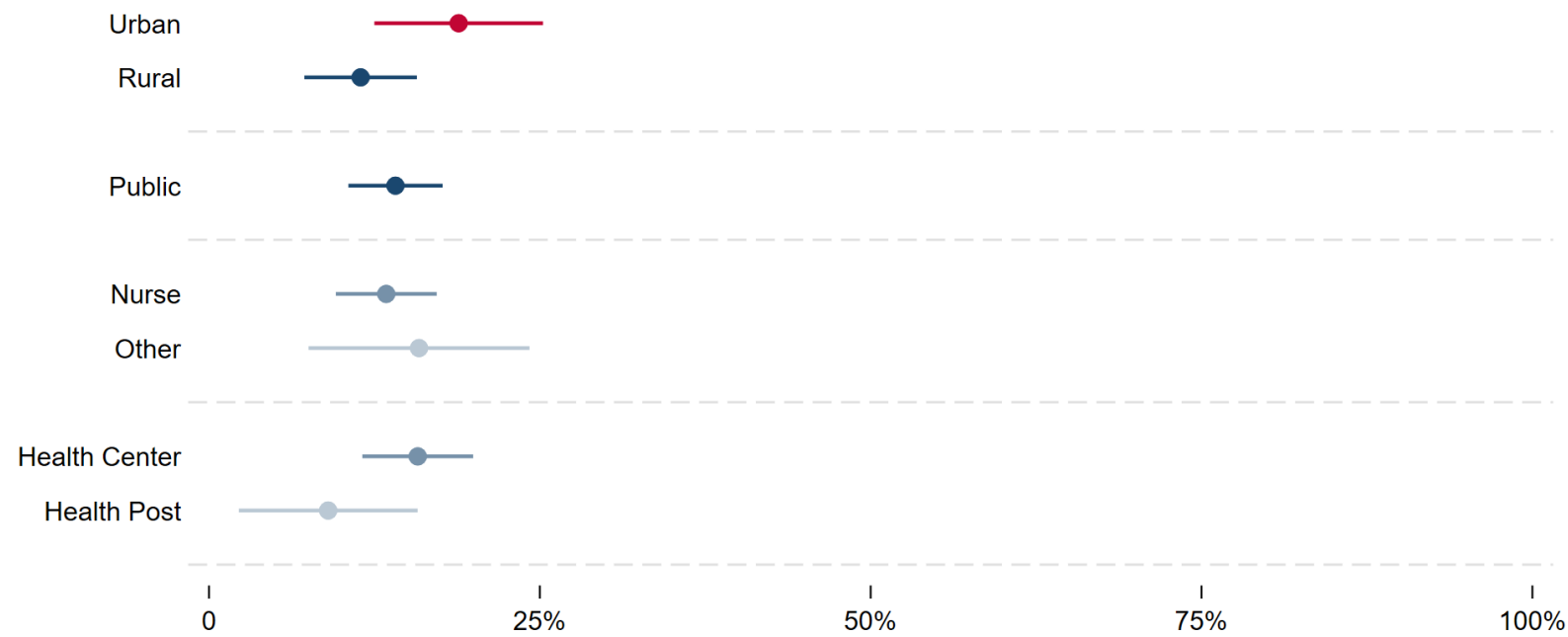
Demographic Variation

Antibiotics Prescription Behavior Across Different Provider Characteristics

Finally, we can determine whether providers with a particular set of characteristics are more likely to know when not to prescribe antibiotics.

The mean values with a 95% confidence interval are shown.

Fraction of Conditions Prescribed Antibiotics



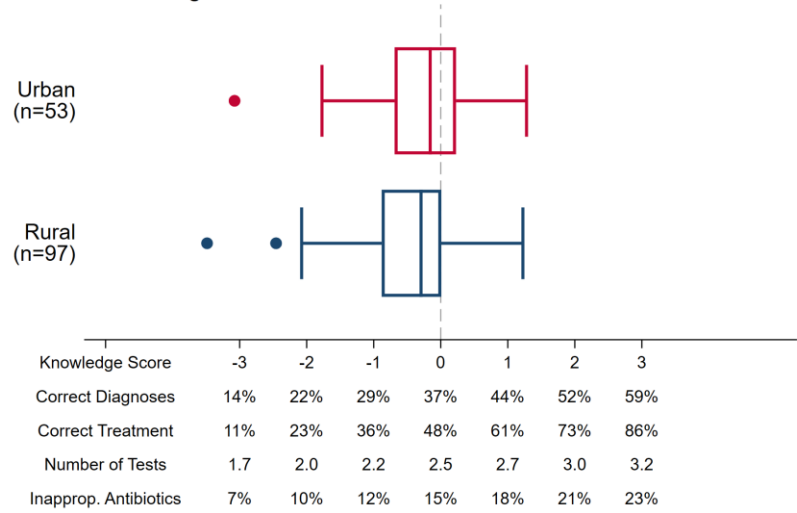
Inappropriate antibiotics includes diarrhea+dehydration, tuberculosis, pelvic inflammatory disease vignettes.
Data is not shown for categories containing less than 5 observations.

Demographic Variation

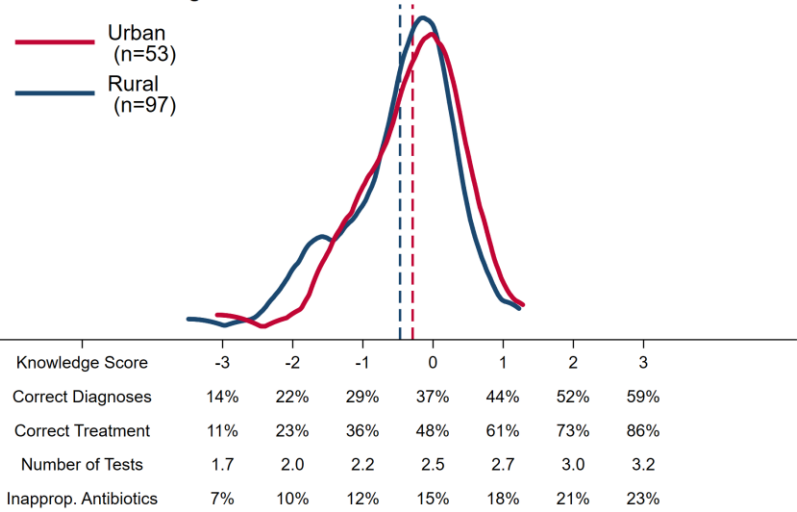
Rural vs. Urban Providers

The knowledge distribution of health care providers who work in urban facilities is compared to the knowledge distribution of health care providers who work in rural facilities.

Providers in Senegal 2010



Providers in Senegal 2010



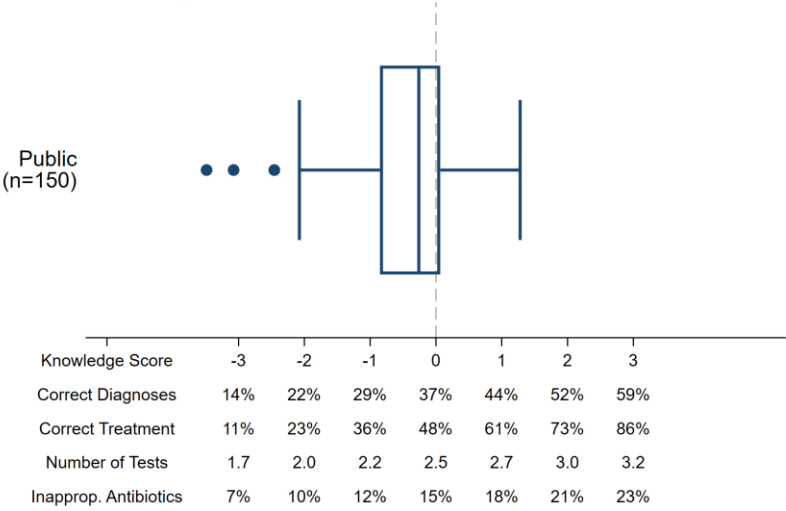
Demographic Variation

Public vs. Private Providers

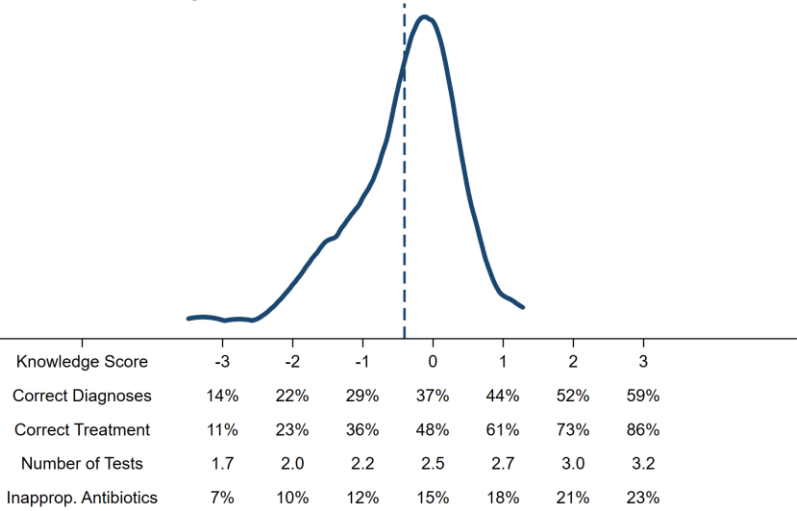
In this figure, one can see how the distribution in provider knowledge for providers who work in private facilities compare to those who work in public facilities.

In Senegal, no private facilities were surveyed.

Providers in Senegal 2010



Providers in Senegal 2010



Demographic Variation

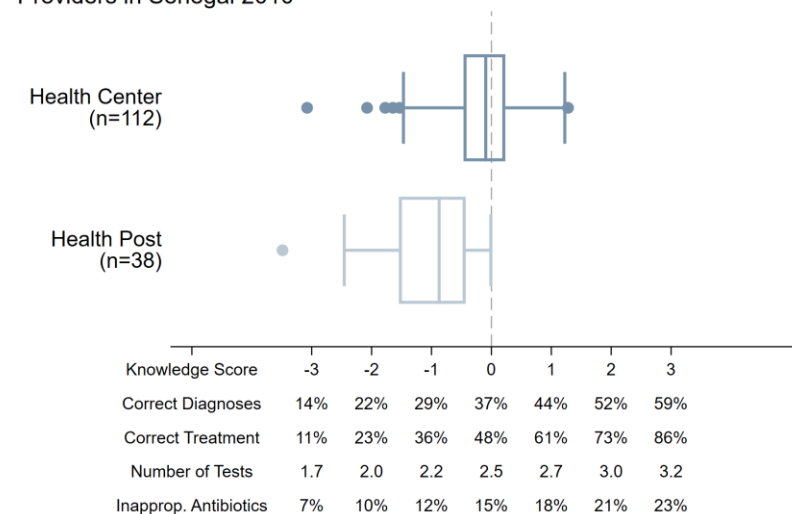
Comparing Providers at Different Facility Types

The distributions of knowledge for providers working in different tiers of the health care system are shown here.

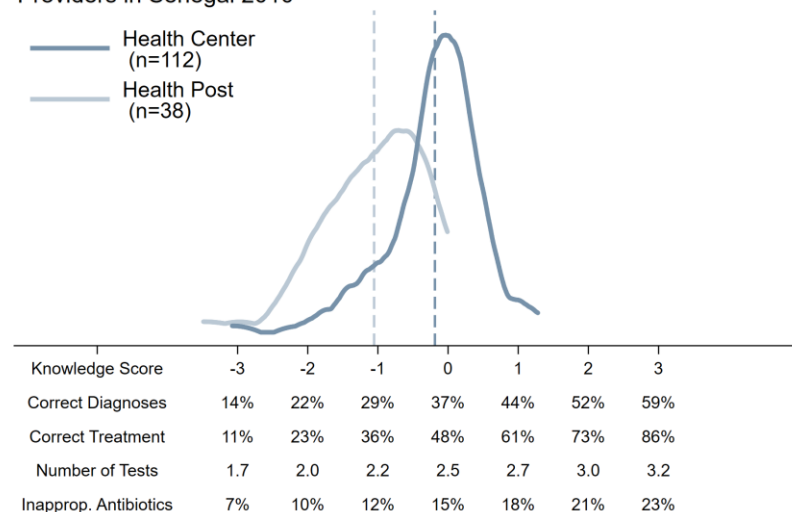
There were no hospitals surveyed in Senegal.

Those in health posts have a lower median knowledge score. Providers in health posts are mainly nurses while those in hospitals span different professions.

Providers in Senegal 2010



Providers in Senegal 2010



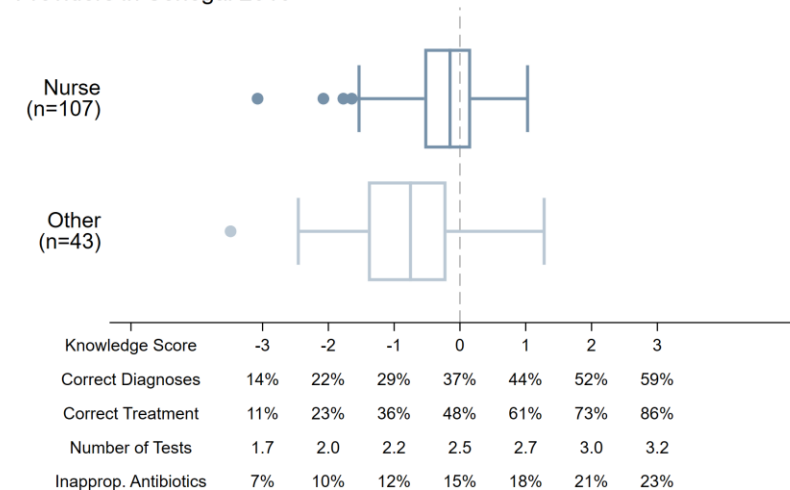
Demographic Variation

Comparing Providers of Different Professions

These figures allow one to compare the overall distribution in provider knowledge across different professional cadres.

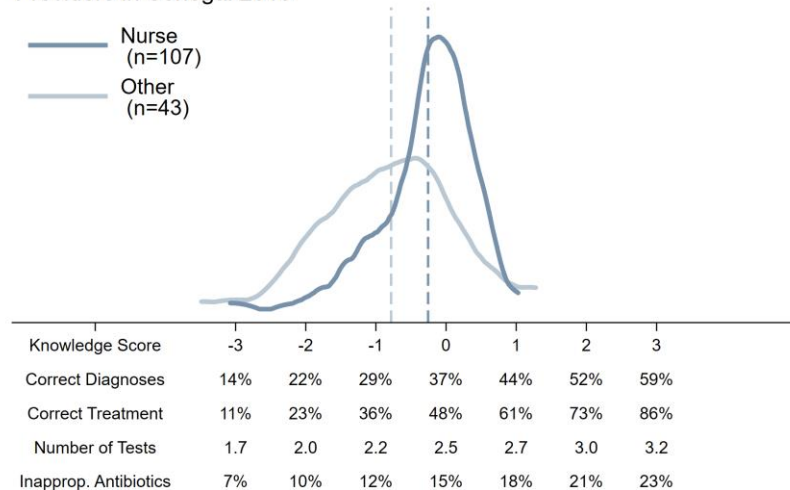
There were no doctors surveyed in Senegal, leaving one to compare nurses to “other” providers, which captures nursing assistants and various other auxiliary health care workers.

Providers in Senegal 2010



Categories with less than 10 observations were excluded.

Providers in Senegal 2010



Categories with less than 10 observations were excluded.

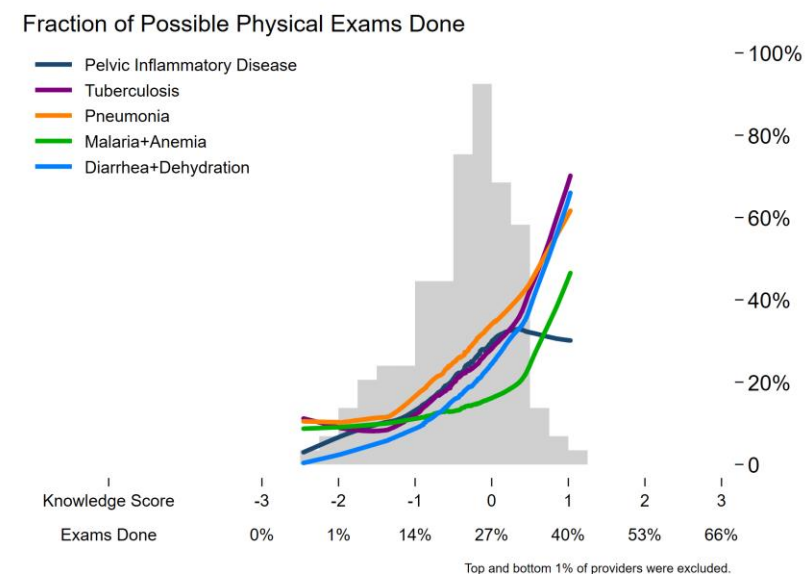
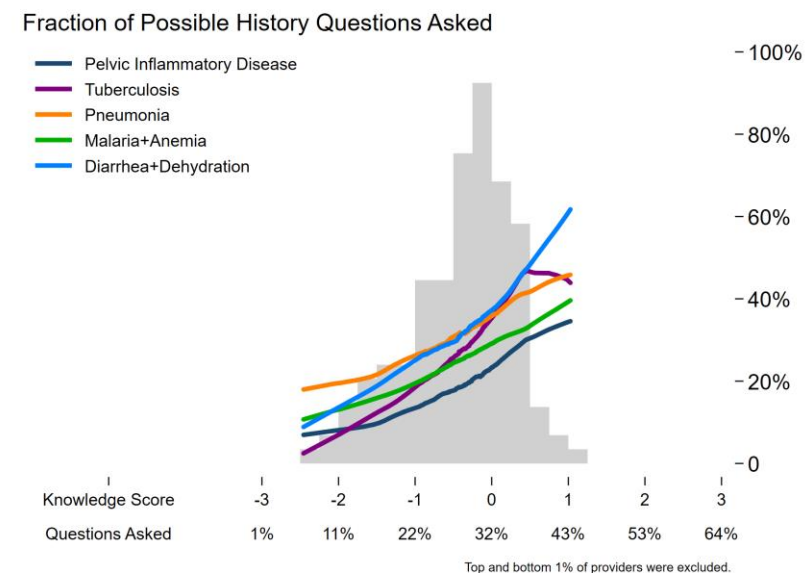
Appendix - Knowledge Score vs. Vignette-Specific Behavior

SDI – Senegal

Diagnostic Knowledge Assessment

Vignette-Specific History Taking and Physical Examination Behavior

Here, one can see whether and how the history taking and physical examination behaviors vary over the knowledge distribution, allowing one to compare the behavior of the most and least knowledgeable provider for specific vignettes.



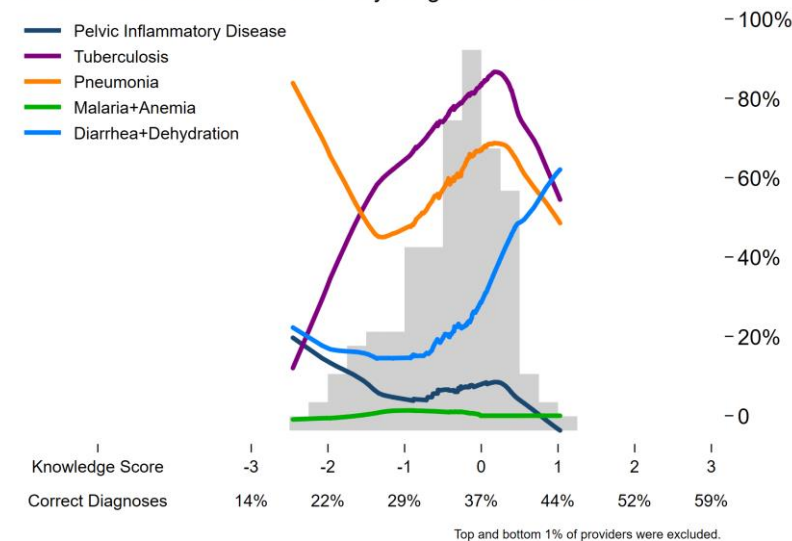
Diagnostic – Treatment Linkages

Vignette-Specific Treatment Indicators, By Knowledge Score

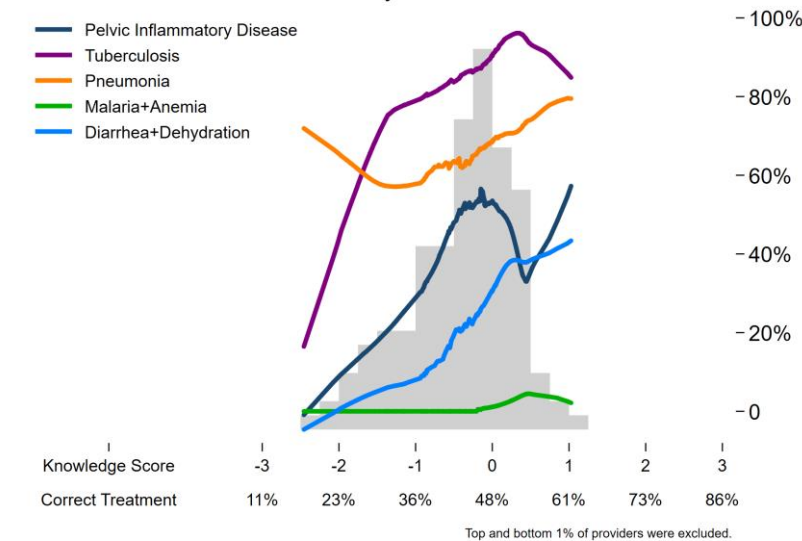
In these figures, one can look at the degree to which correct diagnosis and treatment for the different vignettes vary across the spectrum of provider knowledge.

Similarly, one can look at how the number of tests ordered for each vignette and whether inappropriate antibiotics were prescribed varies over the provider knowledge distribution.

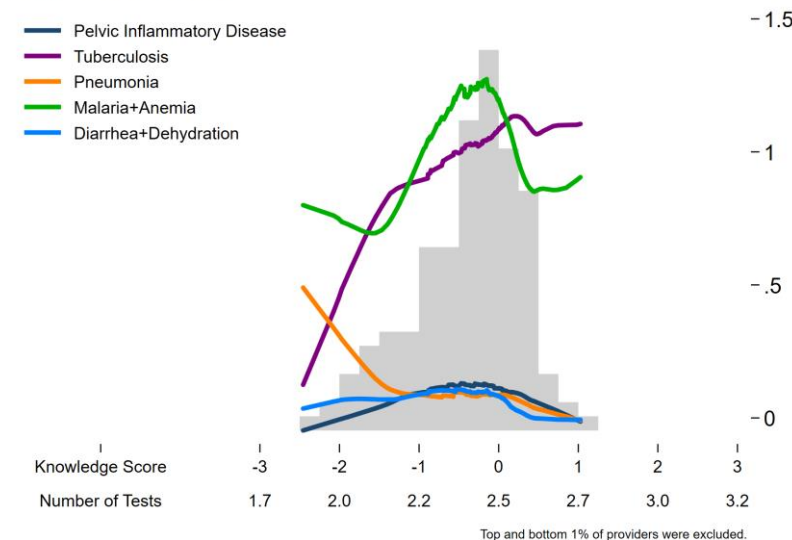
Fraction of Providers Who Correctly Diagnosed Condition



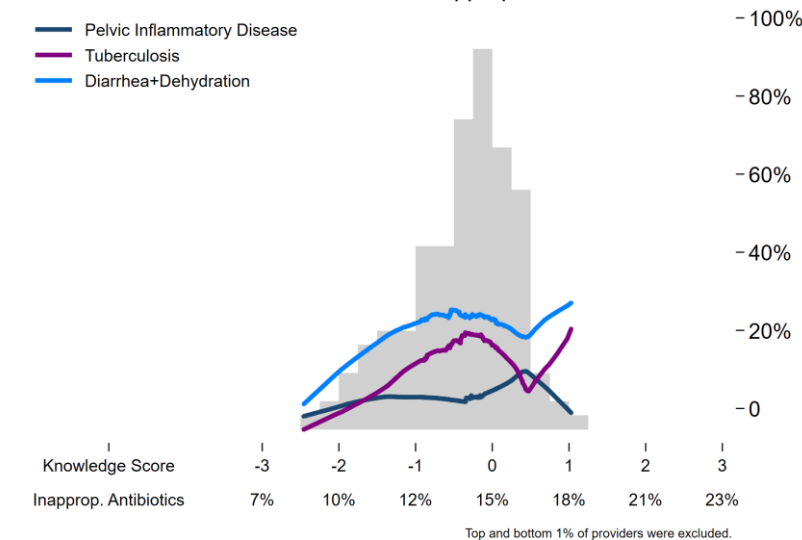
Fraction of Providers Who Correctly Treated Condition



Number of Tests Done



Fraction of Providers Who Prescribed Inappropriate Antibiotics



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- Jishnu Das

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- SDI Team

For any questions, please contact: Jishnu Das, jdas1@worldbank.org

The data used for this analysis can be found <https://github.com/worldbank/SDI-Health>. Additional documentation on the Service Delivery Indicators can be found <https://www.sdindicators.org/>.