

Supplemental Data

Fig. S1. The vectors used to clone probiotic *L. lactis*. pTKR was created by cloning Kanamycin resistance and *E. coli* oriC site genes in the pT1NX vector.

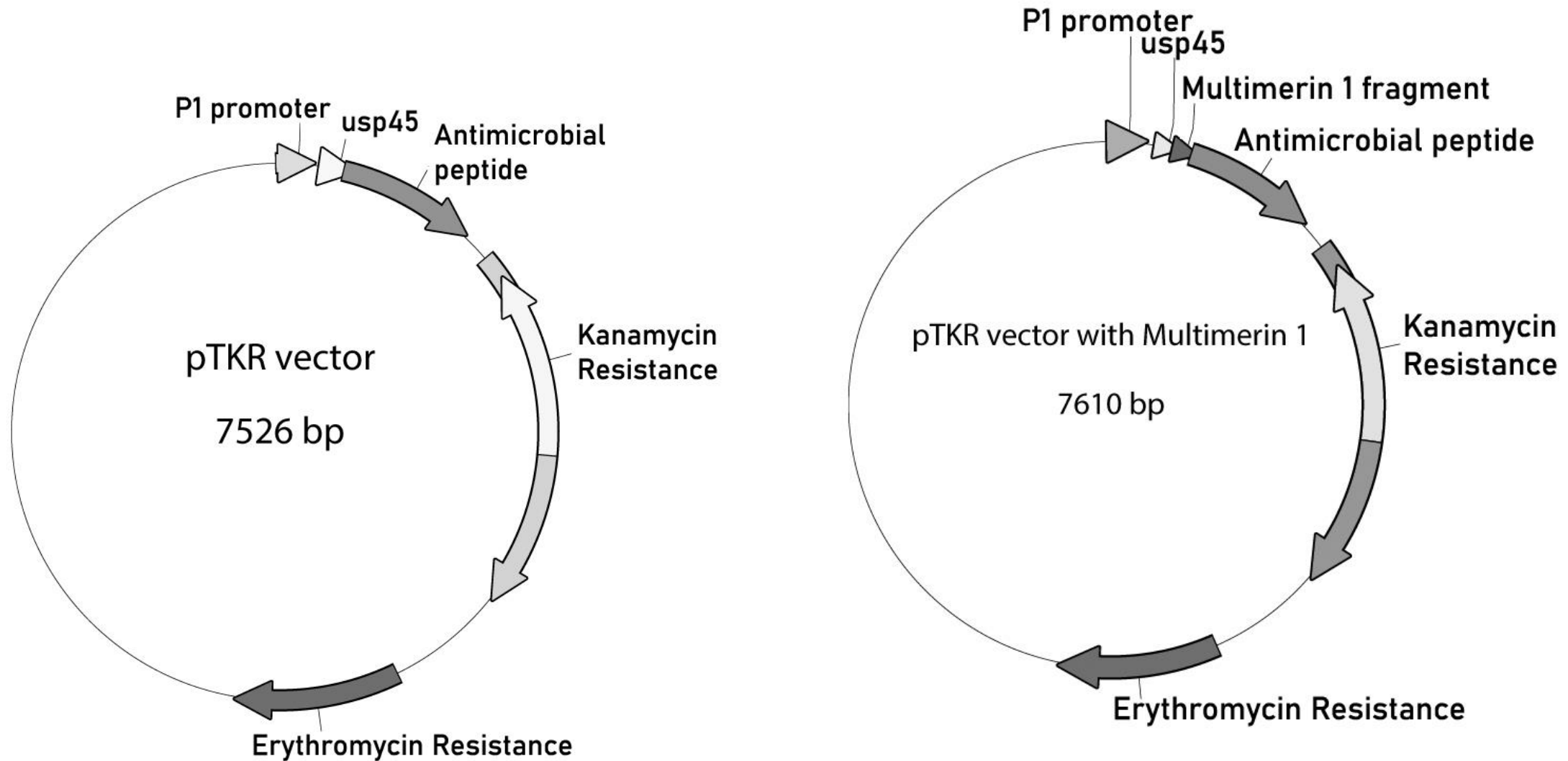


Fig. S2. Flow cytometry of MM1-GFP off-target treated cells. Plotted are the fluorescence intensity measures of (Panel A) *H.pylori* 60190 Δ vacA , (Panel B) *P.aeruginosa* , (Panel C) *S.aureus* cells and (Panel D) *A. faecalis* . Each species was untreated (red), treated with GFP (green) or MM1-GFP (dark blue) with averaged median fluorescence from triplicate samples; Standard deviation shown; statistical significance (One-way Anova, ns- not significant, ** $P \leq 0.01$ and *** $P \leq 0.001$).

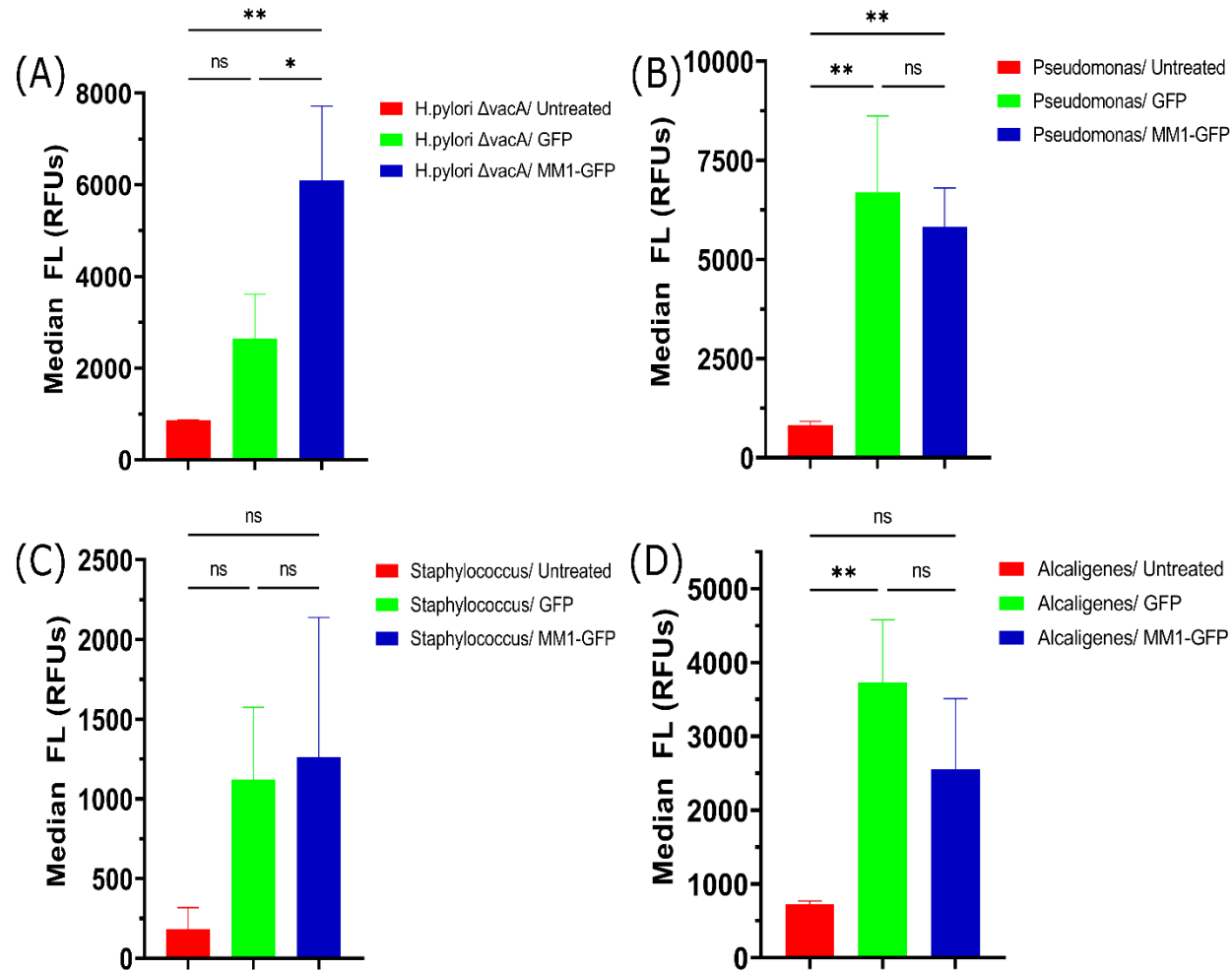


Fig. S3 *H. pylori* (a), *Lactobacillus* (b), and *E. coli* (c) standard curves plotted with $\log_{10}$ CFU values obtained by plating them on respective agar plates and the C_t values obtained by qPCR of the same culture

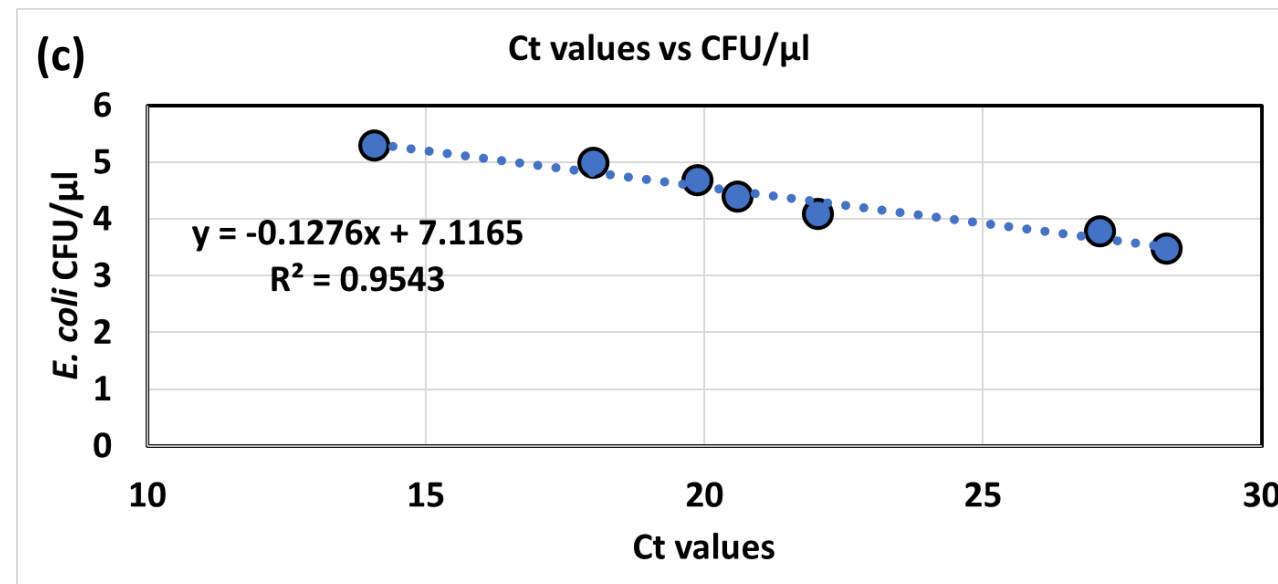
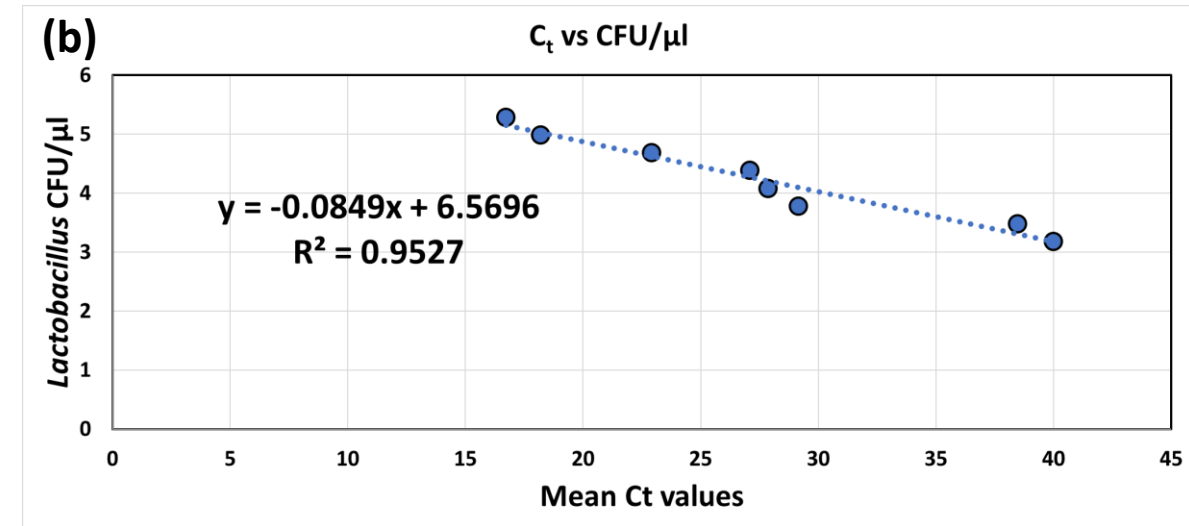
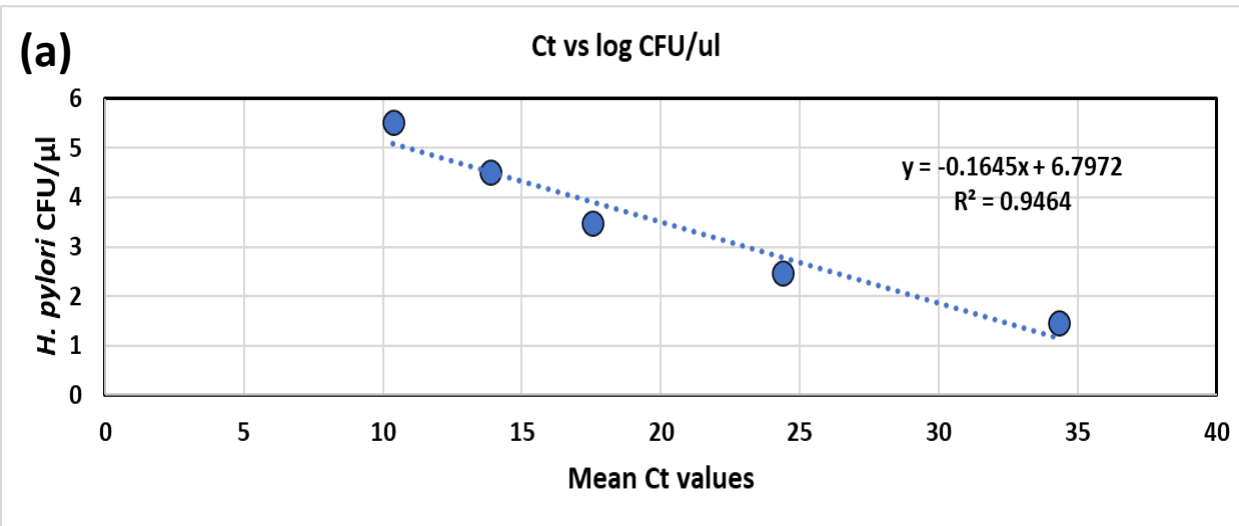


Fig. S4. Shannon diversity index for each therapeutic treatment cohorts at each day of the experiment

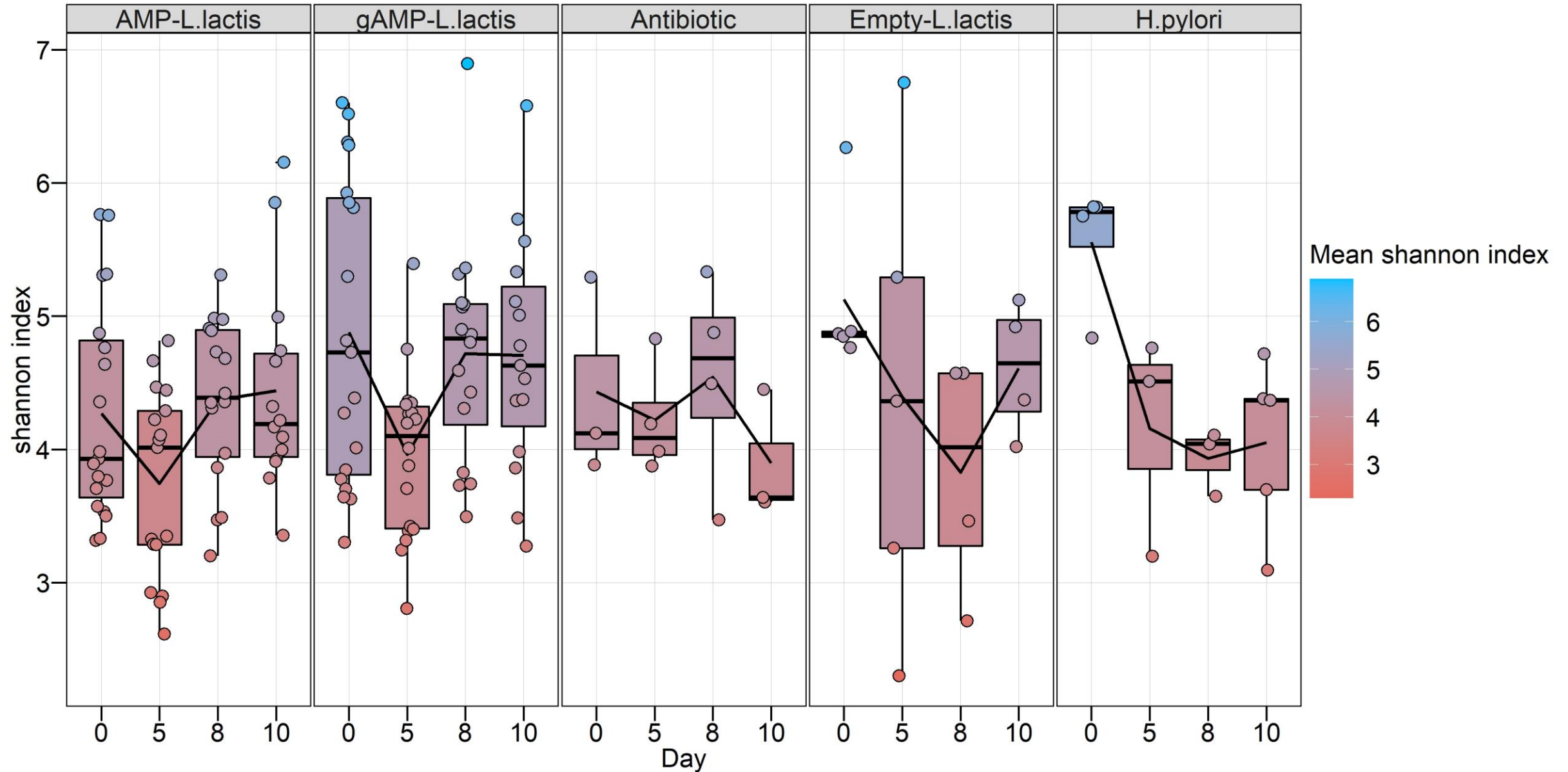


Fig. S5. Shannon diversity index for each prophylactic treatment cohorts at each day of the experiment

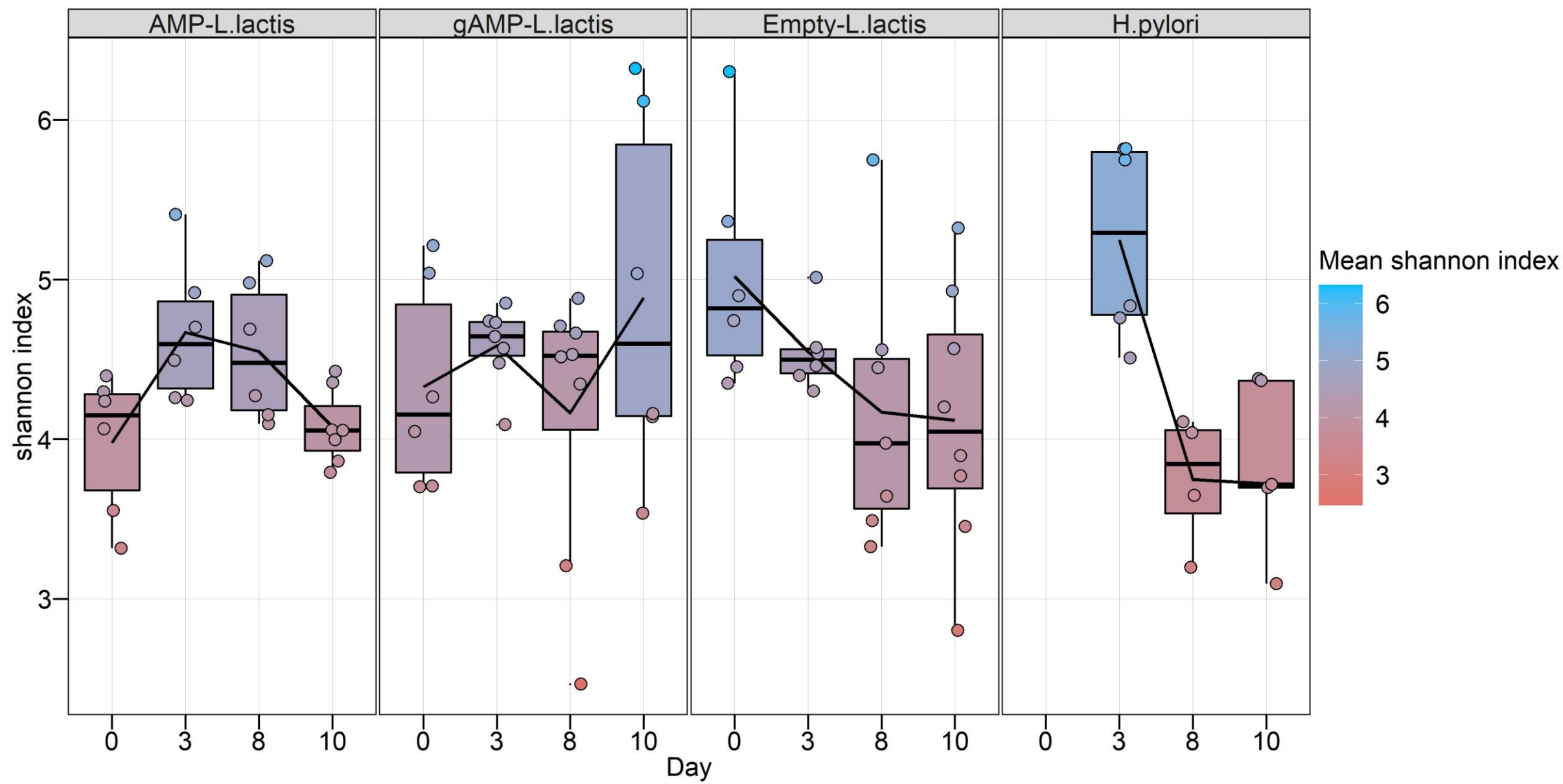


Fig. S6. Faith phylogenetic diversity index for each therapeutic treatment cohorts at each day of the experiment

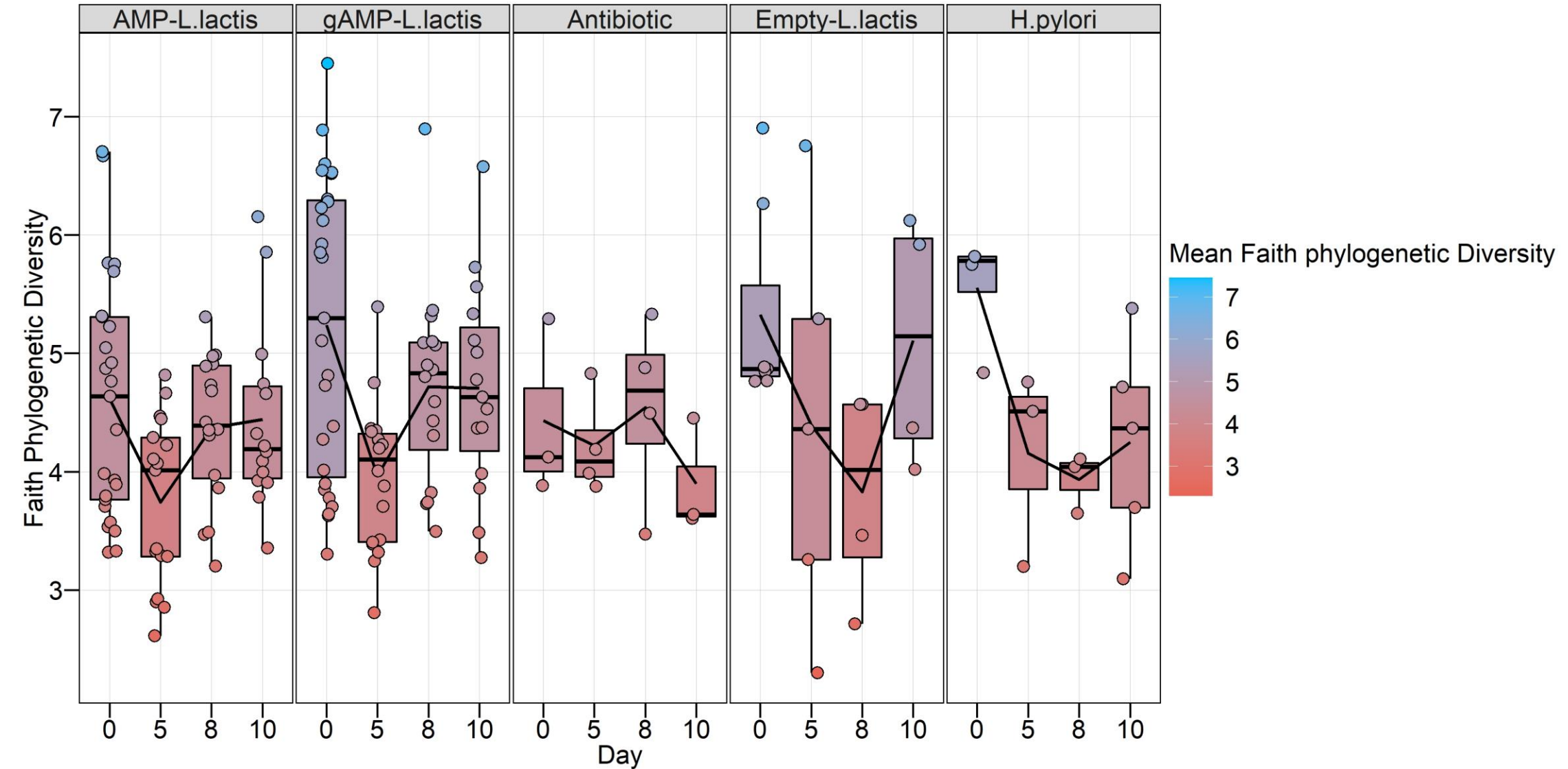


Fig. S7. Faith phylogenetic diversity index for each prophylactic treatment cohorts at each day of the experiment

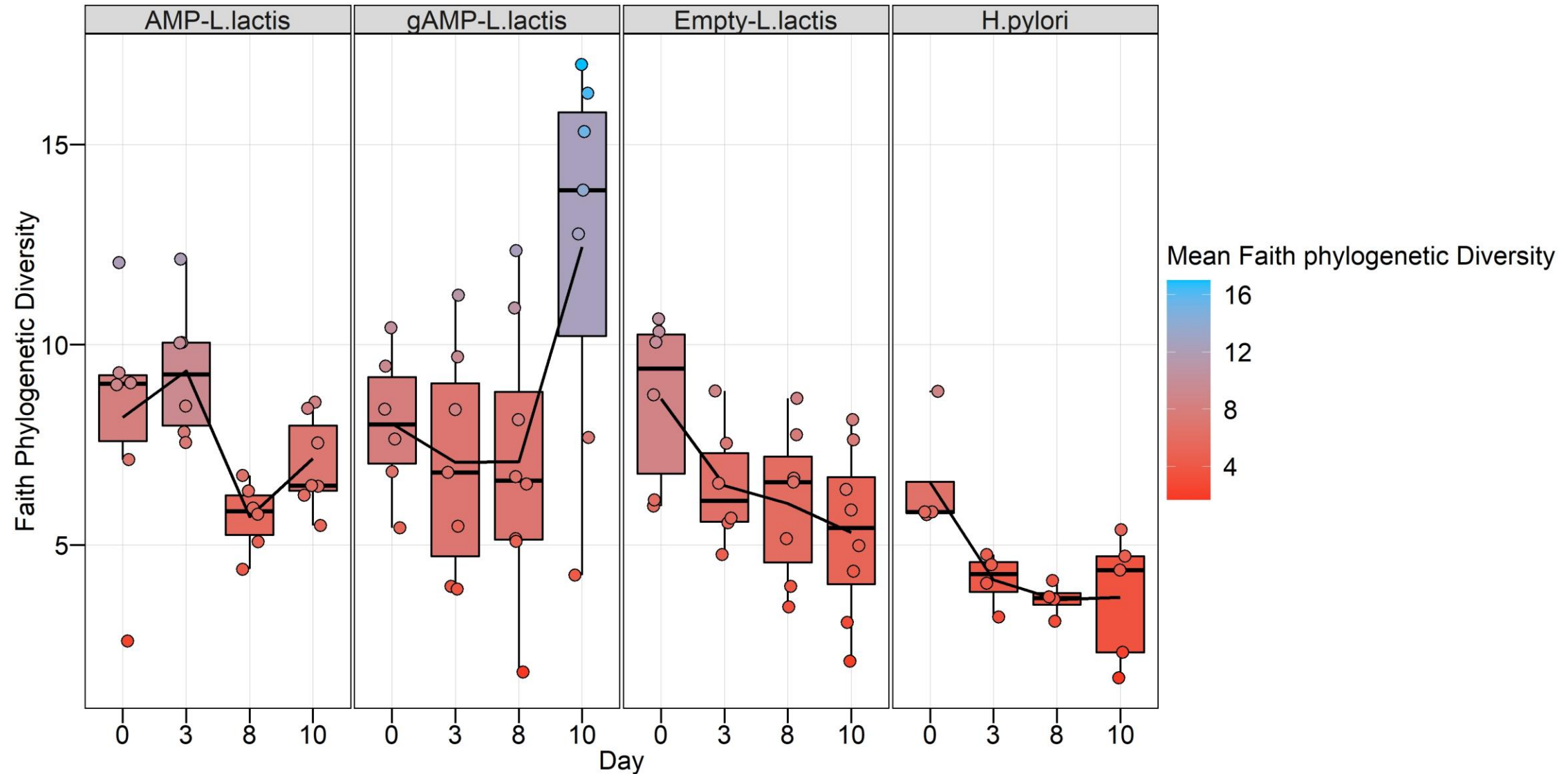
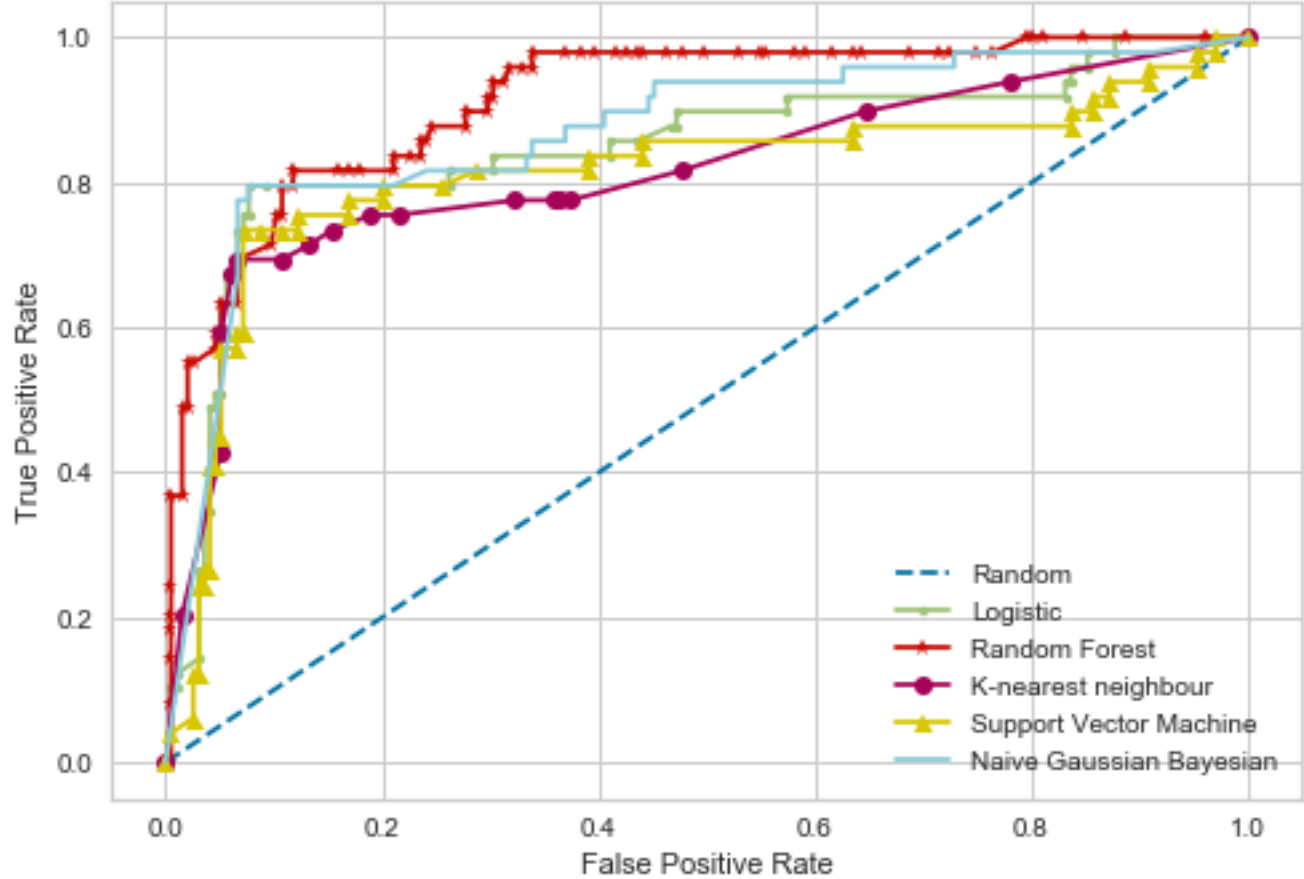
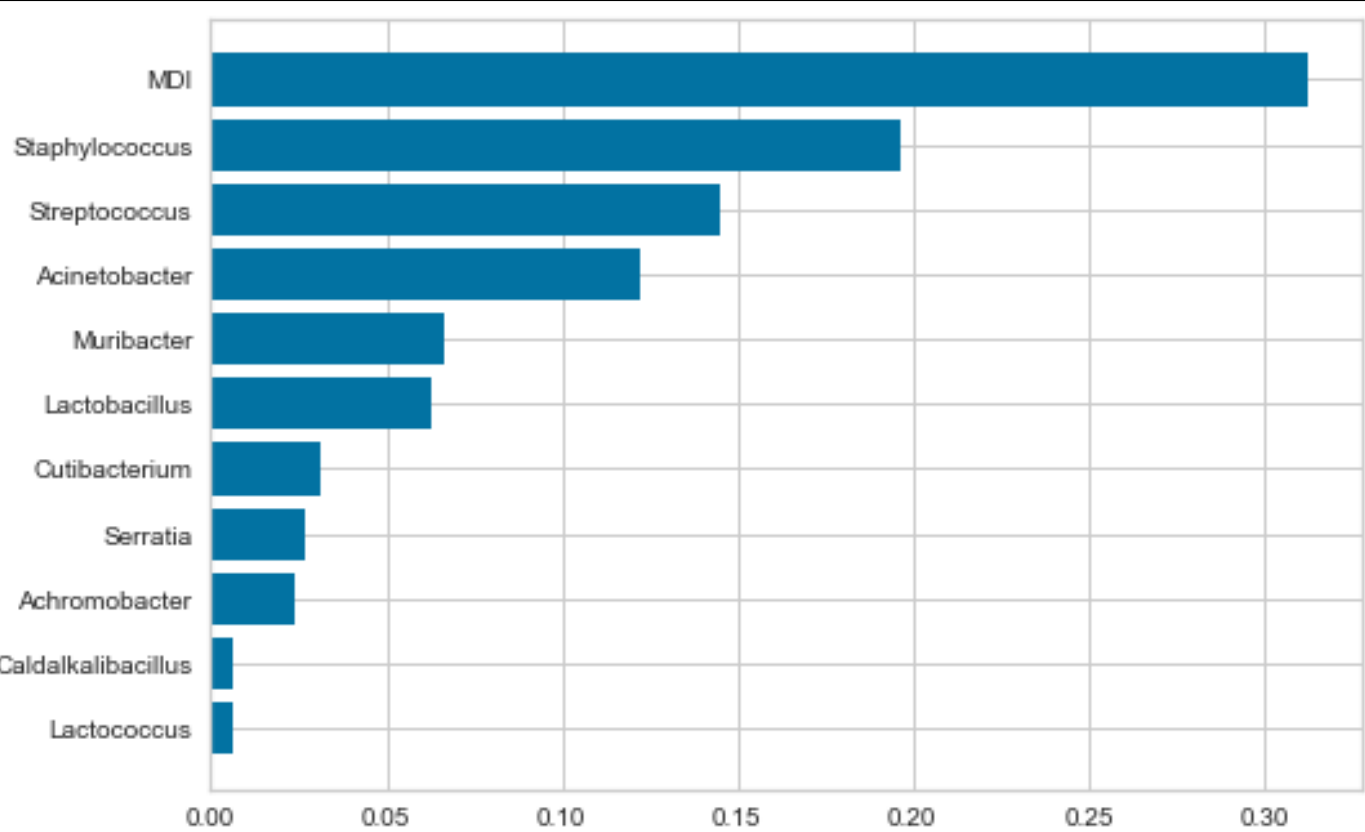


Fig. S8. AUC scores of algorithms using MDI and relative abundance of ten bacterial genera to predict the dysbiotic state of the sample i.e., fed only *H. pylori*.

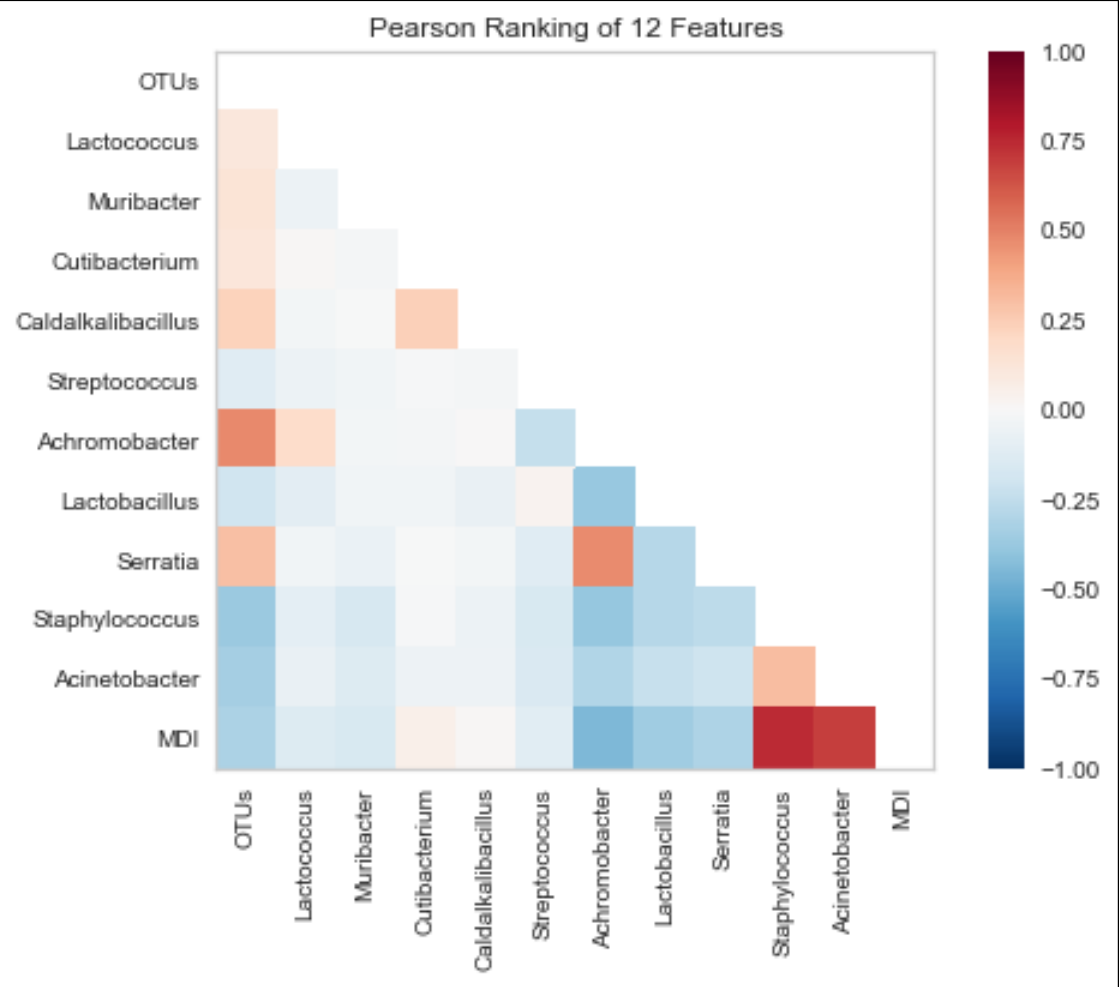


AUC Scores:
Logistic Regression: 0.8484563055991627
Random Forest Classifier: 0.9133437990580847
K-Nearest neighbor: 0.8154892726321298
Support Vector machine: 0.8122448979591834
Gaussian Naive Bayesian model: 0.8695970695970696

Fig. S9. Spearman (A) and Pearson (B) ranking of features used in the Random Forest classifier



A



B

TABLE S1. The peptide sequences of three AMPs and their corresponding gAMPs with multimerin1 fragment fused to the N-terminus separated by a linker

AMP/ gAMP	Peptide Sequence
Laterosporulin	ACQCPDAISGWTHTDYQCHGLENKMYRHVYAICMNGTQVYC RTEWGSSC
Multimerin1(MM1)- laterosporulin	MQKMTDQVNYQAMKLTL LQ SGGGS ACQCPDAISGWTHTDY QCHGLENKMYRHVYAICMNGTQVYCRTEWGSSC
Alyteserin	GLKDIFKAGLGSLVKGIAAHVAN
MM1-alyteserin	MQKMTDQVNYQAMKLTL LQ SGGGS GLKDIFKAGLGSLVKG IAAHVAN
CRAMP	ISRLAGLLRKGGEKIGEKLLKKIGQKIKNFFQKLVPQPE
MM1-CRAMP	MQKMTDQVNYQAMKLTL LQ SGGGS ISRLAGLLRKGGEKIG EKLLKKIGQKIKNFFQKLVPQPE
Blue = Multimerin1, Red = linker	

Table S2. p-values of all CFU values of *H. pylori* for all treatment vs Day for in vivo therapeutic experiments

Day	pTKR	Alyteserin	MM1-Alyteserin	CRAMP	MM1-CRAMP	Laterosporulin	MM1-Laterosporulin	Antibiotic	Treatment
0	0.34607	0.467459	0.215381	0.081516	0.254538184	0.776073	0.103358	0.387186	Null
5	0.015451	0.428519	0.087484	0.975067	0.870429205	0.444576	0.267252	0.198333	
8	0.008943	0.007684	0.007411	0.007414	0.007411531	0.008125	0.007705	0.030924	
10	0.005192	0.003831	0.003807	0.003802	0.003770856	0.003895	0.003842	0.00427	
0	1	0.176318	0.111203	0.291126	0.13263648	0.091847	0.231938	0.454293	pTKR
5	1	0.01587	0.007915	0.017646	0.002896649	0.061365	0.042453	0.057843	
8	1	0.07307	0.053533	0.052685	0.052660441	0.190541	0.075258	0.062701	
10	1	0.039988	0.038568	0.038282	0.036621635	0.043789	0.040658	0.081771	
0		1	0.285696	0.083002	0.32489647	0.229294	0.119879	0.451168	Alyteserin
5		1	0.053075	0.228006	0.241878544	0.111932	0.08035	0.142134	
8		1	0.184734	0.043186	0.079155408	0.147012	0.451542	0.049455	
10		1	0.200829	0.125313	0.020322686	0.039267	0.380268	0.081643	
0			1	0.100896	0.460872819	0.154003	0.183151	0.314591	MM1-Alyteserin
5			1	0.106988	0.030519649	0.322362	0.368682	0.07015	
8			1	0.433618	0.453738191	0.087472	0.170367	0.046996	
10			1	0.394445	0.047280591	0.005988	0.165983	0.077365	
0				1	0.122830099	0.08951	0.185735	0.107199	CRAMP
5				1	0.437479122	0.263403	0.190216	0.096216	
8				1	0.47311071	0.073903	0.049111	0.04701	
10				1	0.010066071	0.003126	0.120219	0.07658	
0					1	0.165327	0.194758	0.358203	MM1-CRAMP
5					1	0.189996	0.107719	0.103198	
8					1	0.076802	0.077756	0.046989	
10					1	0.001084	0.032913	0.071742	
0						1	0.10422	0.207353	Laterosporulin
5						1	0.432257	0.074787	
8						1	0.156808	0.054122	
10						1	0.115616	0.0939	
0							1	0.13775	MM1-Laterosporulin
5							1	0.072487	
8							1	0.049649	
10							1	0.083609	

Table S3. CFU values of *H. pylori* for all treatment vs Day for in vivo therapeutic experiments

log10(CFU/ml)	Day	Null		Empty <i>L. lactis</i>		Alyteserin		MM1-Alyteserin		CRAMP		MM1-CRAMP		Laterosporulin		MM1-Laterosporulin		Antibiotic	
		Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE
	0	4.168055	1.339393	4.498902	1.270948	3.873131	1.293921	3.653439	1.272044	3.713066	1.175893	4.085446	1.238243	4.081421	1.323419	3.582956	1.191635793	4.728116	1.239987
	5	6.647503	1.217981	6.011062	1.187677	6.887585	1.137737	6.844684	1.129154	7.024468	1.171769	6.904182	1.103229	6.632587	1.224588	6.767043	1.140779031	7.432851	1.15541
	8	7.187798	1.079283	6.240183	1.235639	5.22933	1.265512	5.554992	1.182607	5.812495	1.134802	5.680376	1.142421	6.141252	1.144018	5.938671	1.143877798	6.759111	1.111848
	10	7.607933	1.135349	7.192776	1.334218	4.446757	1.317031	4.195873	1.250462	5.016954	1.22951	4.59946	1.246162	4.900758	1.268642	4.378478	1.336920645	6.136341	1.237059
CFU/ml	Day	Null		Empty <i>L. lactis</i>		Alyteserin		MM1-Alyteserin		CRAMP		MM1-CRAMP		Laterosporulin		MM1-Laterosporulin		Antibiotic	
		Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE
	0	92333.91	42245.58	89668.4	28335.72	58214.05	33316.33	34940.07	20761.93	15186.72	10296.03	44454.95	25015.82	124031.9	75841.6	12789.27	8570.862797	78258.8	33236.77
	5	8218373	2066538	2370862	940991.6	10941435	3958493	10100926	2837459	16562757	4161146	10480457	2391655	10462486	3274822	8875687	2025373.97	31985201	9157343
	8	17133780	2258701	16199934	14157292	370209.5	89734.34	891391.2	356773.2	1220568	536374.6	801466.2	224198.5	2073070	681775.2	1770736	706726.3799	6341958	1624273
	10	71762618	37710926	1.55E+08	95564168	143289.8	43839.5	33472.23	31651.96	216570	50234.84	97636.05	43320.11	230020.8	58140.26	119827	55929.91934	1910994	657413.1

Table S4. p-values between observed OTUs for all therapeutic treatment regimen amongst different days of experiment

Days	AMP- <i>L. lactis</i>				gAMP- <i>L. lactis</i>				Antibiotic				Empty- <i>L. lactis</i>				Only <i>H. pylori</i>			
	0	5	8	10	0	5	8	10	0	5	8	10	0	5	8	10	0	5	8	10
0	1.00000	0.00001	0.00018	0.46100	1.00000	0.00000	0.00000	0.52660	1.00000	0.03789	0.22917	0.17932	1.00000	0.00349	0.00352	0.98184	1.00000	0.00244	0.00108	0.00001
5		1.00000	0.01810	0.00000		1.00000	0.04781	0.00000		1.00000	0.00332	0.00061		1.00000	0.84182	0.00895		1.00000	0.72215	0.01893
8		1.00000	0.00000	1.00000		0.00000	1.00000	0.02482		1.00000	0.01452	1.00000		0.02063						
10		1.00000	1.00000	1.00000		1.00000	1.00000													

Table S5. p-values between observed OTUs for all therapeutic treatment regimen amongst themselves at each day of the experiment

	AMP-L.lactis	gAMP-L.lactis	Antibiotic	Empty-L.lactis	Days
gAMP-L. lactis	0.026854613				0
	0.081931714				5
	0.703164546				8
	0.117640308				10
Antibiotic	0.987968122	0.360921299			0
	0.001742615	0.003148531			5
	0.155909767	0.074791408			8
	4.93273E-08	7.71292E-08			10
Empty-L.lactis	0.026854613	0.653996412	0.48317939		0
	0.081931714	0.206861429	0.51444783		5
	0.0703164546	0.0745047107	0.01940923		8
	0.1933831747	0.0117640308	0.0071271		10
H. pylori	0.044265569	0.320987335	0.54201676	0.769715646	0
	0.033777062	0.043089091	0.34828784	0.230365208	5
	0.067260472	0.098598758	0.03550178	0.135036551	8
	2.91726E-06	4.66188E-07	0.25261204	0.005933432	10

Table S6. Observed OTUs for all therapeutic treatment regimens for each day of the experiment

Treatment	Day	Mean	SE
<i>AMP-L. lactis</i>	0	111.551077	12.40330351
	5	38.0295739	1.73867928
	8	51.7975174	4.849706376
	10	123.06498	8.434694901
<i>gAMP-L. lactis</i>	0	160.212938	16.6492163
	5	42.7670679	1.894378149
	8	54.5856944	5.071584638
	10	166.963241	11.47240435
Antibiotic	0	112.259259	33.06344126
	5	66.8833333	3.340274024
	8	43.0791667	2.645458471
	10	30.1666667	2.190044816
<i>Empty-L. lactis</i>	0	148.238804	18.4746069
	5	58.9169841	9.557273309
	8	56.5755556	2.573158097
	10	148.879167	16.13032121
<i>H. pylori</i>	0	141.869444	5.50675984
	5	76.6513889	6.443820711
	8	72.6178836	5.728003074
	10	40.118	6.45212052

Table S7. p-values between observed OTUs for all prophylactic treatment regimen amongst different days of experiment

Day	AMP- <i>L. lactis</i>				gAMP- <i>L. lactis</i>				Empty- <i>L. lactis</i>				<i>H. pylori</i>		
	0	3	8	10	0	3	8	10	0	3	8	10	3	8	10
0	1.00000	0.01009	0.84404	0.04680	1.00000	0.00031	0.52342	0.04768	1.00000	0.86998	0.00665	0.57011	1.00000	0.00208	0.00009
3		1.00000	0.00144	0.00007		1.00000	0.00197	0.23669		1.00000	0.00001	0.52462			
8		1.00000	0.00510	1.00000		1.00000	0.03520	1.00000		0.00295	1.00000				
10		1.00000	1.00000	1.00000		1.00000									

Table S8. p-values between observed OTUs for all prophylactic treatment regimen amongst themselves at each day of the experiment

	AMP-<i>L. lactis</i>	gAMP-<i>L. lactis</i>	Empty-<i>L. lactis</i>	Days
gAMP-<i>L. lactis</i>	0.931305566			0
	0.228948433			3
	0.632562178			8
	0.013133248			10
Empty-<i>L. lactis</i>	0.477512806	0.366176625		0
	0.008350127	0.004004745		3
	0.000311906	0.004527501		8
	0.022369944	0.0060257183		10
<i>H. pylori</i>	0.056975984	0.191648431	0.330431167	3
	0.007091466	0.077699665	0.019776596	8
	0.00552311	0.004658643	0.000802383	10

Table S9. Observed OTUs for all prophylactic treatment regimens for each day of the experiment

Treatment	Day	Mean	SE
<i>AMP-L. lactis</i>	0	103.3175926	14.59940328
	3	168.3703704	11.39806636
	8	99.64814815	7.577382989
	10	61.09206349	6.534697096
<i>Empty-L. lactis</i>	0	121.9798942	17.83894003
	3	118.4648148	5.920348311
	8	39.95376984	7.33390052
	10	107.3444444	14.51688127
<i>gAMP-L. lactis</i>	0	101.7555556	6.416933616
	3	150.2619048	5.343384735
	8	92.2375	11.78199331
	10	205.4111111	38.63256452
<i>H. pylori</i>	3	131.9488889	9.906642042
	8	65.48302154	4.224867978
	10	24.95	6.486694073

Table S10. Species specific primers used in the qPCR quantification analysis

Target bacteria	Target gene/protein	Sequence
<i>H. pylori</i>	<i>vacA</i>	forward: 5'-ATGGAAATACAACAAACACAC-3'; reverse: 5'-CTGCTTGAATGCGCCAAAC-3'
<i>L. lactis</i>	<i>acmA</i>	forward: 5'-GGAGCTCGTGAAAGCTGACT-3'; reverse: 5'-GCCGGAACATTGACAACCAC-3'
<i>E. coli</i>	DE3-T7 polymerase	forward: 5'-GTGTGGGCACACGAGAAGTA-3'; reverse: 5'-GAGACTCGTGCAACTGGTCA-3'
<i>L. plantarum</i>	<i>recA</i>	forward: 5'-CCGTTTATGCGGAACACCTA-3'; reverse: 5'-TCGGGATTACCAAACATCAC-3'