

Supplementary Table 1: RE-AIM Dimensions and selected indicators reported by the reviewed articles (n =17)

Author/year/ Country	Design/ Outcome	Reach	Efficacy	Adoption	Implementation	Maintenance
Chodick et al (2020) Israel	<ul style="list-style-type: none"> • Design: RCT • Outcome: HPV vaccine uptake 	<ul style="list-style-type: none"> • Target Population: Mothers with 14-year-old daughters • Behavior: Not described • Sample (n = 21,592) • Recruitment: No specific recruitment method was described but mothers who were members of Maccabi Healthcare Services were recruited to the study. 	<ul style="list-style-type: none"> • Uptake: 55.3% vaccine uptake in Intervention group vs 55.0% in control. • Increased in vaccine uptake in Higher SES Facebook campaign group 55.8% • Condition: Facebook campaign group (n=17,271) vs control condition (n=4,321) • Assessment: Post assessment of outcome • Vaccinated = 9551+2377=11928 	<ul style="list-style-type: none"> • Setting: Hospital setting (Maccabi Healthcare Services) • Staff: Gynecologist developed the campaign messages 	<ul style="list-style-type: none"> • Medium: Facebook was used to deliver the content and videos • Theory: Inoculation theory • Duration: No specific time frame but participants re-view the content on Facebook and watch the video • Cost: Total cost of intervention not reported 	<ul style="list-style-type: none"> • Institutionalization: No Data
Fontenot et al (2020) USA	<ul style="list-style-type: none"> • Design: Pilot Intervention • Outcome: HPV vaccine uptake 	<ul style="list-style-type: none"> • Target Population: MSM 18-26 years • Behavior: unvaccinated, not up to date, no vaccine status. • Sample (n = 42) • Participation rate: 42/54= 78% • Recruitment: Mobile app recruitment through MSM dating app. 	<ul style="list-style-type: none"> • Uptake: 23% vaccine uptake • Condition: Single group pre/post-intervention • Assessment: Pre/post assessment of outcome • Vaccinated =10 	<ul style="list-style-type: none"> • Setting: Communities in Boston, Massachusetts • Staff: Intervention delivery staff was not described but hospital staff involved in the data collection process 	<ul style="list-style-type: none"> • Medium: mHealth tool • Theory: Implementation intention theory and design thinking • Duration: No specific time frame but participants re-view the mHealth tools at their own pace • Cost: Total cost of intervention not reported but participants received \$5 gift cards 	<ul style="list-style-type: none"> • Institutionalization: No Data

					plus a chance to win \$75 gift card	
Gerend & Madkins et al. (2020) USA	<ul style="list-style-type: none"> • Design: RCT • Outcome: HPV vaccine uptake 	<ul style="list-style-type: none"> • Target Population: Young Sexual Minority Men 18 -25 • Behavior: Unvaccinated • Sample (n = 150) • Participation rate: (150/155) 96.77% • Recruitment: Recruited participants using social media and advertisement 	<ul style="list-style-type: none"> • Uptake: Vaccination initiation higher among the intervention group (19.4%) vs. control group (6.6%) • Condition: RCT: Intervention group (n=72) vs. control group (n=76) • Assessment: Assessed vaccination status at baseline, 3-week follow-up and 9-month follow-up assessments. • Vaccinated =14+5 = 19 	<ul style="list-style-type: none"> • Setting: No specific setting but participants were recruited from Chicago areas. • Staff: No intervention delivery staff description 	<ul style="list-style-type: none"> • Medium: Used text messages to deliver intervention messages. • Theory: Information-Motivation-Behavioral Skills (IMB) model framework • Duration: Intervention duration or contact was daily for the first 3 weeks and changed to 1 per month for 8 months. • Cost: Total cost not reported but each participant could receive \$75 	<ul style="list-style-type: none"> • Institutionalization: No Data • However, 9-month follow-up was conducted • Attrition rate: between 4% -7% attrition rate at 3 weeks follow up and 9% -12% at 9 months follow-up
Gerend et.al (2020) USA	<ul style="list-style-type: none"> • Design: Not stated • Outcome: Increase in overall HPV vaccination rates 	<ul style="list-style-type: none"> • Target Population: Male and female students • Sample (n = 799) • Behavior: had not yet completed the HPV vaccine series • Recruitment: No specific recruitment strategy described. 	<ul style="list-style-type: none"> • Observed a 75% increase in HPV doses. • Observed a trend that more HPV vaccine doses were administered to students older than 26 years of age in 2019 vs 2018 • Intervention condition was not described but it was a single group intervention • Baseline assessment and post intervention assessment 	<ul style="list-style-type: none"> • Setting: University campus • Staff: UHS staff consisted of physicians, physician assistants, and nurse practitioners delivered the intervention 	<ul style="list-style-type: none"> • Medium: Weekly social media postings (Not mention specific social media) • Theory: No Theory • Duration: Multi-intervention components which had 30-minute PowerPoint presentation • Intervention has 2 components: (1) student direction 	Institutionalization: No Data

Note: RCT = Randomized Controlled Trial; MSM = Men having sex with men;

			<ul style="list-style-type: none"> • Vaccinated =599 		<p>campaign materials (2) provider directed training and HPV vaccination encouragement</p> <ul style="list-style-type: none"> • Intervention was limited to the first three months of the Spring semester • Cost: No data 	
Kempe et al. (2016) USA	<ul style="list-style-type: none"> • Design: RCT • Outcome: Increase HPV vaccine completion series 	<ul style="list-style-type: none"> • Target Population: Parents of eligible adolescents receiving their first HPV vaccine • Adolescents (males and females) ages 11-17; PCO members for past 2 years Sample (n = 929) • Behavior: Already received 1st dose • Recruitment: Active enrollment with intervention group, passive enrollment in control group 	<ul style="list-style-type: none"> • Uptake: Significant increased vaccination completion rate among intervention group compared to control group (63% vs 38% respectively) • Intent-to-treat analysis • Condition: RCT: cluster, randomized pragmatic trial (intervention n=374 or control group n=555) • Assessments: Two follow-up assessments • Vaccinated = 236+211=447 	<ul style="list-style-type: none"> • Setting: KPCO Clinic • Staff: Clinic staff including pediatric, nurses, medical assistants who helped in enrollment phase. 	<ul style="list-style-type: none"> • Medium: Used text messages, email, or auto-dial: • Theory: No theory • Duration: Not specific but KPCO used an Interactive Voice Response (IVR) system, which is capable of producing multiple automated recall messages parents selected reminder recall method • Recalls issued for each remaining dose • Cost: No data 	<ul style="list-style-type: none"> • Institutionalization was part of the long-term plan of the researchers. • Series completion rates were measured 1 year after HPV dose 1 was received
Kim et.al (2020) USA	<ul style="list-style-type: none"> • Design: RCT • Outcome: measure increase/change in initiation of 	<ul style="list-style-type: none"> • Target population: Korean undergraduate and graduate female students living in the USA • Behavior: Had not yet received HPV vaccination 	<ul style="list-style-type: none"> • Vaccine uptake: Intervention group was twice as likely to receive HPV vaccine dose compared to control group. • Other impact: Both condition increased knowledge. 	<ul style="list-style-type: none"> • Setting: Colleges, churches, social media. • Staff: 3 peers paired of Korean American college women and 	<ul style="list-style-type: none"> • Medium: Mobile web technology to deliver storytelling HPV video and emails. • Theory: Situation specific theoretical framework along 	<ul style="list-style-type: none"> • Institutionalization: No Data

	HPV vaccination	<ul style="list-style-type: none"> • Sample size: (n=104) • Recruitment: Use student leaders, pastors and social media to recruit participants • Loss to follow up: Intervention group (n=9); control (n=8) 	<ul style="list-style-type: none"> • Condition: intervention (n=54) and control group (n=50) • Assessments: Two short-term assessment (post intervention and 2-month follow-up) • Vaccinated = 10 	Physicians address common misconceptions	<ul style="list-style-type: none"> with storytelling and communication theory • Duration: Not specific. • Cost: Total cost not reported. However, each participant received \$20 gift certificate and had chance to win additional \$100 gift card 	
Lee et al. (2016) USA	<ul style="list-style-type: none"> • Design: Pilot efficacy • Outcome: Increase receipt of HPV vaccine 	<ul style="list-style-type: none"> • Target Population: Korean American women ages 21-29 • Behavior: No prior receipt of HPV vaccine • Sample (n = 30) • Recruitment: Multi-recruitment methods including brochures, flyers, advertisement on social media. 	<ul style="list-style-type: none"> • Vaccine uptake: 30% received first dose of vaccine. • Other impact: Increase in knowledge and intent for the vaccine. • Condition: Single pre/post quasi-experimental design • Assessments: Baseline and post-intervention assessment (one week) • Vaccinated = 9 	<ul style="list-style-type: none"> • Setting: No one specific setting. Recruited participants from churches, clinic and other community settings • Staff: Delivery staff was not described. 	<ul style="list-style-type: none"> • Medium: Used text message, mobile phone intervention • Theory: Fogg Behavioral and Trans-theoretical Models • Duration: Messages delivered for 20-30 minutes each day for 7 days • Cost: Not reported 	<ul style="list-style-type: none"> • Institutionalization: No Data
Matheson et al. (2014) USA	<ul style="list-style-type: none"> • Design: Not stated • Outcome: measure increase in HPV vaccine series completion rates 	<ul style="list-style-type: none"> • Target Population: Adolescent and young adult between 11 – 22 years. • Behavior: Patients and parent hospital visits and family initiated the vaccine. • Sample: (n=312) • Recruitment: Recruited during hospital visit 	<ul style="list-style-type: none"> • Vaccine uptake: 14% in intervention group completed the vaccine series compared to 0% in interested group and 3% in standard care group • Other impact: Increased in second doses. • Condition: Not RCT: Three aims (Intervention group n=37, interested group n=43 and standard care n=232) 	<ul style="list-style-type: none"> • Setting: Pediatric clinic • Staff: Health care providers 	<ul style="list-style-type: none"> • Medium: Third party Web-based reminder system delivered text message reminders • Theory: No theory • Duration: Three different text messages at different times • Cost: Not reported 	<ul style="list-style-type: none"> • Institutionalization: Conducted long term follow-up

			<ul style="list-style-type: none"> Assessments: two post intervention assessment for 2 dose and 3 doses. Vaccinated =5+7=12 			
Mohanty et al. (2018) USA	<ul style="list-style-type: none"> Design: Population-based Outcome: measure increases in HPV vaccine uptake 	<ul style="list-style-type: none"> Target Population: Male and female adolescents ages 13-18 Behavior: Under-vaccinated population Sample: (n=155,110) Recruitment: Facebook campaign was used to recruit participants 	<ul style="list-style-type: none"> Vaccine uptake: 152 adolescents received vaccinations Other impact: 63 participants completed 3 doses Condition: No specific comparison group. Assessments. Assessed participants activities through Facebook matrix and the hospital verifications. Vaccinated = 215 	<ul style="list-style-type: none"> Setting: No specific setting but participants were recruited from Philadelphia areas. Staff: Staff from the Philadelphia Department of Public Health 	<ul style="list-style-type: none"> Medium: Facebook and webpage were used to deliver the intervention Theory: Health Belief Model Duration: Campaign was run for two weeks period. Cost: Described the campaign cost (\$3,000 per advertising campaign but did not report total cost. 	<ul style="list-style-type: none"> Institutionalization: No data reported.
Ortiz et al. (2018) USA	<ul style="list-style-type: none"> Design: Not stated Outcome: measure HPV vaccine completion/uptake 	<ul style="list-style-type: none"> Target Population: Adolescents 13-18 years Behavior: Not yet initiated or completed HPV vaccine series Sample: (n= 108) Recruitment: Posters and fliers were used to recruit participants from community center and clinic. 	<ul style="list-style-type: none"> Vaccine uptake: No significant increase in HPV vaccination Other impact: Condition: Intervention group (n=82) and control group (n =26) Assessments: Baseline and three months post intervention assessments. Vaccinated. Not available 	<ul style="list-style-type: none"> Setting: Took place in 2 Southeastern US cities Staff: No data available 	<ul style="list-style-type: none"> Medium: Facebook was used to deliver the intervention. Theory: Health Belief Model Duration: During 3-month time period totaling 24 health facts Cost: Total cost not reported. However, each participant received \$25 gift card. 	<ul style="list-style-type: none"> Institutionalization: No data reported.

Patel et al. (2014) USA	<ul style="list-style-type: none"> • Design: RCT • Outcome: HPV vaccine uptake and completion 	<ul style="list-style-type: none"> • Target Population: Women between ages 19-26 • Behavior: Received first dose of vaccine. • Sample: (n=365) • Recruitment: Participants were recruited during the hospital visit • Inclusion and exclusion: Sufficiently described • Participation rate: No data 	<ul style="list-style-type: none"> • Vaccine uptake: No increase in completion rates in intervention group (17.2%) and control group (18.9%) • Other impact: Older, college degree holder and having lifetime partner complete 3 doses • Condition: cluster-randomized study (Intervention 180 vs. control 185) • Assessments: Baseline assessment was based on receiving first dose of vaccination. Subsequent assessments were based on when the second or third vaccination were received. • Vaccinated = 31+35=66 	<ul style="list-style-type: none"> • Setting: 9 Planned Parenthood clinics, 1 hospital family planning clinic • Staff: Recruitment was done by trained research staff at 10 family planning clinics across 7 US states but those who delivered the intervention was not described. 	<ul style="list-style-type: none"> • Medium: women selected preferred method (text, email, phone, private Facebook message, and standard mail as reminder) • Theory: No theory • Duration: Each participant received 4 messages reminder (over 32 week period) • Cost: No data 	<ul style="list-style-type: none"> • Institutionalization: Followed up the participants up to 32 weeks
Piedimonte S et al. (2018) USA/Canada	<ul style="list-style-type: none"> • Design: RCT • Outcome: HPV vaccine uptake; also measured 3-dose completion rate 	<ul style="list-style-type: none"> • Target Population: University students with mean 24.79 year • Behavior: Used targeted education and vaccination campaign • Sample: Phase I (n=56) and phase II (n=839) • Recruitment: Campaign was implemented on campuses. 	<ul style="list-style-type: none"> • Vaccine uptake: 29 out of 56 were vaccinated in phase I and 64 of 151 were vaccinated. Additional 957 vaccinated • Other impact: Increased knowledge • Condition: McGill University (intervention group) and Concordia University (control) • Assessments: Baseline assessment in phase I and follow-up assessments not stated but implied that they were done at the time they received vaccines • Vaccinated =1,050 	<ul style="list-style-type: none"> • Setting: Two university campuses. • Staff: 2 residents, 6 medical students 	<ul style="list-style-type: none"> • Medium: Social media advertising and mass emailing and posters on campus (did not specify which social media platforms – just social media advertising) • Theory: No theory • Duration: Not clearly stated • Cost: Total cost was not reported but the cost of vaccination was reported. 	<ul style="list-style-type: none"> • Institutionalization: Reported 2- and 6-months follow-up assessment. • Program continued after the intervention.

Title:		<ul style="list-style-type: none"> Unintended consequences were monitored and re- 		Group Based	Individual	Interactive technology	Theory		
(Author, Journal, Year, Page):		ported.		Comments:					
Rand et al. Outcome Measures: (2015) USA knowledge and attitudes about prevention and on their human papillomavirus vaccination intention	<ul style="list-style-type: none"> Design: RCT Outcomes: measure HPV vaccine dose 1; measure up- 	<ul style="list-style-type: none"> Target Population: Parents of unvaccinated adolescents (11-16) Behavior: No record of HPV vaccination Sample: (n=3812) 	<ul style="list-style-type: none"> Vaccine uptake: Intervention 16% vs. Control 13% Other impact: Not reported Condition: Randomized practices to intervention (n=1,893) and control group (n=1,919) 	<ul style="list-style-type: none"> Setting: 29 pediatric clinics and 10 family medicine clinics in MCO network in up-state NY Staff: Managed care 	<ul style="list-style-type: none"> Medium: Used text message reminder-recall system Theory: No theory Duration: Up to four text messages 	<ul style="list-style-type: none"> Institutionalization: Measured first, second and third doses meaning assessments were done up to 12 months or more but not 			
REACH		Reported (Yes/No)		Data		Comments			
Described Target Population	2 and 3	pages were used to invite participants		<ul style="list-style-type: none"> Vaccinated 303+249=552 	throughout the intervention period. grammar delivered the intervention.				
Demographic information	<ul style="list-style-type: none"> Design: RCT Outcome: 	Target Population: Parents of adolescents 11-17 years	<ul style="list-style-type: none"> Vaccine uptake: 48% of phone intervention vs. 40% of phone control and 	<ul style="list-style-type: none"> Setting: 3 urban primary care clinics in 	<ul style="list-style-type: none"> Medium: Used phone and text message reminders 	<ul style="list-style-type: none"> Institutionalization: 			
Method to identify target population	measure the time from en-	Behavior: Not completed 2 nd and 3 rd doses of vaccine.	49% of text intervention vs 30% of text control had received 2 HPV vaccine doses	Rochester, NY (pediatric, medicine pe-	<ul style="list-style-type: none"> Theory: No theory Duration: maximum of 3 re- 	<ul style="list-style-type: none"> intervention lasted 18 month period 			
Recruitment Strategies	attempt to re-			diatric, family medi-	minders sent for each dose				
Inclusion criteria	cept of HPV	<ul style="list-style-type: none"> Sample: (n = 749) 	<ul style="list-style-type: none"> Other impact: text message reminders 	cine).	one week apart				
Exclusion criteria	doses 2 and 3 (for adoles-	<ul style="list-style-type: none"> Recruitment: Method not 	and phone message reminders proved to be effective for the adolescents	<ul style="list-style-type: none"> Staff: Not data 	<ul style="list-style-type: none"> Cost: No data 				
Target population denominator	cents who had	clearly stated but participants were recruited from	<ul style="list-style-type: none"> Condition: two parallel, two arm RCTs 						
Sample size	already started	clinics	(phone reminder (n=178) vs standard						
Participation rate (vaccine series)		<ul style="list-style-type: none"> Used intent-to-treat analy- 	sis of care (n=180), text reminder (n=191						
Characteristics of both participation and non-participation			vs standard of care n=200)						
Cost of recruitment			<ul style="list-style-type: none"> Assessments: vaccine dose uptake measured during and immediately after intervention 						
			<ul style="list-style-type: none"> Vaccinated 85+72+94+60=311 						

EFFICACY/EFFECTIVENESS		Design		Conditions					ization:
al. (2016) USA	• Outcomes Primary: HPV vaccine series completion	students between 18 – 26 years	HPV doses 2 and 3 not significantly different (53% for intervention grp vs 52% for control grp for HPV dose 2 and 34% for intervention grp vs 32% for control grp for dose 3)		rural university in NC		minders and educational messages. Control participants received standard of care (paper card with next appt date).	• baseline paper survey administered at enrollment, electronic f/u survey via Qualtrics administered 7 months after HPV dose 1 receipt	
Efficacy, Effectiveness, Translational?		• Behavior: had received first HPV vaccine dose			• Staff: student center pharmacist approached and consented students into study, also administered HPV vaccine doses				
Measure of primary outcome with or w/o comparison to a public health goal (e.g. HP 2020 goals, exercise 30 min/day; eat 5 Fruits & Veggies)		• Sample: (n=264) • Recruitment: Participants also recruited through special health education events held by study staff. • Participation rate: all participants completed baseline survey, 34% of intervention group completion f/u survey, 39% of control group completed f/u survey	• Other impact: intervention group had significantly higher mean knowledge scores • Condition: Intervention (n=130) vs control (n = 134)		• Location of intervention was well described		• Theory: No theory • Duration: Intervention group received 7 electronic messages across 7 months • Cost: Total cost not reported but each participant received \$10 iTunes gift card and a chance to win an Apple iPad.		
Results (at shortest assessment)			• Assessments: Baseline assessments and 7 months post intervention assessment						
Intent-to-treat or present at FU (circle one)			• Vaccinate 69+70=139						
Imputation procedures (specify)									
Richman et al. (2019) USA	• Design: RCT	• Target Population: Parent child dyads (child ages 9 - 17 years)	• Vaccine uptake: Completion rates in intervention 65% and control group 65% for HPV dose 2 and HPV dose 3 (35% vs. 30% respectively)		• Setting: 2 community clinics (1 in Pitt county, 1 in Greene county)		• Medium: Used text/email	• Institutional	ization:
Quality of life measure									
Measure of unintended consequences (negative) & Results	HPV vaccine uptake and completion	• Behavior: Never vaccinated • Sample: (n = 257)	• Other impact: intervention not successful at increasing HPV 3		• Staff: study staff trained in basic study recruitment (Pitt county clinic)			No data reported	
Measure of robustness across subgroups (e.g. moderation analyses)		• Recruitment: Participants were recruited when they were at clinic to receive first dose vaccine	• Condition: Parent child dyads randomized to intervention (n=129) vs parent child dyads randomized to control (n=128)		• doctors/nurses who administer HPV vaccine		• Duration: Intervention group received 7 electronic messages		
Measure of short-term attrition (%) and differential rates by patient characteristics or treatment condition							• Cost: Total cost not reported but each participant		

Cost effectiveness				• Assessments: baseline survey administered at enrollment; electronic survey	cines trained in recruitment (Greene)	received \$15 Wal-Mart gift card		
ADOPTION - Setting Level			Reported (Yes/No)	Data		Comments		
Description of intervention	Description of location	Target Population: Students and parents of adolescents of year 7 students (7 th grade students).	• Vaccine uptake: 85.71% of students in control, 88.35% in motivational arm, and 89.00% of students in self-regulatory arm received any dose of HPV vaccine at the third school visit	• Setting: Schools	• Medium: Used text messages (groups were motivational SMS vs self-regulatory SMS vs no SMS at all)	• Institutionalization:		
(2019) Description of staff who delivered HPV vaccine	• Outcome: uptake of any	Behavior: child had not yet completed HPV vaccine	• Other impact: Extended follow-up effect was noticed.	• Staff: No data	• Setting participation rate: 7 out of 12 local government immunization providers identified by research team participated	Extended f/u period for students who missed 3rd dose visit		
Method to identify target delivery agent		series	• Intent to treat analysis		• Theory: motivational strategy based on HBM			
Level of expertise of delivery agent		• Sample: (n=4386)	• Condition: RCT: Motivational Short Message Service (SMS) n=1442 vs. self-regulatory SMS n=1418 vs. no SMS n=1,526		• Duration: 1 reminder SMS sent 2 working days before HPV vaccine visit			
Inclusion/exclusion criteria of settings or interventionist		• Recruitment: Recruited parents using a list from the selected schools.		• 31 out of 108 schools participated	• Cost: No data			
Rate (#participating settings/total settings)		• Used intent-to-treat analysis						
Organizational spread (how far into an organization)			• Assessments: study completion rates measured at end of intervention (Dec 2016) and end of extended f/u period (Jan 2017)					
Characteristics of adoption/non-adoption			• 1308+1274+1262=3,844					
Measures of cost of adoption								
Dissemination beyond originally planned								
IMPLEMENTATION			Reported (Yes/No)	Data		Comments		
Theories								

Technology/Social media			
Intervention number of contacts			
Timing of contacts			
Duration of contacts			
Extent protocol delivered as intended (%)			
Participant attendance/completion rates			
Measures of cost			
MAINTENANCE	Reported (Yes/No)	Data	Comments
Was individual behavior assessed at some duration following the completion of the intervention? (give duration of follow-up)			
Attrition			
Is the program still in place?			
If no: reason for discontinuation			
If yes: was the program modified? Specify			
Was the program institutionalized?			

Measure of primary outcome (with or w/o comparison to a public health goal) at \geq 6mo follow-up after final intervention contact			
Measure of broader outcomes or use of multiple criteria at follow- up (e.g., measure of QoL or potential negative outcome) at follow- up			
Robustness data - something about subgroup effects over the long- term			
Measure of long-term attrition (%) and differential rates by patient characteristics or treatment condition	No		