

Rapid antigen tests for dengue virus serotypes and Zika virus in patient serum

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Fig. 1. NS1 protein alignment and linear epitope mapping of the 10 antibodies used to run the DENV serotype-specific NS1 rapid tests, pan-DENV NS1 test, and ZIKV NS1 test.

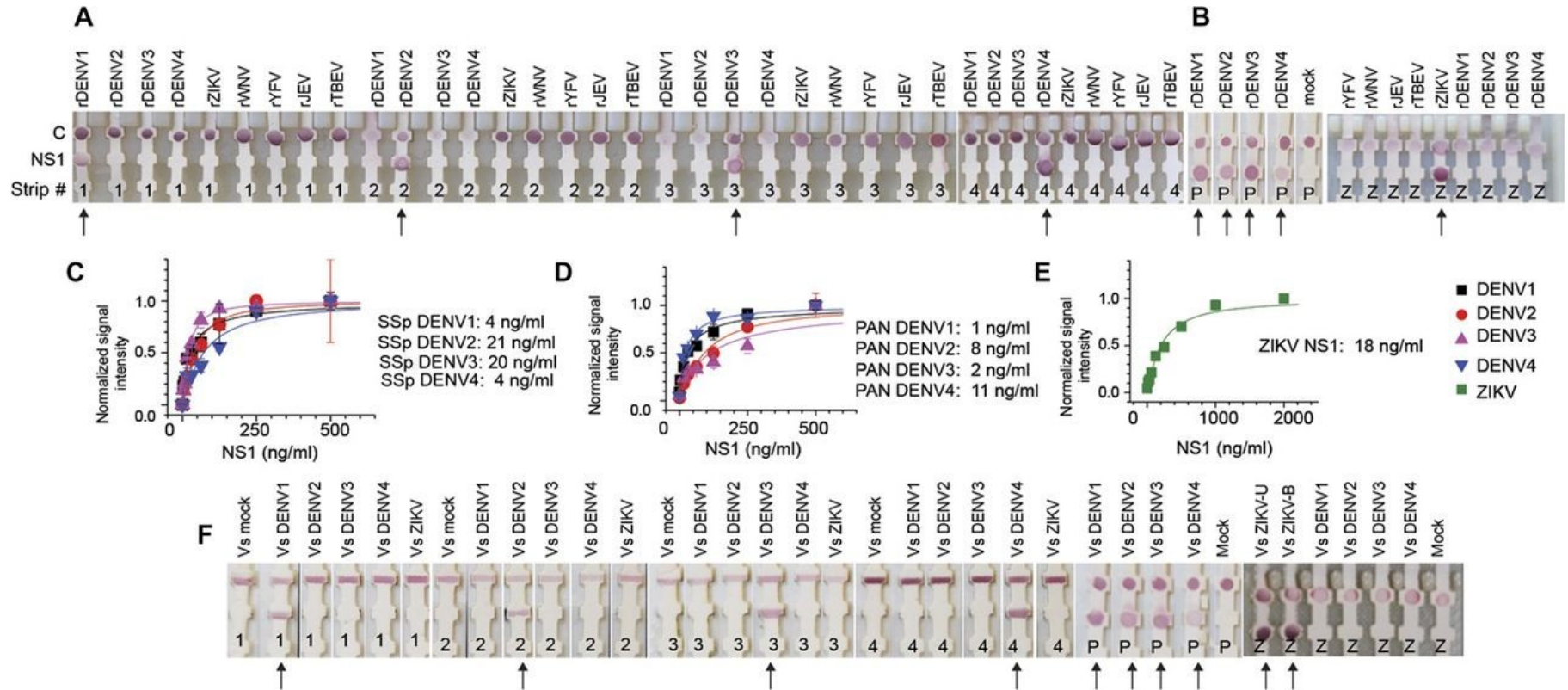
A NS1 protein linear epitope recognition by the ten antibodies used in rapid test

Antibody	Use in rapid test	Linear epitope	Position	Structure
MA724.271	Membrane, dipstick 1 (DENV1) nanoparticles, dipstick 5 (pan-DENV)	DENV3 NS1: MELKYSWKTWGLAKIVT	109	Wing
MA7729.912	Nanoparticles, dipstick 1 (DENV1)	DENV1 NS1: IPKIYGGPISQHNRYR	243	β-Ladder
MA7729.1	Membrane, dipstick 2 (DENV2)	DENV1 NS1 : MEHKYSWKSWSGKAKII DENV1 NS1 : IPKIYGGPISQHNRYR	109 243	Wing β-Ladder
MA7732.243	Nanoparticles, dipstick 2 (DENV2) nanoparticles, dipstick 5 (pan-DENV)	DENV2 NS1: CRSCTLPPLRYRGGDCGW	318	β-Ladder
MA724.55	Membrane, dipstick 3 (DENV3) membrane, dipstick 4 (DENV4)	DENV1 NS1: IPKIYGGPISQHNRYR DENV3 NS1: MELKYSWKTWGLAKIVT DENV3 NS1: GVFTTNIWLKLRVYVYQ DENV4 NS1: GFGMFTTNIWMKFRFG	243 109 161 159	β-Ladder Wing Wing/finger Wing/finger
MA724.411	Nanoparticles, dipstick 3 (DENV3) nanoparticles, dipstick 5 (pan-DENV)	DENV1 NS1: IPKIYGGPISQHNRYR DENV3 NS1: MELKYSWKTWGLAKIVT DENV1 NS1: IWLKLRDSYQMCDDH	243 109 167	β-Ladder Wing Wing/finger
MA725.626	Nanoparticles, dipstick 4 (DENV4) nanoparticles, dipstick 5 (pan-DENV)	DENV3 NS1: MELKYSWKTWGLAKIVT DENV4 NS1: GFGMFTTNIWMKFRFG DENV4 NS1: MPPLRFLGEDGCWYGMGE	109 159 318	Wing Wing/finger β-Ladder
MA724.323	Membrane, dipstick 5 (pan-DENV)	DENV1 NS1: MEHKYSWKSWSGKAKII DENV2 NS1: TELKYSWKTWGKAKML DENV3 NS1: MELKYSWKTWGLAKIVT DENV3 NS1: GVFTTNIWLKLRVYVYQ DENV4 NS1: PVNDLKYSWKTWGKAKI	109 114 109 161 107	Wing Wing Wing Wing/finger Wing
7746-50.110	Membrane, ZIKV NS1 dipstick	ZIKV NS1: KECPLKHRAWNSFLV ZIKV NS1: LSFRAKDGWCYWGMEI	141 321	Wing β-Ladder
7746-50.130	Nanoparticles, ZIKV NS1 dipstick	ZIKV NS1: NELPHGWKAWGKSYF	109	Wing

B NS1 protein alignment and epitope mapping of the 10 antibodies used in rapid tests

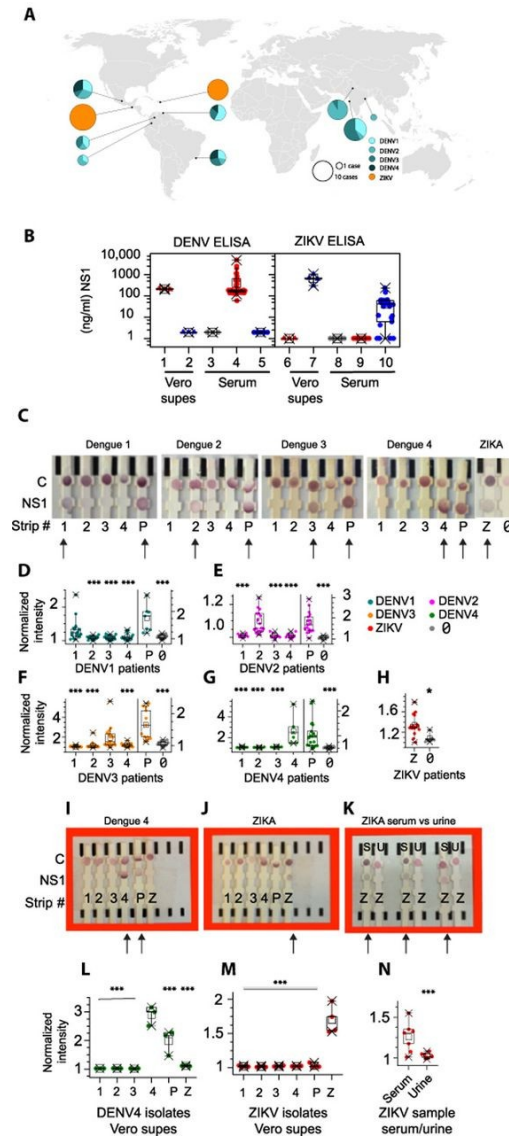
	β-Roll domain 1-29	
DENV1	----DSGCVINWKGRELKCGSGIFVTNEVHTWTEQYKFOADSPKRISAA	45
DENV2	VMVQADSGCVVSWKNKELKCGSGIFITDNVHTWTEQYKFOPEPESPKLIASA	50
DENV3	----DMGCVINWKGRELKCGSGIFVTNEVHTWTEQYKFOADSPKRVATA	45
DENV4	----DMGCVVSWSGRELKCGSGIFVADNVHTWTEQYKFOPEPESPARIASA	45
ZIKV	----DVGCVSDPSRKRKTRCGTGVFVYNDVEAWDRYKYVHPSRRIIAAA	45
	Wing domain 30-180	
DENV1	IGHAWHEGVCGRHSATRLLENIMWQITSNELNHIILLENMKHTVVVGVVVG	95
DENV2	IQRAHEEGICGRHSVTRLENIMWQITPELNHILSENEVKLTIMTGDITK	100
DENV3	IAGAWENGVCGRIRSTRLENLWQITANELNYILWENDIKLTVVGVGITG	95
DENV4	ILNAHKGVCGRIRSTRLENVWQITNELNYVLMEGGDLTVVAGGVK	95
ZIKV	VKQAWHEGICGRSSVSEIMWKSVEGELNAILLENGVQLTVVGVSVKN	95
	Connector domain 159-163	
DENV1	ILAQGKMTIRPOPHRHKYSWKSWSGKAKITGADIQNTFPIIDGPDTECHPD	145 mAb 1; 323
DENV2	IMQAGKRSLOPOPTELKYSWKTWGKAKMLSTESHNTPLIDGPETAECHN	150 mAb 323
DENV3	VLEQGRRLTPOPHTELKYSWKTWGKAKIWTAEQNSFIIIDGPTTECHS	145 mAb 55; 271; 323; 411; 626
DENV4	VLTQKRALTPPVNDLKYSWKTWGKAKIPTPEARNSTPLIDGPTTECHN	145 mAb 323
ZIKV	PMWRGQRLPVPVNELPHGWKAWGKSYFVRAAKTNSFPVVDGDTLRECHL	145 mAb 130; 410
	β-Ladder domain 181-352	
DENV1	DQRAWNIVEVEDYGFGRITTNIWLKLRDSYQMCDDHRLMSAAIKDSKAVH	195 mAb 411
DENV2	TNRAWNSLEVEDYGFGRITTNIWLKLRKQDVFCDSKLSAAIKDNRAVH	200
DENV3	ASRAWNVVEVEDYGFGRITTNIWLKLRVYVYQDLCDHRLMSAAIKDERAVH	195 mAb 55; 323
DENV4	ERRAWNIVEVEDYGFGRITTNIWLKLRVYVYQDLCDHRLMSAAIKDQAVH	195 mAb 55; 626
ZIKV	EHRAWNSFVEVDHGFGRITTSVWLKVRDYSLCEDPAVIGTAVKGRGAAH	195 mAb 110
	β-Ladder domain 181-352	
DENV1	ADMGYWIESEKNETWALRASFI EVKTCWPKSHTLWSNGVLESSEMIIPK	245 mAb 1; 55; 411; 912
DENV2	ADMGYWIESALNDTWIEKASFI EVKSWPKSHTLWSNGVLESSEMIIPK	250
DENV3	ADMGYWIESQKNGSWLEKASLI EVKTCWPKSHTLWSNGVLESSEMIIPK	245
DENV4	ADMGYWIESSKNOTWIEKASLI EVKTCWPKSHTLWSNGVLESSEMIIPK	245
ZIKV	SDLGYWIESEKNETWALKRAHLIEMKTCWPKSHTLWTDGVEESDLIIPK	245
	β-Ladder domain 181-352	
DENV1	TYGGPISQHNRYRPGYFTOTAGPWHLGKLELDFDLCEGTTVVVDEHCGNRG	295 mAb 1; 55; 411; 912
DENV2	NFAGPVSQHNRRPGYHTOTAGPWHLGKLELDFDFCEGTTVVVTEDCGNRG	300
DENV3	SLAGPISQHNRRPGYHTOTAGPWHLGKLELDFNYCEGTTVVVISENCGTRG	295
DENV4	SYAGPFSQHNRRPGYATOTVGPWHLGKLELDFGCEGTTVVVITQEDCDHTRG	295
ZIKV	SLAGPLSHNRRPGYRTOVGPWHSELEIRFECEGTRVTVVETCGTRG	295
	β-Ladder domain 181-352	
DENV1	PSLRITTTVGKIIHEWCCRSTLPPLRFKGEDGCWYGMIEIRPVKEEENL	345
DENV2	PSLRITTTASGKLIITWECRCSCTLPPLRYRGGDCWYGMIEIRPLKEEENL	350 mAb 912 243
DENV3	PSLRITTTVSGKIIHEWCCRSTLPPLRYMGEDGCWYGMIEIRPINKEEENM	345
DENV4	PSLRITTTASGKLVITWCCRSTLPPLRFLGEDGCWYGMIEIRPLSEKEENM	345 mAb 626
ZIKV	PSLRITTTASGRVIEWCCRCTMPPLSFRAKDGWCYGMIEIRPRKEEENL	345 mAb 110
	β-Ladder domain 181-352	
DENV1	VKSLVTSAG--- 353	
DENV2	VNSLVTA--- 357	
DENV3	VKSLASAG--- 353	
DENV4	VKSQVTSAG--- 353	
ZIKV	VRSVVTAGSTD 356	

Fig. 2. Rapid immunochromatography for specific detection of DENV NS1 proteins (serotypes 1 to 4) and ZIKV NS1 protein.



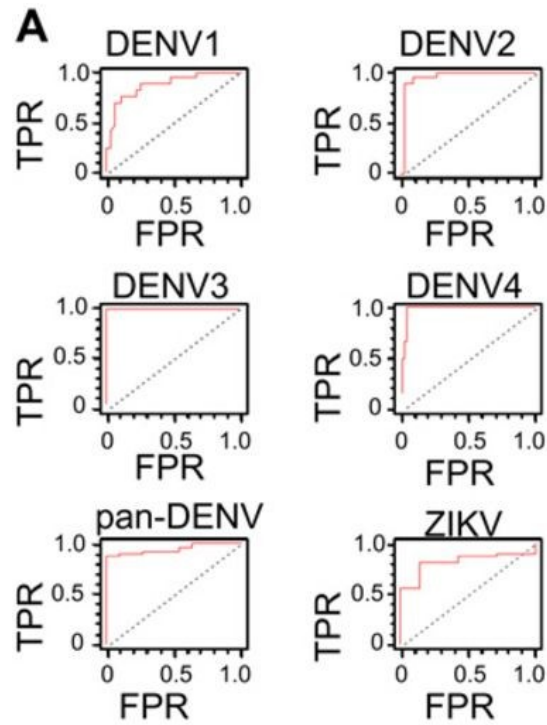
Irene Bosch et al., Sci Transl Med 2017;9:eaan1589

Fig. 3. Applying the rapid test to analyze human patient sera.



Irene Bosch et al., *Sci Transl Med* 2017;9:eaan1589

Fig. 4. ROC analysis, sensitivity/specificity analysis, and 95% confidence intervals of the dengue and Zika tests.



B

	DENV1	DENV2	DENV3	DENV4	PAN-DENV	Zika
Area under the curve	0.88	0.96	1.00	0.98	0.95	0.82
95% Conf. int.	0.74–0.96	0.89–1.00	1.0–1.0	0.89–1.0	0.87–0.98	0.65–0.91
Cutoff	1.14	1.18	1.20	1.37	1.19	1.08
Sensitivity	0.76	0.89	1.00	1.00	0.88	0.81
Specificity	0.89	0.98	1.00	0.96	1.00	0.86
N positive	17	19	16	6	58	31
N negative	37	45	39	46	11	7