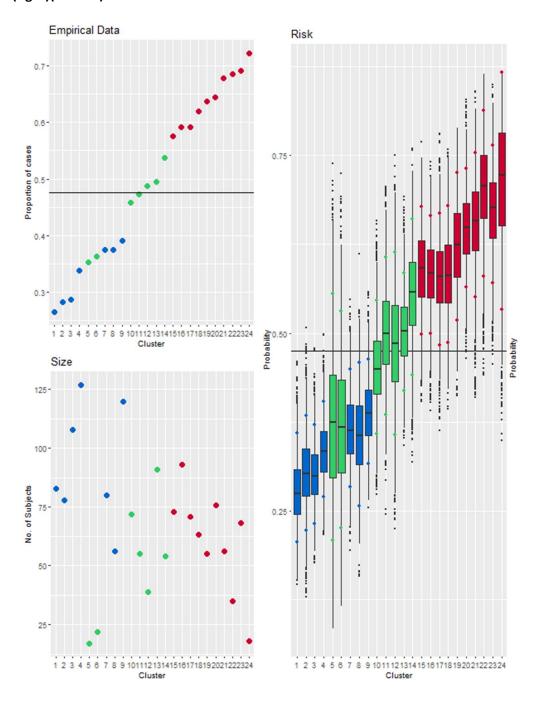
Supplementary Materials

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1. Bayesian Profile regression, additional results

Figure S1: Description of the 24 clusters: sample size (left)and median MDR risk with CI (right)(n=1610)



Note: Blue colours represent clusters with low risk of MDR UTI; green colours indicate clusters with average risk of MDR UTI, and red colours indicate clusters with high risk of MDR UTI

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Figure S2: Difference from the median values for 42 variables in the 7 low-risk MDR UTI clusters.

Tertiary/secondary vs primary care	0.48	-0.35 0.12	0.48	0.47	-0.35 0.15	-0.1	0.48		
Urban vs rutal - International travel (yes vs no) -	-0.16	0.12	-0.16	-0.16	0.19	-0.1	-0.12		
Site: KY: Nairobi -	0.18	0.66	-0.07	-0.1	0.62	-0.13	0.46		
Site: KY: Makueni •	0.14	-0.1	0.34	0.39	-0.09	-0.08	-0.01		
Site: KY: Nanyuki -	0.19	-0.1	0.26	0.25	-0.08	-0.07	90.0		
Site: UG: Nakapiripirit •	-0.00	-0.00	-0.06	-0.06	-0.06	0.49	-0.06		
Site: US: Mberara	-0.09	4.02	-0.09 -0.04	-0.04	-0.07	-0.08	-0.09		
Site: UG: Nakasongola • Site: TZ: Mboya •	-0.07	4.07	-0.07	-0.07	-0.02	0.05	-0.04		
Site: TZ: Kilimanjaro -	-0.00	-0.09	-0.09	-0.09	-0.07	-0.07	-0.09		
Site: TZ: Mwarga-	40.17	-0.13	-0.18	-0.17	-0.15	0.08	-0.17		
HH consumes milk -	0.14	0.13	0.15	0.12	0.12	-0.06	0.15		
Pubbish dumped near HH -	-0.21	0.1	-0.19	-0.17	-0.04	0.23	-0.53		
Uses ABs with livestock -	-0.09	-0.09	-0.07	-0.09	0.49	-0.01	-0.1		
HH uses manure *	-0.2	-0.2	-0.12	-0.19	0.3	-0.02	-0.22		
HH has livestock-	0.00	-0.3 0.15	-0.22	-0.28	0.35	-0.00	-0.3 0.14		
Uses soop when handwashing - Tollet Public flush -	0.00	0.15	0.12	0.08	0.09	-0.08	-0.01		
Tolet: Private flush	0.26	-0.14	0.64	-0.16	D	4.21	0.01		
Tollet: Pit latrine -	-0.21	-0.22	-0.36	-0.2	-0.26	0.34	-0.25		
Tollet: No facility -	-0.05	-0.05	-0.06	-0.06	-0.03	0.04	-0.05		
Drinking water: Protected public -	-0.01	9.32	-0.29	0.64	-0.05	-0.00	0.16		
Drinking water: Protected private -	0.12	-0.26	0.51	-0.40	-0.11	-0.14	-0.11		
Drinking water: Unprotected private -	-0.04	0.01	-0.06	0.04	0.04	0.04	90.02		
Drinking water: Unprotected public -	-0.07	-0.06	-0.06	-0.07	0	0.00	-0.06		
Washing water: protected public -	0.04	-0.28	-0.37 0.51	0.54	0.03	-0.06	-0.2		
Washing water: Protected private - Washing water: Unprotected public -	-0.04	4.02	-0.06	-0.06	-0.01	0	-0.02		
Washing water: Unprotected private -	-0.09	-0.09	-0.09	-0.09	-0.04	-0.01	-0.06		
Raw servage near HH -	-0.14	0.15	-0.26	-0.24	-0.12	-0.16	0.21		
HH head has secondary+ education -	0.41	0.36	0.41	0.49	0.39	0.23	0.42		
HH has a TV+	0.21	0.36	0.43	0.1	0.21	-0.19	0.19		
HH has electricity -	0.17	0.15	0.17	0.17	0.08	-0.09	0.17		
HH has a smartphone *	-0.10	0.61	-0.14	-0.13	0.6	-0.09	-0.13		
HH owns land-	-0.22	-0.45	0.09	-0.02	0.23	0.23	-0.24		
Temporary or mud walls vs cement, brick or metal = HH owns house =	-0.16	-0.16	-0.18 -0.11	-0.18	-0.15	0.07	-0.17 -0.45		
Has health insurance	0.27	0.23	0.39	0.21	0.05	-0.00	0.16		
Medicine stock outs are an obstacle -	0.07	-0.23	0.14	0.05	-0.1	0.59	0.51		
Lack of money is an obstacle -	-0.05	0.31	-0.19	0.1	-0.04	-0.35	-0.3		
Experienced AMR -	-0.11	0.14	-0.01	-0.03	0.33	0.09	0.2		
Difficulty whealth costs -	-0.02	0.1	-0.06	0.07	0.07	0.1	-0.32		
Sick household member -	-0.13	-0.12	-0.13	-0.12	0.11	0.12	-0.06		
Knows the term 'antibiotic' -	0.42	-0.15	0.43	0.42	-0.11	0.22	0.26		
UTI treatment seeking: direct to clinic - UTI treatment seeking: 1 treatment failure -	-0.43	0.09	0.42	0.43	0.25	0.12	-0.08		
UTI treatment seeking: 2 treatment failure -	-0.07	-0.05	-0.13	-0.13	-0.09	-0.08	-0.11		
UTI treatment seeking: 3+ treatment failure -	-0.01	-0.06	-0.08	-0.07	-0.05	4.05	-0.06		
Is familiar with Albs -	0.01	4.11	0.15	-0.17	-0.3	0.34	-0.06		
Feels UTI stigme -	0.11	0.31	-0.17	0.2	0.16	-0.02	0.06		
Has recurrent UTI symptoms -	0.23	4.09	0.05	0.11	-0.01	-0.09	-0.12		
Heard the form AMR -	-0.08	-0.07	-0.08	-0.05	0.23	0.18	0.22		
Took Alls in past 6 months -	0.39	-0.52	0.02	-0.06	-0.52	0.17	0.12		
Went to government clinic to treat UTI symptoms - Took Alik recently for UTI -	0.12	0.22	-0.26	-0.25	-0.17	0.06	-0.09		
Patient difficulty with health costs -	0.57	-0.23 0.11	-0.25 -0.26	-0.05	0.08	0.06	-0.18 -0.21		
Went to private clinic to treat UTI symptoms -	0.15	0.11	-0.14	-0.14	-0.06	4.06	-0.12		
Delayed seeking UTI treatment -	-0.18	0.06	-0.2	-0.22	0.18	0.06	-0.11		
Has secondary educ or higher -	0.44	0.15	0.5	0.47	0.35	0.27	0.43		
Age: 25-44 years •	0.23	0.18	0.21	0.03	0.01	0.13	0.13		
Age: <25 years -	-0.01	0.04	-0.04	0.19	0.11	0	90.0		
Age: 45+ years	-0.22	-0.22	-0.17	-0.23	-0.15	4.15	-0.23		
Patient works -	0.09	-0.09	0.08	-0.18	-0.1	0.19	-0.06		
	Cluster-1:	Cluster-2;	Cluster-3:	Cluster-4;	Cluster-6;	Cluster-6;	Cluster-7;		
	(N = 83) (Bldo = 0.27)	(N = 76)	(N = 108) (Mdn = 0.00)	(N = 127)	(N = 17) (Mide = 0.75)	(N = 22)	(N = 80) (Mdn = 0.36		
(Mich = 0.27) (Mich = 0.28) (Mich = 0.29) (Mich = 0.34) (Mich = 0.35) (Mich = 0.36) (Mich = 0.36)									
	Low risk MDR clusters (Cluster Size)								
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Notes: Figure S2 displays how the 42 important variables (y axis) are distributed within each low-risk MDR cluster (x axis). The variables are grouped thematically and within each theme, ranked according to the strength and direction of the associations with MDR. The numbers in the cells indicate the distance between the proportion of this characteristic in the whole sample and the median probability of having this characteristic in the specific cluster. The shading of the blue and red colours indicates the strength of the prevalence of the factor's category in

the low-risk cluster, with deeper colours showing a higher prevalence. For example, a row which contains majority red blocks indicates that subjects that belong to a low-risk MDR UTI cluster are likely to have this factor characteristic, whereas majority blue blocks indicate that subjects that belong to a low-risk MDR cluster are not likely to have this factor characteristic. A mixture of blue or reds, or more neutral shades indicate no clear signal. Source data are provided as a Source Data file. For more detail, please consult the detailed PReMiuM plots available in Github repository: https://github.com/katykeenan1981/hatuaprofilepaper/blob/main/README.md

Figure S3: Predicted MDR UTI risks for low risk (orange) and high risk (blue) using risk factors from Figure 6, across sites (n=1610). Source data are provided as a Source Data file.

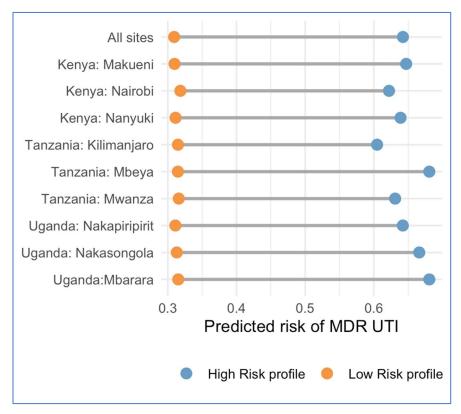


Figure S4: Predicted MDR UTI risks for low risk for very deprived (blue) and not deprived (orange) using HATUA MPI, and across sites (n=1610). Source data are provided as a Source Data file.

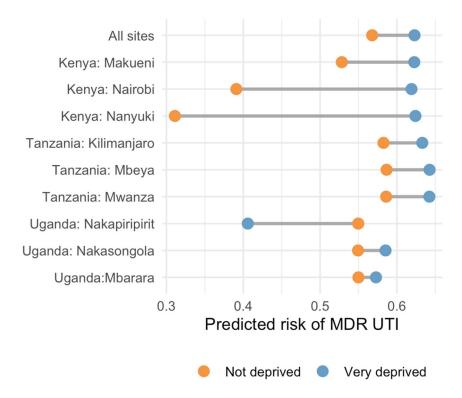


Figure S5: Difference from the median values for 37 variables in the 8 high-risk MDR UTI clusters, women only (n=1,369).

International travel (yes vs no) -	-0.15	0.12	0.12	-0.13	-0.09	0.79	0.39	-0.11
Urban va rural	-0.15	0.2	0.2	-0.14	-0.17	-0.49	-0.17	0.14
Terliary/secondary vs primary care -	-0.32	-0.04	0.09	-0.33	0.31	-0.43	-0.29	0.08
Site: UG: Nakasongola •	0.06	-0.04	-0.04	0.59	0.17	-0.03	-0.03	0.35
Site: US: Mberara	0.66	-0.09	0.08	0	0.49	-0.08	-0.06	0.27
Site: UG: Nakapiripirt - Site: TZ: Mbeys -	-0.08	-0.07 0.1	0.47	-0.07 -0.06	4.07	-0.06 0.61	-0.07 0.19	-0.06 -0.05
Site: TZ: Kilimaniaro	-0.06	0.09	0.08	-0.00	-0.04	-0.00	0.01	-0.04
Site: TZ: Mwaruta *	-0.16	0.31	0.01	-0.11	-0.16	-0.15	0.01	-0.15
Site: KY: Nanyuki-	-0.11	-0.09	-0.11	-0.1	-0.1	-0.09	-0.1	-0.1
Site: KY: Makueni -	-0.12	-0.1	-0.12	-0.11	-0.11	-0.1	-0.11	-0.11
Bita: KY: Nairobi -	-0.18	-0.14	40.16	40.17	-0.15	-0.16	-0.17	-0.15
Pubblish dumped near HH- HH uses manure -	0.16	0.16	0.28	-0.14	-0.01 0.03	0.31 0.53	0.29	-0.11
HH has livestock-	0.27	0.13	-0.02	-0.13	0.36	-0.24	0.39	-0.21
Uses Alls with livestock =	0.21	0.13	-0.05	-0.05	0.29	-0.01	0.15	-0.04
HH consumes milk-	0.04	-0.13	-0.15	0.04	-0.03	-0.46	-0.12	-0.09
Drinking water: Protected private -	-0.32	0.4	0.47	-0.35	0.29	-0.1	-0.26	0.4
Drinking water: Unprotected private -	0.12	-0.03	-0.03	-0.02	0.08	80.0	0.29	-0.02
Drinking water: Unprotected public - Drinking water: Protected public -	0.35	-0.09 -0.02	-0.05 -0.41	0.36	-0.01 -0.33	-0.11	-0.26	-0.01 -0.37
Washing water: Protected private -	-0.32	0.4	0.49	0.33	0.29	0.04	-0.25	0.35
Washing water: Unprotected public -	0.13	-0.04	-0.04	-0.03	0.00	0.19	0.29	-0.04
Washing water: Unprotected private -	0.42	-0.07	-0.06	0.07	0	-0.06	0.21	0.04
Washing water: protected public -	-0.23	-0.3	-0.4	0.27	-0.34	-0.19	-0.27	-0.30
Tollet: Pit latrine *	0.6	-0.3	-0.17	0.53	0.53	0.07	0.22	0.52
Tollet: Public flush - Tollet: Private flush -	-0.26	0.01	0.13	-0.22	-0.25 -0.25	0.19	-0.1	-0.28 -0.26
Tollet: No facility -	-0.05	-0.05	40.05	40.04	42.05	-0.03	0.06	-0.04
Raw sewage near HH-	-0.18	0.16	0.01	0.06	-0.11	-0.17	0.19	0.06
Uses scep when handwashing -	-0.17	-0.05	-0.25	-0.12	-0.12	-0.65	-0.34	-0.13
HH owns house -	0.29	0.17	-0.15	-0.1	0.23	0.3	0.36	-0.33
HH owns land =	0.36	-0.05	-0.28	0.04	0.32	-0.21 0.06	0.25	-0.09
HH has a fridge - HH has a smartphone -	-0.13	0.38	0.04	0.15	0.1	0.11	-0.11	-0.06
Temporary or mud walls vs cement, brick or metal.	0.43	-0.16	-0.09	0.04	-0.05	0.14	0.11	-0.07
HH has a TV-	-0.42	0.37	0.03	-0.34	0.14	-0.06	-0.42	-0.18
HH has electricity =	-0.2	0.11	-0.01	-0.14	0.1	-0.09	-0.26	-0.1
HH head has secondary+ education -	-0.37	0.11	-0.16	0.04	0.14	-0.14	-0.42	-0.16
Lack of money is an obstacle -	0.13	-0.31	0.2	0.27	-0.15	-0.3	0.29	0.06
Sick household member - Kept left over ABs -	-0.04	0.15	0.22	0.21	-0.06	-0.16	0.17	0.16
Difficulty whealth costs =	0.25	-0.00	-0.03	0.23	0.28	-0.49	0.01	0.21
Experienced AMR -	0.18	-0.07	-0.1	0.07	0.09	-0.41	80.0	0.06
Has health insurance -	-0.36	0.26	-0.20	-0.41	-0.32	0.17	0.00	-0.29
Medicine stock outs are an obstacle -	-0.19	0.02	-0.29	42.15	80.0	-0.29	-0.25	-0.11
Went to government clinic to treat UTI symptoms - Went to private clinic to treat UTI symptoms -	0.17	0.21	0.02	0.25	0.33	-0.2 0.27	0.43 0.18	0.13
Took ABs recently for UTI-	0.15	0.14	0.03	0.24	0.25	-0.15	0.16	0.19
is familiar with Albs -	0.16	0.24	D	0.15	0.34	-0.22	-0.27	0.91
UTI treatment seeking: 2 treatment failure -	0.12	0.12	0.00	0.08	0.13	0.16	0.26	0.07
UTI treatment seeking: 3+ treatment failure -	0.09	0.09	-0.01	0.07	0.13	-0.00	0.08	0.1
UTI treatment seeking: 1 treatment failure -	0.06	0	0.15	0.16	0.00	-0.15	-0.03	0.04
UTI treatment seeking: direct to dinic - Feets UTI stigms -	0.41	-0.23 -0.15	-0.18 -0.14	-0.32 0.34	-0.37 0.31	-0.04	-0.34 -0.16	-0.28 0.16
Delayed seeking UTI treatment -	0.27	0.13	0.16	0.13	0.13	0.16	0.37	0.16
Knows the term 'antibiotic' -	0.17	0.1	-0.39	0.27	-0.01	-0.33	-0.43	0.02
Took ABs in past 6 months -	-0.25	0.31	0.13	-0.47	-0.25	0.4	0.16	-0.33
Heard the term AMR-	0.16	0.05	0.12	0.2	0.11	-0.26	-0.03	0.11
Plass recurrent UTI symptoms -	-0.02	-0.04	-0.06	0.01	0.22	-0.21	0.04	0.04
Patient difficulty with health costs - No of children: 4 -	0.22	-0.06	-0.02	-0.05 -0.04	0.01	0.09	-0.09 0.45	-0.04
No of children: 2-	-0.05	0.07	40.01	-0.08	4.00	-0.11	-0.05	0
No of children: 3 -	-0.03	0.00	-0.02	9.00	0.01	0.06	-0.09	0.04
No of children: 1 =	-0.08	-0.04	D	0.06	-0.07	-0.12	-0.15	-0.03
No of children: 0 -	-0.17	-0.07	0.09	-0.04	-0.05	80.0	-0.18	-0.06
Currently pregnant -	-0.14	-0.07	0.06	0.08	-0.09	-0.22	-0.18	-0.11
Patient works - Age: 45+ years -	0.13	0.07	-0.08	40.13	0.11	0.11	0.1 0.54	-0.08
Age: <25 years *	-0.06	-0.14	0.14	0.25	-0.03	-0.02	-0.2	-0.06
Age: 25-44 years -	-0.06	0.08	-0.06	-0.16	-0.09	-0.12	-0.36	0.07
Has secondary educ or higher -	-0.01	0.02	-0.17	0.01	0.05	-0.18	-0.38	-0.17
	Cluster-15:	Cluster-16:	Cluster-17;	Cluster-18:	Cluster-19:	Cluster-20:	Cluster-21;	Cluster-22;
	(N = 106)	(N = 49)	(N = 77)	(N = 31)	(N = 33)	(N = 19)	(N = 26)	(N = 48)
	(Mdn=0.58)	(Mdn=0.59)	$\{Mdn=0.61\}$		$\{Mdn=0.64\}$	(Mdn = 0.74)		(Mdn = 0.77)
			High	risk MDR clus	sters (Cluster)	Size)		
			_	later	make are en			
			D	istance from	m the Media	ın		
			1 1					

Notes: Figure S5 displays how the 37 important variables (y axis) are distributed within each high-risk MDR cluster (x axis). The variables are grouped thematically and within each theme, ranked according to the strength and direction of the associations with MDR. The numbers in the cells indicate the distance between the proportion of this characteristic in the whole sample and the median probability of having this

characteristic in the specific cluster. The shading of the blue and red colours indicates the strength of the prevalence of the factor's category in the high-risk cluster, with deeper colours showing a higher prevalence. For example, a row which contains majority red blocks indicates that subjects that belong to a high-risk MDR UTI cluster are likely to have this factor characteristic, whereas majority blue blocks indicate that subjects that belong to a high-risk MDR cluster are not likely to have this factor characteristic. A mixture of blue or reds, or more neutral shades indicate no clear signal. Source data are provided as a Source Data file.

Figure S6: Difference from the median values for 37 variables in the 5 low-risk MDR UTI clusters, women only (n=1,369).

Tertiary/secondary vs primary care - Urban vs rural -	-0.38 0.14	0.49	0.51	0.5	0.49
International travel (yes vs no) -	0.49	-0.16	-0.17	-0.17	-0.12
Site: KY: Nanyuki =	-0.11	0.23	0.26	0.0	0
Site: KY: Makueni -	-0.12	0.16	0.38	0.35	0.1
Site: KY: Nainobi - Site: UC: Naivasongola -	-0.02	0.07 -0.04	-0.14 -0.05	-0.13 -0.05	-0.05
Site: U.G. Nakapiripirit	-0.08	-0.09	-0.08	-0.09	-0.08
Site: UG: Mberers •	-0.09	-0.09	41	-0.1	-0.1
Site: TZ: Kilimanjaro -	-0.05	0.04	-0.05	-0.05	-0.05
Site: TZ: Mbeyn	-0.07	4.67	-0.00	-0.00 -0.17	-0.00 -0.17
Site: TZ: Mwanza - HH consumes mik -	-0.14 0.13	-0.17 0.13	0.17	0.13	0.15
Uses ABs with livestock -	-0.06	-0.06	-0.02	-0.07	-0.03
HH uses manure -	-0.17	-0.17	-0.08	-0.13	-0.21
Rubbish dumped near HH -	0.09	-0.17	-0.18	-0.25	-0.52
HH has livestock -	-0.26	40.28	-0.16	-0.15	-0.21
Uses soap when handwashing - Tollet: Public flush -	0.14	0.1	0.11 -0.26	0.08	-0.08
Tollet: Private flush-	-0.13	0.27	0.65	-0.07	0.34
Tollet: Pit latrine -	-0.22	4.23	-0.34	-0.21	-0.21
Toilet: No facility -	-0.05	-0.05	-0.06	0.05	-0.05
Drinking water: Protected public -	0.29	-0.05	-0.42	0.52	-0.09
Drinking water: Protected private -	-0.24	-0.08	0.54	-0.42 -0.64	-0.1 0.06
Drinking water: Unprotected private - Drinking water: Unprotected public -	-0.06	-0.04	-0.07	-0.06	0.00
Washing water: protected public -	0.36	-0.01	-0.43	9.52	0.18
Washing water: Protected private -	-0.27	0.08	0.57	-0.30	-0.12
Washing water: Unprotected public -	-0.01	-0.03	-0.06	-0.05	-0.01
Washing water: Unprotected private -	-0.08	-0.06	-0.09	-0.09	-0.06
Flaw servage near HH - HH head has secondary+ education -	0.17	-0.15 0.87	-0.26 0.38	-0.26 0.4	0.19
HH has a TV-	0.35	0.21	0.42	0.13	0.22
HH has electricity -	0.16	0.16	0.16	0.17	0.16
HH has a fridge -	0.12	0.14	0.39	-0.12	0.1
HH has a smartphone *	0.6	4.13	-0.14	4.14	-0.12
HH owns land-	-0.43 -0.40	-0.2 -0.33	0.11	-0.08	-0.29 -0.37
emporary or mud walls vs cement, brick or metal -	-0.14	0.16	-0.18	0.14	-0.15
Has health insurance -	0.27	0.29	0.4	0.19	0.2
Medicine stock outs are an obstacle -	-0.24	0.04	0.16	0.14	0.42
Lack of money is an obstacle -	0.34	-0.01	-0.2	93.0	-0.3
Kept left over Albs =	0.17	-0.05 -0.11	-0.17	4.13	-0.13
Sidk household member - Experienced AWR -	0.14	-0.13	-0.1	-0.07	0.14
Difficulty whealth costs -	0.09	40.00	-0.08	0.00	-0.37
Knows the term 'antibiotic' -	-0.2	0.41	0.42	0.42	0.19
Is furnitur with ABs *	-0.13	0.36	0.15	42.17	-0.11
Took ABs in past 6 months -	-0.5	0.41	0.03	-0.02	0.21
Feels UTI stigms - UTI treatment seeking: direct to clinic -	0.36	0.05	-0.19 0.39	0.41	0.01
UTI treatment seeking: 1 treatment failure -	0.02	0.52	-0.21	-0.23	0.07
UTI treatment seeking: 2 treatment failure -	-0.02	-0.07	-0.13	42.13	-0.09
UTI treatment seeking: 3+ treatment failure -	0	0	-0.06	-0.06	-0.01
Has recurrent UTI symptoms -	-0.06	0.29	0.00	0.11	-0.11
Heard the term AMR - Took Alik recently for UTI -	-0.11	-0.07 0.67	-0.04	-0.94	-0.09
Patient difficulty with health costs -	0.1	4.02	-0.29	4.05	-0.17
Went to private clinic to treat UTI symptoms -	0.13	0.18	-0.12	-0.12	-0.06
Vent to government clinic to treat UTI symptoms =	-0.2	0.12	-0.25	-0.24	0.07
Delayed seeking UTI treatment -	0.14	0.18	0.2	0.21	0.14
No of children: 2+ No of children: 1+	0.11	0.17	0.02	0.07	-0.02
No of children: 0 -	-0.05	0.08	0.1	0.18	0.17
No of children: 3 *	0	-0.00	-0.02	-0.00	-0.03
No of children: 4-	-0.19	-0.2	-0.2	-0.22	-0.21
Outrently pregnant •	0.07	4.22	-0.01	0.15	0.04
Has secondary educ or higher-	0.06	0.45	0.48	0.46	0.37
Age: 25-44 years - Age: <25 years -	0.13	0.16	0.17 -0.05	-0.02 0.18	0.11
Age: 45+ years -	-0.16	43.15	-0.12	-0.16	-0.14
Patient works	-0.15	0.11	0.03	-0.2	-0.09
	Cluster-1;	Cluster-2;	Cluster-3:	Cluster-4;	Cluster-5:
	(N = 00)	(N = 65)	(N = 103)	(N = 152)	(N = 78)
	(Mdn = 0.29)	$\{Mdn = 0.29\}$	(Mdn = 0.3)	(Mcln = 0.3)	(Mdn = 0.31)
		Low ris	k MDR clusters (Clust	or Size)	

Notes: Figure S6 displays how the 37 important variables (y axis) are distributed within each low-risk MDR cluster (x axis). The variables are grouped thematically and within each theme, ranked according to the strength and direction of the associations with MDR. The numbers in the cells indicate the distance between the proportion of this characteristic in the whole sample and the median probability of having this

characteristic in the specific cluster. The shading of the blue and red colours indicates the strength of the prevalence of the factor's category in the low-risk cluster, with deeper colours showing a higher prevalence. For example, a row which contains majority red blocks indicates that subjects that belong to a low-risk MDR UTI cluster are likely to have this factor characteristic, whereas majority blue blocks indicate that subjects that belong to a low-risk MDR cluster are not likely to have this factor characteristic. A mixture of blue or reds, or more neutral shades indicate no clear signal. Source data are provided as a Source Data file.

Figure S7: Difference from the median values for 39 variables in the 10 high-risk EA ABR clusters.

International travel (yes vs.no) =	a	0.13	0.14	-0.17	0.77	-0.13	-0.15	-0.12	-0.12	-0.1
Site: TZ: Mbeys =	-0.04	0.11	0.07	-0.07	0.62	-0.04	-0.06	-0.03	-0.06	-0.05
Site: UG: Nakasongola • Site: TZ: Meurus •	-0.04	-0.03 D.46	-0.04 0.36	-0.04 -0.18	-0.02	-0.02	-0.17	-0.04 -0.08	-0.17	-0.14
Site: UG: Mbanani -	-0.09	-0.08	-0.09	-0.09	-0.07	-0.04	0.71	-0.08	0.62	0.06
Site: TZ: Kilmanjaro *	0.66	-0.03	0.06	-0.09	-0.07	-0.07	-0.09	0.63	-0.08	-0.09
Site: UG: Nakapiripirit -	-0.08	-0.07	-0.08	0.85	-0.06	0.57	-0.08	-0.07	-0.08	-0.07
Site: KY: Makueni -	-0.1	-0.11	-0.1	-0.11	-0.09	-0.08	-0.11	40.1	-0.09	-0.1
Site: KY: Nanyuki -	-0.1	-0.1	-0.1	-0.1	-0.06	-0.08	42.1	4.1	-0.09	-0.1
São: KY: Nairobi -	-0.14	-0.17	-0.14	-0.17	-0.15	-0.15	-0.17	-0.16	0.16	-0.16
Tertiary/secondary vs primary care -	0.36	-0.38	-0.1	0.5	-0.46	-0.42	0.4	0.35	0.35	-0.26
Urban vs rural - HH has livestock -	80.0	-0.14	0.21	-0.59	-0.46 -0.31	-0.15	-0.84	0.08	-0.09	-0.01
Uses ABs with Evestock -	0.46	0.36	0.1	-0.07	-0.07	-0.06	0.23	0.37	0.21	-0.22
HH uses manure -	0.16	0.29	0.09	0.41	0.61	0.01	0.16	0.13	-0.05	-0.21
Rubbish dumped near HH-	0.04	0.28	0.1	-0.06	0.31	0.2	0.08	0.1	0.05	0.24
HH consumes milk -	0.04	-0.16	-0.16	0.12	-0.48	-0.09	0.09	-0.1	-0.04	-0.07
Drinking water: Protected private -	0.42	-0.36	0.42	-0.45	-0.1	-0.12	-0.36	0.45	0.24	-0.09
Drinking water: Unprotected private -	-0.03	0.13	-0.04	-0.05	0.02	0.01	0.12	-0.03	-0.01	-0.02
Drinking water: Unprotected public +	-0.07	0.29	-0.07	0.01	-0.01	-0.02	0.30	-0.07	0.03	0.01
Drinking water: Protected public -	-0.34	-0.08	-0.50	0.47	-0.01	0.07	-0.15	-0.97	-0.27	0.05
Washing water: Protected private -	-0.04	-0.35 0.13	-0.05	-0.09 -0.05	0.2	-0.05	-0.36	-0.04	-0.01	-0.1 -0.04
Washing water: Unprotected public = Washing water: Unprotected private =		0.13	-0.06	-0.01	-0.06	-0.02	0.46	-0.04	0.05	0.07
Washing water: Protected public -	-0.34	-0.11	-0.31	0.45	-0.16	0.07	-0.23	-0.07	-0.28	0.06
Tallet: Pit latrine -	-0.08	0.24	-0.0	-0.09	0.07	0.37	0.6	0.09	0.55	0.55
Tollet: Private flush -	0.29	-0.16	0.3	-0.31	-0.26	-0.27	-0.31	0.15	-0.28	-0.29
Total: No facility =	-0.05	0.07	-0.05	0.64	-0.03	0.08	-0.05	-0.04	-0.05	-0.05
Tollet: Public flush=	-0.17	-0.15	0.05	-0.24	0.21	41.2	-0.24	-0.21	-0.23	-0.21
Raw sowage near HH-	-0.04	0.08	0.23	-0.01	-0.17	-0.16	-0.17	-0.02	-0.09	0.02
Uses soap when handwashing -	0.1	-0.36	0	0.14	-0.67	-0.06	-0.19	-0.11	-0.09	-0.1
HH owns house - HH owns land -	0.38	0.17	-0.01	0.34	-0.24	0.03	0.26	0.02	0.07	-0.29
Temporary or mud walls vs cement, brick or metal -	-0.14	0.12	-0.17	0.8	0.16	0.61	0.42	0	-0.07	-0.03
HH has a smartphone -	0.02	-0.12	0.38	-0.14	0.11	-0.1	-0.1	-0.05	0.08	0.15
HH has a TV-	0.24	-0.42	0.37	-0.6	-0.07	-0.29	-0.41	-0.05	-0.01	-0.27
HH has electricity -	0.12	-0.26	0.11	-0.66	-0.09	-0.12	-0.22	-0.06	0.1	-0.13
HH head has secondary+ education -	-0.19	-0.45	0.18	-0.49	-0.09	0.13	-0.38	-0.5	-0.12	0.01
Sick household member -	0.14	0.17	0.12	-0.12	-0.02	0.12	0.21	0.14	0.34	0.17
Difficulty whealth costs -		0.11	-0.42	0.07	-0.52	0.12	0.23	0.19	0.31	0.22
Lack of money is an obstacle -	-0.23	0.25	-0.25	-0.26	-0.32	-0.32	0.15	0.47	-0.16	0.15
Has health insurance - Medicine stock outs are an obstacle -	-0.13	-0.09 -0.24	0.02	-0.14 0.40	-0.27	-0.14	-0.39 -0.17	-0.25 -0.25	-0.25 D	-0.06
Experienced AMFI -	-0.25	0.12	-0.07	-0.23	-0.43	0.02	0.19	-0.29	0.07	0.11
Took Affa recently for UT1 -	0.01	-D.11	0.17	-0.07	-0.17	0.14	0.10	0.29	0.18	0.25
Went to government clinic to treat UTI symptoms =	0.2	0.06	0.19	-0.12	-0.23	0.12	0.15	0.19	0.2	0.18
Took ABs in past 6 months -	0.39	-0.16	0.31	-0.14	0.39	0.23	-0.26	0.4	-0.25	-0.53
UTI treatment seeking: 3+ treatment failure -	0.27	-0.01	0.11	-0.06	-0.05	-0.04	0.09	0.22	0.09	0.06
UTI treatment seaking: 2 treatment failure -	0.11	0.11	0.11	-0.13	0.17	-0.06	0.1	0.09	0.06	0.11
UTI treatment seeking: direct to clinic -	-0.38	-0.11	-0.23	0.24			-0.25	-0.41	-0.27	-0.27
UTI treatment seeking: 1 treatment failure -	-0.02	-0.02	0	-0.04	-0.16	0.06	0.06	0.09	0.1	0.08
Is familiar with ABs - Feels UTI stigma -	-0.04	-0.24	0.24 -0.15	-0.08	-0.21	0.02	0.16	0.01	0.35	0.24
Consumed NTG ABs -		-0.23	0.15	0.04	-0.12	0.28	-0.07	0.24	-0.01	-0.29
Knows the term 'antibiotic' -	-0.08	-0.5	0.13	-0.19	-0.32	0.17	0.25	-0.34	-0.09	0.29
Patient difficulty with health costs -		90.0	-0.32	0.31	-0.22	0.17	0.24	0.28	0.07	0.05
Has recurrent UTI symptoms -	0.16	-0.2	-0.01	-0.3	-0.22	-0.11	0.01	0.19	0.15	0.08
Age: 45+ years -	0.67	0.34	0.09	-0.04	0.03	-0.12	0.09	0.63	0.02	-0.19
Age: <25 years -	-0.23	-0.06	-0.11	0.09	0.01	0.01	0	-0.21	-0.02	0.17
Age: 25-44 years -	-0.45	-0.29	0	-0.06	-0.1	0.09	-0.09	-0.33	-0.09	0.01
Has secondary educ or higher -	-0.23	-0.42	0.09	-0.41	-0.16	0.25	-0.29	-0.46	-0.11	-0.03
	Cluster-16;	Cluster-17;				Cluster-21;		Cluster-23;	Cluster-24;	Cluster-25;
	(N = 63) (Mdn = 0.6)	(N = 79) (Mdn = 0.61)	(N = 61) (Mdn = 0.64)	(N = 117) (Mdn = 0.66)	(N = 18) (Mdn = 0.72)	(N = 23) (Mdn = 0.78)	(N = 102) (Mdn = 0.79)	(N = 44) (Mdn = 0.84)	(N = 63) (Mdn = 0.86)	(N = 64) (Mdn = 0.8)
	,					sters (Cluster		,	, = 1000)	,
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Notes: Figure S7 displays how the 39 important variables (y axis) are distributed within each high-risk MDR cluster (x axis). The variables are grouped thematically and within each theme, ranked according to the strength and direction of the associations with MDR. The numbers in the cells indicate the distance between the proportion of this characteristic in the whole sample and the median probability of having this characteristic in the specific cluster. The shading of the blue and red colours indicates the strength of the prevalence of the factor's category in

the high-risk cluster, with deeper colours showing a higher prevalence. For example, a row which contains majority red blocks indicates that subjects that belong to a high-risk MDR UTI cluster are likely to have this factor characteristic, whereas majority blue blocks indicate that subjects that belong to a high-risk MDR cluster are not likely to have this factor characteristic. A mixture of blue or reds, or more neutral shades indicate no clear signal. Source data are provided as a Source Data file.

Figure S8: Difference from the median values for 39 variables in the 8 low-risk EA ABR clusters.

Tertiary/secondary vs primary care •	-0.36	0.40	-0.35	0.47	0.48	0.47	-0.34	0.47
International travel (yes vs no) =	0.53	-0.15	0.47	-0.16	-0.16	-0.15	0.06	-0.11
Urban vs rural •	0.13	0.12	0.13	-0.15	0.07	0.14	0.21	0.2
Site: ICY: Nanyuki =	-0.09	0.26	-0.1	0.27	0.25	0.17	-0.1	0.08
Site: ICY: Makueni -	-0.09	0.33	4.11	0.13	0.39	0.14	-0.1	-0.04
Site: KY: Nairobi =	0.53	-0.06	0.68	0.08	-0.1	0.17	0.62	0.47
Site: TZ: Mbeye *	-0.05	-0.07	-0.07	-0.07	-0.07	-0.04	-0.05	-0.06
Site: TZ: Klimanjaro -	-0.07	-0.09	-0.00	-0.09	-0.09	-0.08	-0.07	-0.09
Site: TZ: Mwarza -	-0.15	-0.17	40.13	-0.17	-0.17	49.17	-0.15	-0.17
Site: UG: Nakasongola-	50.0	0.04	4.03	-0.04	0.04	0.04	0.08	0.04
Site: UG: Mbarara -	-0.07	-0.09	-0.09	-0.09	0.09	-0.09	-0.09	0.09
Site: UG: Nakapiripint -	-0.06	-0.08	-0.08	-0.07	-0.08	-0.08	-0.08	0.08
HH consumes milk -	0.11	0.16	0.13	0.14	0.12	0.14	0.06	0.15
HH has livestock -	0.38	-0.21	-0.3	0.56	-0.28	-0.29	-0.38	-0.3
HH uses manure -	0.28	-0.13 -0.07	-0.2	0.16	-0.19 -0.09	-0.08	-0.2	-0.22
Uses ABs with Ivestock -	-0.03	-0.07	0.1	-0.6	-0.18	-0.18	-0.06	-0.1 -0.54
Rubbish dumped near HH -	0.07	0.12	0.15	0.11	0.09	0.08	0.1	0.14
Uses soap when handwashing -	90.0	-0.05	-0.01	0.12	-0.04	-0.06	-0.04	-0.02
Drinking water: Unprotected private -		-0.00	0.31	0.12	0.54	0	-0.36	0.15
Drinking water: Protected public - Drinking water: Protected private -	-0.00 -0.00	0.5	40.25	-0.27	-0.40	0.11	0.45	-0.09
Drinking water: Protected public =	-0.04	-0.00	4.05	-0.05	-0.07	4.07	-0.06	-0.05
Washing water: Protected public =	-0.01	-0.06	0.37	0.23	0.53	0.05	-0.05	0.26
Washing water: Unprotected public =	-0.03	-0.06	4.02	0.12	-0.05	4.05	-0.04	-0.02
Washing water: Protected private -	0.05	0.5	4.27	-0.29	-0.4	80.0	0.44	-0.19
Washing water: Unprotected private •	-0.06	-0.09	-0.08	-0.07	-0.09	-0.09	-0.06	-0.06
Tolet: Private Bush -	0	0.64	-0.12	0.12	-0.16	0.24	0.08	0.32
Tollet: Public flush-	0.24	-0.23	0.42	-0.06	0.43	90.0	-0.1	-0.02
Toilet: Pit latrine -	-0.24	-0.35	41.25	-0.08	-0.22	49.21	0.06	40.25
Tollet: No facility -	-0.03	-0.06	40.05	-0.08	-0.06	49.05	-0.05	40.05
Raw sewage near HH-	-0.13	0.25	0.16	-0.3	-0.24	-0.16	0.33	0.23
HH head has secondary+ education -	0.39	0.4	0.34	0.26	0.43	0.41	0.13	0.41
HH has electricity -	0.07	0.17	0.15	0.16	0.17	9.17	0.09	0.17
HH has a TV-	0.22	0.42	0.36	0.2	0.1	0.22	-0.06	0.19
HH has a smartphone -	0.68	-0.18	0.62	-0.18	-0.14	-0.12	0.2	-0.12
HH owns house -	0.26	-0.11	-0.51	0.41	-0.21	-0.36	-0.47	-0.46
HH owns land -	0.26	0.08	-0.45	0.47	-0.03	-0.23	-0.64	-0.26
Temporary or mud walls vs cement, brick or metal -	-0.15	-0.18	-0.15	0.15	-0.18	-0.16	-0.14	-0.16
Has health insurance -	0.36	0.38	0.22	0.2	0.21	0.25	-0.02	0.15
Experienced AMR -	0.32	-0.01	0.13	0.47	-0.02	-0.11	-0.07	0.2
Medicine stock outs are an obstacle -	-0.1	0.15	-0.23	0.61	0.07	0.06	-0.26	0.51
Lack of money is an obstacle -	-0.04	-0.19	0.0	-0.26	0.09	-0.04	0.41	-0.01
Difficulty whealth costs -	0.05	-0.07	0.1	-0.27	0.05	-0.00	-0.07	-0.22
Sick household member -	0.12	-0.12	-0.12	0.13	-0.11	-0.13	-0.11	-0.05
Knows the term 'antibiotic' =	-0.13	0.43	-0.15	0.0	0.43	0.42	-0.27	0.23
Consumed NTG ABs =	-0.25	0.12	-0.3	0.19	D	0.52	-0.26	0.21
Took ABs in past 6 months -	-0.51	0.03	-0.53	0.12	-0.06	0.41	-0.46	0.13
UTI treatment seeking: direct to clinic -	0.25	0.41	0.08	0.14	0.42	-0.45	-0.02	0.22
UTI treatment seeking: 1 treatment failure -	-0.14	-0.22	9.02	-0.02	-0.23	0.53	-0.03	-0.06
UTI treatment seeking: 3+ treatment failure -	-0.05	-0.08	-0.06	-0.02	-0.07	-0.02	-0.05	-0.06
UTI treatment seaking: 2 treatment failure -	-0.09	-0.12	40.05	-0.12	-0.13	0.08	0.05	40.11
Feels UTI stigma -	0.13	-0.16	0.3	-0.11	-0.2	0.11	0.08	0.07
is familiar with ABs -	-0.3	0.14	4.11	-0.14	-0.18	0.34	-0.1	-0.09
Has recurrent UTI symptoms -	-0.32	0.05	-0.09	0.13	0.12	0.24	-0.26	-0.13
Took ABs recently for UTI -	-0.17	-0.24	-0.23	-0.06	-0.25	0.69	-0.18	-0.17
Went to government clinic to treat UTI symptoms -	-0.18	-0.26	-0.22	-0.1	-0.25	0.11	-0.1	-0.07
Patient difficulty with health costs -	80.0	-0.26	0.12	-0.11	0.02	0.01	0.23	-0.22
Has secondary educ or higher -	0.38	0.49	0.15	0.38	0.49	0.43	0.1	0.42
Age: 25-44 years -	-0.01	0.2	0.18	-0.06	0.03	0.26	0.1	0.13
Age: <25 years -	0.15	-0.04	0.04	-0.02	0.2	-0.03	0.01	0.09
Age: 45+ years +	-0.16	-0.17	-0.22	0.02	-0.23	4.23	-0.12	-0.23
	Cluster-1;	Cluster-2:	Cluster-3:	Cluster-4;	Cluster-6:	Cluster-6;	Cluster-7;	Cluster-8;
	(N = 18)	(N = 113)	(74 = 77)	(N = 49)	(N = 129)	(N = 80)	(N = 63)	(74 = 78)
	(Mdn = 0.11)	(Mdn = 0.12)	${Mdn = 0.12}$	(Mdn = 0.14)	(Widn = 0.15)	$\{Mdn = 0.15\}$	(Mdn = 0.16)	(Mdn = 0.17)
			Lo	w risk NTG clus	ters (Cluster Siz	10)		
				Dietones from	n the Hedi			
				Distance from	n the Median			

Notes: Figure S8 displays how the 39 important variables (y axis) are distributed within each low-risk MDR cluster (x axis). The variables are grouped thematically and within each theme, ranked according to the strength and direction of the associations with MDR. The numbers in the cells indicate the distance between the proportion of this characteristic in the whole sample and the median probability of having this characteristic in the specific cluster. The shading of the blue and red colours indicates the strength of the prevalence of the factor's category in

the low-risk cluster, with deeper colours showing a higher prevalence. For example, a row which contains majority red blocks indicates that subjects that belong to a low-risk MDR UTI cluster are likely to have this factor characteristic, whereas majority blue blocks indicate that subjects that belong to a low-risk MDR cluster are not likely to have this factor characteristic. A mixture of blue or reds, or more neutral shades indicate no clear signal. Source data are provided as a Source Data file.

Figure S9: Difference from the median values for 41 variables in the 6 high-risk MDR clusters (intermediate as susceptible).

1 40.15 14 0.33 15 0.01 15 0.01 16 0.02 17 0.06 14 0.05 15 0.17 16 0.17 16 0.17 16 0.17 17 0.00 18 0.17 18 0.00 19 0.17 19 0.00 19 0.19 19 0.19 19 0.19 19 0.19 19 0.19 19 0.24 19 0.24 19 0.25 19 0.25 19 0.25 19 0.25 19 0.26 19 0.2	0.14 -0.17 -0.19 -0.14 -0.17 -0.19 -0.14 -0.17 -0.19 -0.14 -0.17 -0.19 -0.14 -0.17 -0.19 -0.14 -0.17 -0.19 -0.19 -0.10 -0.17 -0.19 -0.10 -0.17 -0.19 -0.10 -0.17 -0.19 -0.10 -0.17 -0.10 -0.17 -0.10 -0.17 -0.10 -0.17 -0.10 -0.17 -0.10 -0.17 -0.10 -0.17 -0.10 -0.17 -0.10 -0.17 -0.10 -0.17 -0.10 -0.17 -0.10 -0.17 -0.10 -0.10 -0.17 -0.10 -	0.13 -0.13 -0.13 -0.15 -0.06 -0.06 -0.07 -0.1 -0.1 -0.1 -0.1 -0.1 -0.1 -0.1 -0.1	42.03 0.25 0.1 -0.25 0 0.25 -0.1 -0.25 -0.27 -0.1 -0.1 -0.1 -0.1 -0.15 -0.22 -0.15 -0.36 -0.07 -0.1 -0.1 -0.29 -0.15 -0.39 -0.24 -0.29 -0.17 -0.14 -0.30 -0.44 -0.29 -0.17 -0.14 -0.30 -0.44 -0.29 -0.17 -0.14 -0.18 -0.19 -0.19 -0.19 -0.14 -0.19 -0.19 -0.14 -0.19 -0.19 -0.14 -0.19 -0.14 -0.19 -0.14 -0.19 -0.14 -0.19 -0.14 -0.19 -0.14 -0.19 -0.14 -0.19 -0.14 -0.19 -0.14 -0.19 -0.14 -0.19 -0.14 -0.19 -0.14 -0.19 -0.14 -0.14 -0.19 -0.14 -0.14 -0.19 -0.14 -0.	-0.11 -0.06 -0.16 -0.17 -0.08 -0.08 -0.08 -0.08 -0.08 -0.09 -0.11 -0.11 -0.15 -0.19 -0.15 -0.23 -0.09 -0.15 -0.23 -0.09 -0.04 -0.09 -0.09 -0.09 -0.09 -0.09 -0.09 -0.09 -0.01
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7 0.01	0.26		0.45	
The second secon	0.09	0.18		0.04
7 0.02			0.1	9.01
-0.09		0.19		0.16
0.1	0.11	0.22	0.17	0.19
0.96	0.13	0.25	-0.2	0.1
8 0.08	0.14	0.04	90.0	0.13
2 0.3	-0.00	-0.35	-0.16 -0.58	-0.32
9 4.11	0.21	-0.18 0.39	0.23	-0.08 0.11
9 433	-0.09	0.34	0.29	0.16
0.24	0.12	9.36	9.26	0.1
4.11	0.2	0.24	0.26	0.18
-0.08	-0.02	0.18	0.17	0.07
5 -0.11	0.14	0.16	0.15	0.05
0.3	-0.11	-0.44	-0.38	-0.19
0.14	-0.03	0.07	90.06	0.05
2 -0.15	-0.02	0.19	0.21	0.11
9 0.05	-0.16	0.27	0.2	9.06
5 0.02	-0.25	0.26	-0.01	0.35
0.05	-0.11	-0.2	0.58	-0.37
8 43.18	0.18	0.4	80.0	0.19
0.35	-0.49	0.96	-0.09	0.00
2 4.08		0.17		0.16
0.17				0.14
				0.08
0.01		0.34	-0.06	0.25
0 0.01 7 40.79	0.17		-0.42	-0.14
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9 0.01 7 40.19 5 0.06	t; Cluster-22	2: Cluster-23:	Cluster-24; (N = 68)	Cluster-25: (N = 57)
9	-0.4 1; Cluster-25 (N = 86)	2: Cluster-23: (N = 68)	Cluster-24:	Cluster-25:
0 0.01 7 40.19 5 0.06 2 0.27 -20; Cluster-21 51) (N = 30)	-0.4 1; Cluster-25 (N = 88) (1) (Mdn = 0.5	2: Cluster-23: (N = 68)	Cluster-24; (N = 68) (Mdn = 0.54)	Cluster-25: (N = 57)
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	17 -0.19	00 0.01 d.29 17 d.19 d.29	02 0.01 -0.29 -0.05 17 -0.19 -0.06 -0.19 25 0.06 0.17 0.54	02 0.01 43.29 43.06 43.33 17 43.19 43.96 42.09 42.19 25 0.06 0.17 0.34 43.06

Notes: Figure S9 displays how the 41 important variables (y axis) are distributed within each high-risk MDR cluster (x axis). The variables are grouped thematically and within each theme, ranked according to the strength and direction of the associations with MDR. The numbers in the cells indicate the distance between the proportion of this characteristic in the whole sample and the median probability of having this

characteristic in the specific cluster. The shading of the blue and red colours indicates the strength of the prevalence of the factor's category in the high-risk cluster, with deeper colours showing a higher prevalence. For example, a row which contains majority red blocks indicates that subjects that belong to a high-risk MDR UTI cluster are likely to have this factor characteristic, whereas majority blue blocks indicate that subjects that belong to a high-risk MDR cluster are not likely to have this factor characteristic. A mixture of blue or reds, or more neutral shades indicate no clear signal. Source data are provided as a Source Data file.

Figure S10: Difference from the median values for 41 variables in the 7 low-risk MDR clusters (intermediate as susceptible).

Tertiary/secondary vs primary care -	-0.34	0.48	0.48	0.48	-0.45	0.46	0.36
Urban vs rural - International travel (yes vs no) -	0.13	0.12	0.15	0.07	-0.15	-0.15 -0.16	D.11 -0.07
Site: KY: Nanyuki =	-0.1	0.26	0.16	0.76	-0.08	0.26	0.22
Site: KY: Makueni -	-0.1	0.34	0.13	0.38	-0.08	0.13	-0.08
Site: KY: Nairobi -	0.66	-0.06	0.19	4.1	-0.15	0.08	-0.02
Site: UG: Nakapiripirit -	-0.09	-0.08	-0.06	-0.00	0.62	-0.06	-0.05
Bite: UG: Nakasongola -	-0.02	-0.04	-0.04	-0.04	-0.02	0.04	0.06
Site: US: Mbarara •	-0.09	-0.09	-0.09	-0.09	-0.06	-0.09	-0.03
Site: TZ: Mbeyn-	-0.07	-0.07	-0.06	-0.07	-0.06	-0.07	-0.02
Site: TZ: Kilmanjaro • Site: TZ: Mwanza •	-0.09	-0.09 -0.17	-0.08 -0.17	-0.09 -0.18	-0.07 -0.16	4.08	-0.08 -0.11
HH consumes mik-	0.13	0.15	0.14	0.12	-0.1	0.14	-0.04
HH uses manure -	-0.2	-0.13	-0.2	-0.19	0.01	0.15	a
HH has livestock -	-0.3	-0.22	-0.3	-0.28	-0.1	0.63	-0.02
Uses ABs with livestock -	-0.09	40.07	-0.09	-0.09	-0.02	-0.02	0.12
Rubbish dumped near HH -	0.1	-0.19	-0.2	-0.18	0.23	-0.59	-0.26
Uses scap when handwashing-	0.14	0.12	0.08	0.08	-0.11	0.1	0.01
Tolet Public Rush	0.41	-0.23	0	0.40	-0.2	-0.06	-0.18
Tollet: Private flush - Tollet: Pit latrine -	-0.14 -0.23	0.64 -0.38	0.27	-0.16 -0.22	0.38	0.13 -0.04	-0.22 0.38
Tollet: No facility -	-0.05	-0.06	-0.06	-0.06	0.00	-0.05	-0.01
Drinking water: Protected public -	0.32	4.38	-0.01	0.53	0.07	0.19	0.34
Drinking switer: Unprotected private -	-0.01	4.05	-0.05	-0.04	-0.01	0.11	0.17
Drinking water: Protected private -	-0.25	0.6	0.12	-0.42	-0.09	-0.25	-0.32
Drinking water: Unprotected public +	-0.06	-0.08	-0.07	-0.0T	-0.03	-0.06	0.46
Washing water: protected public -	0.97	437	0.04	0.53	0.05	0.23	-0.34
Washing water: Unprotected public -	-0.02	-0.08	-0.08	0.05	-0.03	0.1	0.17
Washing water: Protected private -	-0.27	0.51	0.06	-0.4	-0.01	-0.27	-0.31
Washing water: Unprotected private - Plaw servage near HH -	0.16	-0.09 -0.25	-0.09 -0.14	-0.08 -0.24	-0.05 -0.16	40.07	-0.07
HH head has secondary+ education -	0.34	0.41	0.41	0.43	0.16	0.27	0.13
HH has electricity -	0.15	0.17	0.17	0.17	-0.13	0.16	-0.06
HH has a TV+	0.36	0.43	0.21	0.1	-0.01	0.2	a
HH owns land-	-0.45	90.0	-0.23	-0.03	0.24	0.46	0.18
Temporary or mud walls vs cement, brick or metal.	-0.15	-0.18	-0.16	-0.16	0.54	0.14	-0.07
HH owns house -	-0.51	-0.11	-0.37	-0.22	0	0.39	-0.08
HH has a smartphone -	0.61	42.14	-0.13	-0.13	-0.1	-0.13	-0.06
Has health insurance -	0.23	0.39	0.27	0.21	-0.15	0.2	0.1
Medicine stock outs are an obstacle - Experienced AMR -	0.14	0.15	0.07 -0.12	-0.03	0.66	0.6	-0.15 D.01
Kept left over ABs -	0.22	-0.16	-0.02	-0.11	0.14	-0.2	-0.00
Lack of money is an obstacle -	0.3	-0.2	-0.06	0.09	-0.35	4.38	0.1
Difficulty whealth costs -	0.1	-0.06	-0.00	0.06	0.17	4.27	-0.00
Sick household member -	-0.12	-0.12	-0.13	-0.11	0.12	0.12	0.06
Knows the term 'antibiotic' -	-0.14	0.43	0.42	0.43	0.2	0.3	0.14
is familiar with ABs -	-0.11	0.15	0.31	-0.18	0.35	-0.12	-0.07
Has recurrent UTI symptoms -	-0.09	0.08	0.24	0.12	-0.12	0.12	0.25
Took Alls in past 6 months -	-0.52	0.00	0.39	-0.06	0.25	-0.1	0.23
Feels UTI stigma - UTI treatment seeking: direct to clinic *	0.31	0.42	0.11 -0.44	0.42	D. D.	0.14	-0.43
UTI treatment seeking: 1 treatment failure -	0.01	-0.22	0.61	-0.23	0.05	-0.02	0.3
UTI treatment seeking: 3+ treatment failure -	-0.06	-0.08	-0.01	-0.07	-0.04	49.92	0.06
UTI treatment seeking: 2 treatment failure -	-0.05	-0.13	-0.07	-0.13	-0.07	-0.12	0.00
Went to government clinic to treat UTI symptoms -	-0.22	-0.26	0.18	-0.25	0.12	-0.11	0.67
Took Alba recently for UTI =	-0.22	-0.25	0.58	-0.25	0.14	-0.08	0.54
Heard the term AWR -	-0.09	-0.04	-0.09	-0.05	0.15	0.3	-0.11
Patient difficulty with health costs - Went to private clinic to treat UTI symptoms -	0.12	-0.26 -0.14	0.02	0.03 -0.14	-0.03	-0.1 0.08	D.01 D.14
Delayed seeking UTI treatment	0.08	-0.2	-0.19	-0.14	0.07	0.18	0.18
Has secondary educ or higher =	0.14	0.5	0.43	0.48	0.26	0.33	-0.07
Age: 25-44 years -	0.18	0.21	0.24	0.02	0.12	-0.06	-0.1
Age: <25 years -	0.00	-0.04	-0.01	0.2	-0.01	4.01	-0.13
Age: 45+ years •	-0.22	41.17	-0.23	-0.29	-0.13	0.01	0.21
Patient works -	-0.1	0.08	0.09	-0.18	0.21	-0.18	-0.07
	Cluster-1; (N = 79)	Cluster-2; (N = 110)	Cluster-3; (N = 82)	Cluster-4; (N = 127)	Cluster-6; (N = 19)	Cluster-6; (N = 53)	Cluster-7; (N = 15)
	(Mdn = 0.18)	(Mdn = 0.21)	(Mdn = 0.22)	(Mdn = 0.25)	(Mdn = 0.26)	(Mdn = 0.26)	(Mdn = 0.27)
			Low risk N	IDR clusters (Cl	uster Size)		
			Distan	ce from the f	Median		

Notes: Figure S10 displays how the 41 important variables (y axis) are distributed within each low-risk MDR cluster (x axis). The variables are grouped thematically and within each theme, ranked according to the strength and direction of the associations with MDR. The numbers in the cells indicate the distance between the proportion of this characteristic in the whole sample and the median probability of having this

characteristic in the specific cluster. The shading of the blue and red colours indicates the strength of the prevalence of the factor's category in the low-risk cluster, with deeper colours showing a higher prevalence. For example, a row which contains majority red blocks indicates that subjects that belong to a low-risk MDR UTI cluster are likely to have this factor characteristic, whereas majority blue blocks indicate that subjects that belong to a low-risk MDR cluster are not likely to have this factor characteristic. A mixture of blue or reds, or more neutral shades indicate no clear signal. Source data are provided as a Source Data file.

2. HATUA patient recruitment: sites and healthcare facilities

HATUA patient recruitment took place in 9 sites- three each in Kenya, Tanzania, and Uganda. Healthcare facilities were chosen across a number of primary, secondary and tertiary care levels. Table S1 presents a breakdown of types of facilities by sites.

Table S1 Patient recruitment sites in Kenya, Tanzania, and Uganda

Country/site	Number of facilities (TOTAL)	Source of funding	Levels recruited from	Recruitment periods
Kenya				
Makueni	1	Public	Secondary, tertiary	May-June 2020
Nairobi	4	Public and private	Primary, secondary, tertiary	June 2019-March 2020
Nanyuki	1	Public	Secondary	Feb-May 2020
Tanzania				
Kilimanjaro/Moshi	3	Public and private	Primary, secondary, tertiary	August 2019-April 2020
Mbeya	2	Public and private	Primary, secondary, tertiary	July 2019- Aug 2020
Mwanza	5	Public and private	Primary, secondary, tertiary	April 2019-Sept 2020
Uganda				
Mbarara	3	Public	Primary, secondary, tertiary	May 2019- July 2020
Nakapiripirit	3	Public	Primary, secondary	January-June 2020
Nakasongola	3	Public and private	Primary, secondary	July 2019-Oct 2019

Levels of facilities in Kenya are identified following the Kenya Health Policy 2014-2013

(http://publications.universalhealth2030.org/uploads/kenya_health_policy_2014_to_2030.pdf, where Primary care incorporates levels 1-3 (Level 1: Community; Level 2: Dispensaries; Level 3: Health centres, secondary care incorporates levels 4 and 5 (Level 4: Primary referral facilities; Level 5; secondary referral facilities) and tertiary care level 6 (tertiary referral facilities).

Levels of facilities in Tanzania were identified using the scheme used in the Tanzanian Health Sector Strategic Plan IV 2015-2020 (https://www.prb.org/wp-content/uploads/2020/06/Tanzania-Health-Sector-Strategic-Plan-IV-2015-2020-1-4.pdf), p.12 Fig 4. where:

Primary care incorporates village level dispensaries, ward level rural health centres, district level hospitals, secondary incorporates regional level (level 2 facilities), and tertiary includes regional or national level referral hospitals (levels 3 and 4 facilities).

Levels of facilities in Uganda are identified following the Health Facility Categories in the National Health Facility Master List 2018

(<u>file:///Users/klk4/Downloads/National%20Health%20Facility%20Master%20List%202018.pdf</u>) where primary care includes health centre II, health centre III, secondary care includes health centre IV, general hospital (levels 4-5) and tertiary care includes referral hospitals, regional referral hospitals, and national referral hospitals (levels 6-8).

3. Missing data and sample characteristics

As shown in Figure 5, HATUA recruited patients in healthcare facilities, processed their microbiological data, then followed up a subset of microbiologically confirmed UTI patients to their households. In Table S2 we show the sociodemographic, health and location characteristics of the patient sample at three stages: patient recruited with microbiologically confirmed UTI, the subset of those with valid AST data, and the final analysis subset of those who were successfully followed to the household. When trying to understand possible bias from missing data the best comparison is between columns A and C. When we do this, we do not observe large differences in age distribution, sex, working status, education, or health status. In the analysis sample, there are also proportionally more patients from Kenyan sites (especially Nairobi) and fewer from both Tanzanian (particularly Mwanza).

Table S2. Characteristics of patients in the analysis sample (column C) compared to all those who were recruited in the study

	Α	В	C (analysis sample)		
	Of those, with microbiologically confirmed UTI	Of those, with valid AST/MDR data	Of those with complete household follow-up		
	N =2332	N=2063	N=1610		
Age					
Under 25 years	27.4	27.5	26.1		
25-44 years	48.5	49.1	48.8		
45 and over	24.0	23.4	24.7		
Missing	0.1	0.1	0.4		
Sex					
Male	14.9	14.3	15.0		
Female	85.1	85.7	85.0		
Working Status					
Formal employment	18.7	18.1	17.2		
Informal employment	40.3	41.6	42.5		
Homemaker	27.7	27.3	27.0		
Not working	12.9	12.6	12.9		
Missing	0.5	0.4	0.4		
Highest education					
No qualifications	15.1	14.6	15.6		
Primary	35.3	34.4	35.3		
Secondary	33.1	33.7	32.4		
Higher than secondary	16.4	17.3	16.7		
Health status					
No pre-existing conditions	86.6	86.8	85.0		
Has long-term NCD¹ or HIV	13.4	13.2	15.0		
Region					
Kenya: Makueni	10.7	11.8	11.4		
Kenya: Nairobi	15.7	16.5	17.7		
Kenya: Nanyuki	12.7	13.9	11.1		
Tanzania: Kilimanjaro	10.2	8.8	9.8		
Tanzania: Mbeya	7.0	7.0	8.0		
Tanzania: Mwanza	22.6	20.4	18.3		
Uganda: Mbarara	8.3	8.6	10.1		
Uganda: Nakapiripirit	8.5	8.3	8.6		
Uganda: Nakasongola	4.3	4.6	5.0		

¹ Includes heart conditions, cancer, mental illness, gastrointestinal problems, allergies, asthma or bone problems

4. Measurement of multidrug resistance (MDR).

Table S3. ABs considered for MDR calculations.

Gram negative	Amoxicillin/ clavulanate (AMC)	Ampicillin (AMP)	Ceftazidime/ Ceftriaxone (CAZ/CRO)	Ciprofloxacin (CIP)	Gentamicin (GEN)	Nitrofurantoin (NIT)	Trimethoprim (TMP)		
Escherichia coli	AMC	AMP	CAZ/CRO	CIP	GEN	NIT	TMP		
Shigella spp.	AMC	AMP	CAZ/CRO	CIP	GEN	NIT	TMP		
Proteus spp.	AMC	AMP	CAZ/CRO	CIP	GEN	NIT	TMP		
Salmonella spp.	AMC	AMP	CAZ/CRO	CIP	GEN	NIT	TMP		
Serratia spp.	-	-	CAZ/CRO	CIP	GEN	NIT	TMP		
Klebsiella spp.	AMC	-	CAZ/CRO	CIP	GEN	NIT	TMP		
Citrobacter spp.	-	-	CAZ/CRO	CIP	GEN	NIT	TMP		
Enterobacter spp.	-	-	CAZ/CRO	CIP	GEN	NIT	TMP		
Morganella spp.	-	-	CAZ/CRO	CIP	GEN	NIT	TMP		
Pantoea spp.	-	-	CAZ/CRO	CIP	GEN	NIT	TMP		
Providencia spp.	-	-	CAZ/CRO	CIP	GEN	NIT	TMP		
Acinetobacter spp.	-	-	CAZ/CRO	CIP	GEN	-	TMP		
Pseudomonas spp.	-	-	CAZ	CIP	GEN	-	-		
Gram positive	Cefoxitin (FOX)	Erythromycin (ERY)	Linezolid (LNZ)	Ciprofloxacin (CIP)	Gentamicin (GEN)	Nitrofurantoin (NIT)	Trimethoprim (TMP)	Tetracycline (TCY)	Vancomycin (VAN)
Staphylococcus spp.	FOX	ERY	-	CIP	GEN	NIT	TMP	TCY	-
Enterococcus spp.	-	ERY	LNZ	CIP	-	NIT	-	TCY	VAN
Streptococcus spp.	-	ERY	LNZ	-	-	NIT	-	TCY	VAN

Table S4. List of ABs recommended for use for treating uncomplicated upper and lower UTI according to country National Treatment Guidelines (NTG)

	Kenya NTG ¹ (adult outpatients- not admitted to hospital)	Tanzania NTG ² (adult outpatients- not admitted to hospital)	Uganda NTG ³ (adult outpatients- not admitted to hospital)
Amoxicillin	a, b		С
Amoxicillin/ Clavulanic Acid		b, c	
Ampicillin	a		b, c
Ceftriaxone			b, c
Ciprofloxacin		a, b	a, b
Cotrimoxozole/trimethoprim	a, b		
Gentamicin			b, c
Nitrofurantoin	а		a, c

a= uncomplicated lower UTI

b= uncomplicated upper UTI (includes for Uganda, first and second line options)

c= treatments recommended for pregnant women only

1 http://guidelines.health.go.ke:8000/media/Clinical_Guidelines_Vol_II_Final.pdf

2 https://hssrc.tamisemi.go.tz/storage/app/uploads/public/5ab/e9b/b21/5abe9bb216267130384889.pdf

3 https://www.prb.org/wp-content/uploads/2018/05/Uganda-Clinical-Guidelines-2016-National-Guidelines-for-Management-of-Common-Conditions.pdf

For Kenyan patients, we created a binary variable measuring if the patient was resistant to any of the following: ampicillin, cotrimoxazole/trimethoprim or nitrofurantoin. In Tanzanian patients, we created a binary variable indicating resistance to either amoxicillin/clavulanic acid or ciprofloxacin. Among Ugandan patients, we created a binary variable measuring resistance to either ampicillin, ceftriaxone, ciprofloxacin, gentamicin or nitrofurantoin.

5. Statistical Details- Bayesian Profile Regression

We use Bayesian profile regression ^{1,2} to cluster subjects or patients based on covariates collected for each patient and analyse different risk exposures to the response variable of ABR for different groups of patients identified. The R package PReMiuM ³ is employed to fit the model.

We first describe the clustering model underneath profile regression. In our analysis, all clustering variables are categorical, and each follows a categorical distribution. Suppose there are n patients and J variables used for clustering. For cluster c, denote by $\Phi_j^c = (\Phi_{j,1}^c, \dots, \Phi_{j,w_j}^c)$ the cluster-specific probabilities that variable j takes a value from 1 to w_j , where w_j denotes the total number of categories for variable j. Further denote $\Phi^c = (\Phi_1^c, \dots, \Phi_j^c)$ and $\Phi = (\Phi^1, \Phi^2, \dots)$. The likelihood can be written as follows:

$$P(X_i|Z_i = c, \mathbf{\Phi}) = \prod_{j=1}^J P(X_{ij}|Z_i = c, \mathbf{\Phi})$$

$$= \prod_{j=1}^J \Phi_j^c(X_{ij}),$$
(1)

where $X_i = (X_{i1}, X_{i2}, \dots X_{iJ_i})$ denotes a vector of J observed variables for patient i. Z_i represents the cluster allocation variable and $\mathbf{Z} = (Z_1, Z_2, \dots Z_n)$. Denote by $\boldsymbol{\psi} = (\psi_1, \psi_2, \dots)$ the vector of mixture weights such that $\sum_c \psi_c = 1$ and,

$$P(Z_i = c|\boldsymbol{\psi}) = \psi_c \tag{2}$$

Bayesian profile regression uses the Dirichlet process mixture model (DPMM) to perform the clustering. Denote by DP (α , G_0) the Dirichlet process with concentration parameter α and base distribution G_0 . The stick-breaking representation of the DPMM given by Papaspiliopoulos and Roberts⁴ comes from the stick-breaking representation of the DP⁵, where the DPMM can be viewed as an infinite mixture model, namely

$$X_{i} | \mathbf{Z}, \mathbf{\Phi} \sim \prod_{j=1}^{J} Cat (X_{ij} | \Phi_{j}^{Z_{i}}),$$

$$Z_{i} | \boldsymbol{\psi} \sim \prod_{c}^{\infty} \psi_{c} \delta_{c},$$

$$\psi_{c} = V_{c} \sum_{l < c} (1 - V_{l}), \psi_{1} = V_{1},$$

$$V_{c} \sim Beta (1, \alpha),$$

$$\Phi^{c} | G_{0} \sim G_{0}, c = 1, 2, 3, \dots$$
(3)

where Cat represents the categorical distribution; Beta represents the Beta distribution and δ_c is the Dirac delta function centered at c. Note that setting the number of components in the DPMM to be infinite is a mathematical way to express uncertainty over the number of components. The best

representative clustering for the patients is obtained by the post-processing procedure detailed in Molitor et al¹. In this manuscript, it is explained how uncertainty is incorporated in our inferences by considering the samples from all Markov Chain Monte Carlo (MCMC) iterations obtained during the Bayesian inferential sampling procedure.

Since the concentration parameter α can affect the number of clusters identified by the DPMM, a relatively vague prior is placed on α .

To model the risk for a positive outcome associated with the different patient groups, a regression model is added to the overall modelling framework. In the context of our analysis, the response variable is a binary variable describing the presence of MDR. A logistic regression is used, namely

$$logit(\pi_i) = \theta_{Z_i} + \beta \mathbf{f}_i, \tag{4}$$

where π_i denotes the probability of subject i having MDR. $f_i = (f_i^1, f_i^2, \dots, \dots, f_i^P)$ is a vector of P optional confounding or adjusting variables one may elect to include in the regression model. For this manuscript, preliminary analyses showed that inferences were clearer and more interpretable when all covariates were included as clustering variables. θ_{Z_i} are cluster specific risk effect parameters.

The regression model in (4) is fitted simultaneously with the DPMM in (3). Therefore, the response variable also exerts influence on the cluster allocation of patients.

For each cluster of patients, the baseline risk of having MDR can be calculated as

$$p_{z_i} = \frac{exp(\theta_{Z_i})}{1 + exp(\theta_{Z_i})}$$

Under the Bayesian framework, the posterior distribution of θ_{Z_i} can be obtained, which enables us to make inferences for the baseline risk of each cluster. In our analysis, we calculate the 95% credible interval of p_{Z_i} and compare it to the overall sample proportion of patients having MDR, denoted as π . If the lower bound of the credible interval is above π , we regard the corresponding cluster of patients as having high risk of getting MDR. If the upper bound of the credible interval is below π , we regard the corresponding cluster of patients as having low risk of getting MDR. If π is contained in the credible interval, we regard the corresponding cluster of patients as having average risk of getting MDR.

Due to the relatively large number of covariates included in the clustering model, it is of interest to determine which covariates are important for forming the clusters. A variable selection procedure is considered. We utilise the variable selection formulation that involves cluster specific indicators, as proposed by Papathomas et al². This results in estimating continuous selection variables $\rho=(\rho_1,\ldots,\ldots\rho_J)$. Note that $\rho_j\in[0,1]$ for $j=\ldots2,\ldots,J$. The closer ρ_j is to 1 the corresponding covariate j is deemed to be important for determining the overall clustering structure. In contrast, the closer ρ_j is to 0, the corresponding covariate j is considered to be irrelevant for forming clusters. So, the ρ_j can be viewed as variable selection probabilities, where variable j is deemed important when the posterior mean or median of ρ_j exceeds some predefined threshold.

A covariate profile for each cluster of patients can be obtained. More specifically, the 95% credible interval of $\Phi_{j,q}^c$ is calculated for variables that are deemed important based on the posterior inferences for the variables in ρ . The credible interval for each $\Phi_{j,q}^c$ is compared to $p_{j,p}$, where $p_{j,q}$ is the overall sample proportion for variable j when it equals category q. If the lower bound of the credible interval is above $p_{j,p}$, we regard the corresponding cluster of patients as having high probability of having category q for variable j. In the plots produced by PReMiuM (see Figures S3), these CIs are shown with red colour. If the upper bound of the credible interval is below $p_{j,p}$, we regard the corresponding cluster of patients as having low probability of having category q for variable p. In the plots produced by PReMiuM, these CIs are shown with blue colour. To ensure convergence of the MCMC sampling scheme we obtained 5000 samples after a burn-in of 800,000 iterations. Convergence checks showed no reason for concern, with the best representative clustering after different MCMC starting points matching by more than 98%. (RAND index greater than 0.98; see 6 .

As a follow-up step, to aid interpretation and translate the findings, we calculated predictive profiles using PReMiuM software, according to two different methods. First, we used a priori definitions of multidimensional poverty risk based the profiles on patients being not/very deprived according to the HATUA multidimensional poverty index (MPI) considering education and standard of living domains derived in our earlier paper on misuse ⁷.

Not deprived profile:

patient and household head - at least secondary education Assets; has electricity, TV, motorised vehicle, computer, fridge, smartphone, flush toilet House walls made of brick or concrete.

Deprived profile:

patient and household head -less than secondary education, Assets: does not have electricity, TV, motorised vehicle, computer, fridge, smartphone, or flush toilet, house walls not made of brick or concrete.

We also computed predictive profiles based on the profile regression results, using the variables/characteristics we identified as having clear signals for high and low risk MDR clusters listed in Fig 6. Those were:

High risk: age 45+, less than secondary education, urban residence, no electricity, owns own house, no health insurance, does not use soap when handwashing, rubbish dumping, contact with manure, keeps livestock, uses ABs to raise livestock, treatment delay, 3+ treatment failures, went to government clinic, familiar with at least 4 types of ABs, has a sick household member, no obstacle to getting medication.

Low risk: age <45 years, at least secondary education, rural residence, recruited in secondary/tertiary healthcare, has electricity, has health insurance, uses soap when handwashing, no rubbish dumping, does not use ABs to raise livestock, no treatment delay, went straight to clinic (no treatment failures), knows the term 'antibiotic', no sick household members, reports obstacle to getting medication.

6. References

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