

# The effectiveness of digital health technologies for reducing substance use among young people: a systematic review & meta-analysis

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## Aims

We conducted a systematic review and **two meta-analyses** to assess the effectiveness of digital interventions for reducing substance use (alcohol, smoking, and other substances) among young people aged **10 to 24 years**.

# Methods

Figure 1: PRISMA flow diagram

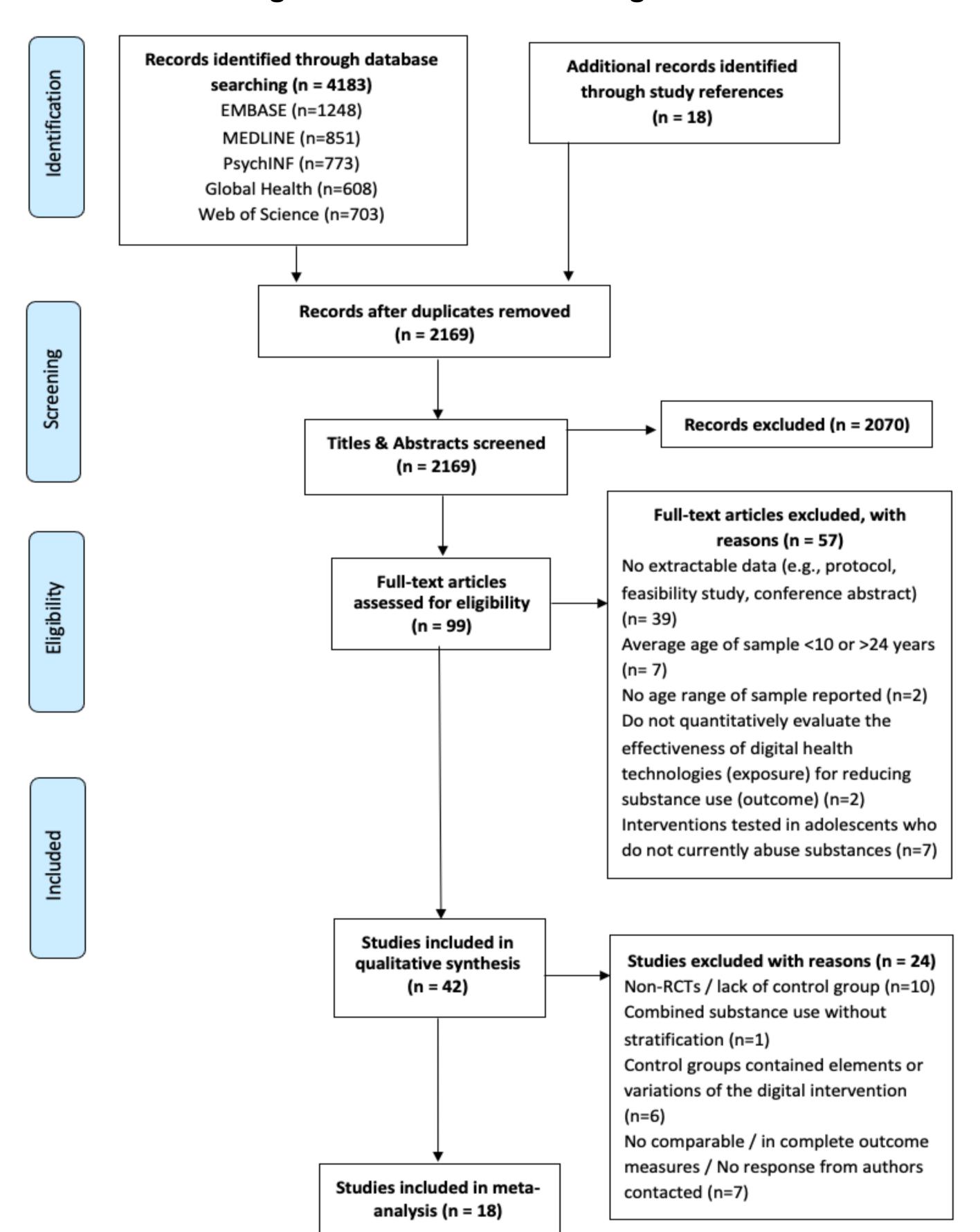


Table 1: Inclusion & Exclusion criteria

Inclusion criteria	Exclusion criteria
Published in English	The mean age of participants was <10 years or >24 years
Quantitatively evaluated the effectiveness of a digital health intervention (exposure) for substance use (outcome)	Assessed passive digital health technologies, such as those developed for the sole purpose of screening, assessment or lacked any user input
Participants who were between 10-24 years of age	<50% of the participant population was between 10-24 years old.
Participants with self-reported current problematic substance use at baseline or a formally diagnosed substance use disorder.	Participants with one-off consumption such as using a substance once a year or once in their lifetime.

Digital health interventions were defined as interventions delivered with the support of computers, mobile phones or portable devices with the primary aim of changing substance use-related behaviours. This systematic review was conducted following Cochrane methodology PRISMA guidelines and was registered with **PROSPERO in November 2020 (CRD42020218442).** 

# Methods (cont.)

- Alcohol use outcome measure = weekly alcohol consumption (continuous).
- Smoking outcome measure = 30-day continuous abstinence (dichotomous).

Post hoc sensitivity analyses investigated whether pooled effect sizes varied by the type of control group under study: face-to-face intervention, assessment only/no intervention, and passive intervention (e.g., leaflets, helplines).

# Results

The pooled SMD (Figure 2) demonstrated a small but statistically significant effect of digital interventions on reducing weekly alcohol consumption at follow-up compared to control arms (SMD=-0.12, 95% Cl=-0.17 to -0.06). There was evidence of low heterogeneity ( $I^2$ =0%; Q(10)=6.20, P=.80).

Figure 2: Forest plot of included alcohol studies

	DI			Control				Std. Mean Difference	Std. Mean Difference		
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Random, 95% CI	IV, Random, 95% CI		
Alfonso 2013	0.05	0.051	48	0.056	0.047	125	2.8%	-0.12 [-0.46, 0.21]	<del></del>		
Bertholet 2015	8.44	8.31	367	9.15	8.8	370	15.0%	-0.08 [-0.23, 0.06]	<del></del>		
Bewick 2010	12.8	19.42	758	15	20.7	354	19.6%	-0.11 [-0.24, 0.02]	<del></del> -		
Deady 2016	15.81	18.2114	24	15.97	14.98511	16	0.8%	-0.01 [-0.64, 0.62]			
Doumas 2009	4.89	3.88	37	5.77	5.91	24	1.2%	-0.18 [-0.70, 0.33]	<del></del>		
Kypri 2004	26	18.75	47	23	31.25	47	1.9%	0.12 [-0.29, 0.52]	<del></del>		
Kypri 2009	9	9.63	811	11	10.37	767	32.0%	-0.20 [-0.30, -0.10]	<del></del>		
Suffoletto 2015	3.78	2.18	308	4	2.3	112	6.7%	-0.10 [-0.32, 0.12]	<del></del>		
Voogt 2013	21.5	20.6	416	22.4	20.5	412	16.9%	-0.04 [-0.18, 0.09]	<del></del>		
Walters 2007	3.17	5.922955	39	2.98	4.809027	43	1.7%	0.04 [-0.40, 0.47]	<del></del>		
Witkiewitz 2014	17.7627	11.6254	59	20.6538	14.3942	26	1.5%	-0.23 [-0.69, 0.23]	-		
Total (95% CI)			2914			2296	100.0%	-0.12 [-0.17, -0.06]	•		
<i>y</i> ,	Heterogeneity: $Tau^2 = 0.00$ ; $Chi^2 = 6.20$ , $df = 10$ ( $P = 0.80$ ); $I^2 = 0\%$								-1 -0.5 0 0.5 1		
Test for overall effect	Z = 4.15 (	P < 0.0001	)						Favours DI Favours Control		

There was no statistically significant effect of digital interventions on 30-day smoking abstinence (OR=1.12, 95% CI=0.70 to 1.80) (Figure 3). There was evidence of considerable and statistically significant heterogeneity ( $I^2$ =81%; Q(6) =32.09, P<0.0001).

Figure 3: Forest plot of included smoking studies

	Digital Interventi	Cont	rol		Odds Ratio	Odds Ratio			
Study or Subgroup	Events	Total	<b>Events</b>	Total	Weight	IV, Random, 95% CI	IV, Random, 95% CI		
An 2008	104	257	60	260	17.8%	2.27 [1.55, 3.32]	<del></del>		
Baskerville 2018	199	820	220	779	19.3%	0.81 [0.65, 1.02]	<del></del>		
Müssener 2020	53	212	31	201	16.5%	1.83 [1.12, 2.99]			
Patten 2006	4	70	8	69	8.4%	0.46 [0.13, 1.61]	· · · · · · · · · · · · · · · · · · ·		
Pbert 2020	15	74	8	43	11.1%	1.11 [0.43, 2.89]			
Simmons 2013	18	81	13	84	12.9%	1.56 [0.71, 3.44]			
Woodruff 2007	37	77	38	59	14.0%	0.51 [0.25, 1.02]	•		
Total (95% CI)		1591		1495	100.0%	1.12 [0.70, 1.80]			
Total events	430		378						
Heterogeneity: $Tau^2 = 0.29$ ; $Chi^2 = 32.09$ , $df = 6$ (P < 0.0001); $I^2 = 81\%$									
Test for overall effect	Z = 0.48 (P = 0.63)	)					0.1 0.2 0.5 1 2 5 10 Favours DI Favours Control		

Digital interventions led to more reductions in alcohol use than no intervention, and comparable reductions to passive interventions and face-to-face therapies (Table 2). For smoking, effect sizes were non-significant regardless of control arm.

Table 2: Sensitivity analysis stratified by control arms

Stratified		Alcoho	ol .	Smoking				
analyses	n	SMD (95% CI)	Cochran's	$I^2$	n	Odds Ratio (95% CI)	Cochran's O	$\mathbf{I}^2$
Control group type			Q			(5570 C1)	Y	
Face-to-face	2	-0.11 (-0.29, 0.07)	Q(1)=0.02 P=0.90	0%	2	0.94 (0.29, 3.05)	Q(1)=2.60 P=0.11	62%
Assessment only / no intervention	6	-0.13 (-0.19, -0.06)	Q(5)=4.66 P=0.46	0%	1		_	_
Passive (e.g., leaflets, standard government websites)	3	-0.00 (-0.28, 0.28)	Q(2)=0.79 P=0.67	0%	4	1.40 (0.76- 2.59)	Q(3)=24.74 P<0.0001	88%

### Conclusion

In young people, digital interventions produced a small but significant reduction in alcohol consumption compared to no intervention, but were not effective for smoking abstinence. Overall, improvements were short-lived and inconsistent.