

Table S1. Covariances among residual terms related constructs and items within a construct for the IHT, HBT and TPB derived measurement models.

IHT derived measurement model	Theory of Planned Behavior and Health Belief Theory derived measurement model
(L1 WITH L2; L1 WITH L3; L1 WITH L4; L3 WITH L4; L3 WITH L5; L3 WITH L6; L4 WITH L6; L5 WITH L6; L6 WITH L7) (L1A WITH L1B; L1A WITH L1C; L1A WITH L1D; L1B WITH L1D; L1B WITH L1C; L1D WITH L1E; L1G WITH L1H; L3C WITH L3D; L3A WITH L3C; L4A WITH L4B; L5A WITH L5C; L5A WITH L5D; L5B WITH L5C; L5B WITH L5D; L7A WITH L7B; L7A WITH L7C; L7D WITH L7E;).	(L1 WITH L2; L1 WITH L3; L1 WITH L4; L3 WITH L4; L3 WITH L5; L4 WITH L5; L5 WITH L6) (L1A WITH L1B; L1A WITH L1C; L1A WITH L1D; L1B WITH L1D; L1B WITH L1C; L1B WITH L1C; L1D WITH L1E; L1G WITH L1H; L2B WITH L2C; L2B WITH L2G; L2C WITH L2D; L2G WITH L2F; L2G WITH L2H; L3D WITH L3C; L3A WITH L3C; L4A WITH L4B; L5A WITH L5C; L5A WITH L5D; L5B WITH L5C; L5B WITH L5D)

Table S2. Factors associated with the attitudes about HPV vaccination among teenagers and young adults in Midwest, US, March/April, 2023.

Exposure	Mediator	Outcome	β (95% CI)
Beliefs about the benefits of vaccination	N.A.	Perceived benefits of HPV vaccination	0.07 (-0.13, 0.26)
Beliefs about barriers to vaccination	N.A.	Perceived benefits of HPV vaccination	-0.27 (-0.41, -0.13)
Beliefs about susceptibility to HPV infection and cervical cancer	N.A.	Perceived benefits of HPV vaccination	0.57 (0.24, 0.90)
Beliefs about severity of HPV infection and cervical cancer	N.A.	Perceived benefits of HPV vaccination	1.14 (0.87, 1.41)
Beliefs about benefits of vaccination	N.A.	Perceived barriers to HPV vaccination	0.72 (0.25, 1.19)
Beliefs about barriers to vaccination	N.A.	Perceived barriers to HPV vaccination	1.84 (0.99, 2.69)
Beliefs about susceptibility to HPV infection and cervical cancer	N.A.	Perceived barriers to HPV vaccination	-0.03 (-0.29, 0.22)
Beliefs about severity of HPV infection and cervical cancer	N.A.	Perceived barriers to HPV vaccination	-0.26 (-0.40, -0.11)
Knowledge and awareness about HPV infection, cervical cancer and HPV vaccine	Beliefs about benefits of vaccination	Perceived benefits of HPV vaccination	0.05 (-0.09, 0.18)
	Beliefs about barriers of vaccination	Perceived benefits of HPV vaccination	0.15 (0.05, 0.25)
	Beliefs about susceptibility to HPV infection and cervical cancer	Perceived benefits of HPV vaccination	-0.12 (-0.23, -0.01)
	Beliefs about severity of HPV infection and cervical cancer	Perceived benefits of HPV vaccination	0.83 (0.61, 1.06)
Total			0.91 (0.82, 1.00)

Knowledge and awareness about HPV infection, cervical cancer and HPV vaccine	Beliefs about benefits of vaccination	Perceived barriers to HPV vaccination	0.50 (0.10, 0.90)
	Beliefs about barriers of vaccination	Perceived barriers to HPV vaccination	-1.03 (-1.44, -0.61)
	Beliefs about susceptibility to HPV infection and cervical cancer	Perceived barriers to HPV vaccination	0.07 (-0.06, 0.07)
	Beliefs about severity of HPV infection and cervical cancer	Perceived barriers to HPV vaccination	-0.19 (-0.31, -0.06)
Total			-0.70 (-0.85, -0.56)
Age	Beliefs about benefits of vaccination	Perceived benefits of HPV vaccination	0.00 (-0.005, 0.006)
	Beliefs about barriers to vaccination	Perceived benefits of HPV vaccination	-0.005 (-0.02, 0.01)
	Beliefs about susceptibility to HPV infection and cervical cancer	Perceived benefits of HPV vaccination	0.06 (0.003, 0.12)
	Beliefs about severity of HPV infection and cervical cancer	Perceived benefits of HPV vaccination	0.03 (-0.04, 0.11)
Total			0.09 (0.01, 0.17)
Age	Beliefs about benefits of vaccination	Perceived barriers to HPV vaccination	
	Beliefs about barriers to vaccination	Perceived barriers to HPV vaccination	0.04 (-0.07, 0.14)
	Beliefs about susceptibility to HPV infection and cervical cancer	Perceived barriers to HPV vaccination	-0.003 (-0.04, 0.03)
	Beliefs about severity of HPV infection and cervical cancer	Perceived barriers to HPV vaccination	-0.008 (-0.02, 0.01)
Total			0.03 (-0.05, 0.105)

Gender	Beliefs about benefits of vaccination	Perceived benefits of HPV vaccination	0.004 (-0.01, 0.02)
	Beliefs about barriers to vaccination	Perceived benefits of HPV vaccination	0.09 (-0.003, 0.02)
	Beliefs about susceptibility to HPV infection and cervical cancer	Perceived benefits of HPV vaccination	-0.03 (-0.07, 0.009)
	Beliefs about severity of HPV infection and cervical cancer	Perceived benefits of HPV vaccination	0.11 (0.05, 0.18)
Total			0.09 (0.04, 0.15)
Gender	Beliefs about benefits of vaccination	Perceived barriers to HPV vaccination	0.05 (0.00, 0.10)
	Beliefs about barriers to vaccination	Perceived barriers to HPV vaccination	-0.06 (-0.13, 0.01)
	Beliefs about susceptibility to HPV infection and cervical cancer	Perceived barriers to HPV vaccination	0.002 (-0.01, 0.02)
	Beliefs about severity of HPV infection and cervical cancer	Perceived barriers to HPV vaccination	-0.03 (-0.04, -0.01)
Total			-0.04 (-0.09, 0.02)
Educational status	Beliefs about benefits of vaccination	Perceived benefits of HPV vaccination	-0.003 (-0.01, 0.01)
	Beliefs about barriers to vaccination	Perceived benefits of HPV vaccination	-0.011 (-0.03, 0.005)
	Beliefs about susceptibility to HPV infection and cervical cancer	Perceived benefits of HPV vaccination	0.04 (-0.07, 0.09)
	Beliefs about severity of HPV infection and cervical cancer	Perceived benefits of HPV vaccination	-0.01 (-0.09, 0.07)
Total			0.02 (-0.06, 0.10)
Educational status	Beliefs about benefits of vaccination	Perceived barriers to HPV vaccination	-0.03 (-0.09, 0.03)

	Beliefs about barriers to vaccination	Perceived barriers to HPV vaccination	0.08 (-0.03, 0.18)
	Beliefs about susceptibility to HPV infection and cervical cancer	Perceived barriers to HPV vaccination	-0.002 (-0.02, 0.02)
	Beliefs about severity of HPV infection and cervical cancer	Perceived barriers to HPV vaccination	0.002 (-0.01, 0.02)
Total			0.05 (-0.03, 0.13)
Ethnicity	Beliefs about benefits of vaccination	Perceived benefits of HPV vaccination	-0.001 (-0.005, 0.003)
	Beliefs about barriers to vaccination	Perceived benefits of HPV vaccination	-0.008 (-0.02, 0.002)
	Beliefs about susceptibility to HPV infection and cervical cancer	Perceived benefits of HPV vaccination	0.01 (-0.02, 0.04)
	Beliefs about severity of HPV infection and cervical cancer	Perceived benefits of HPV vaccination	-0.049 (-0.10, 0.001)
Total			-0.05 (-0.11, 0.008)
Ethnicity	Beliefs about benefits of vaccination	Perceived barriers to HPV vaccination	-0.001 (-0.005, 0.004)
	Beliefs about barriers to vaccination	Perceived barriers to HPV vaccination	-0.008 (-0.02, 0.004)
	Beliefs about susceptibility to HPV infection and cervical cancer	Perceived barriers to HPV vaccination	0.008 (-0.03, 0.04)
	Beliefs about severity of HPV infection and cervical cancer	Perceived barriers to HPV vaccination	-0.05 (-0.11, 0.008)
Total			0.06 (0.001, 0.10)