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Background:

The mental health chatbot represents an innovative online-based intervention designed for adolescents and young adults. This digital assistant is dedicated to providing assistance and guidance to individuals grappling with the complexities of depression and anxiety.

Objective:

The study objective was to evaluate the effectiveness of the mental health chatbot in alleviating symptoms of depression and anxiety among adolescents and young adults.

Methods:

framework was A systematic review employed with a protocol pre-registered on (CRD42023418877). Prospero were systematically searched, including PubMed, ACM Digital Library, Embase, Cochrane and IEEE. The data extraction process adhered to a predefined framework. The studies quality was appraised using the Skills Critical Appraisal Programme questionnaire. Data synthesis was conducted meta-analysis narratively, and was performed by pooling data from the original studies.

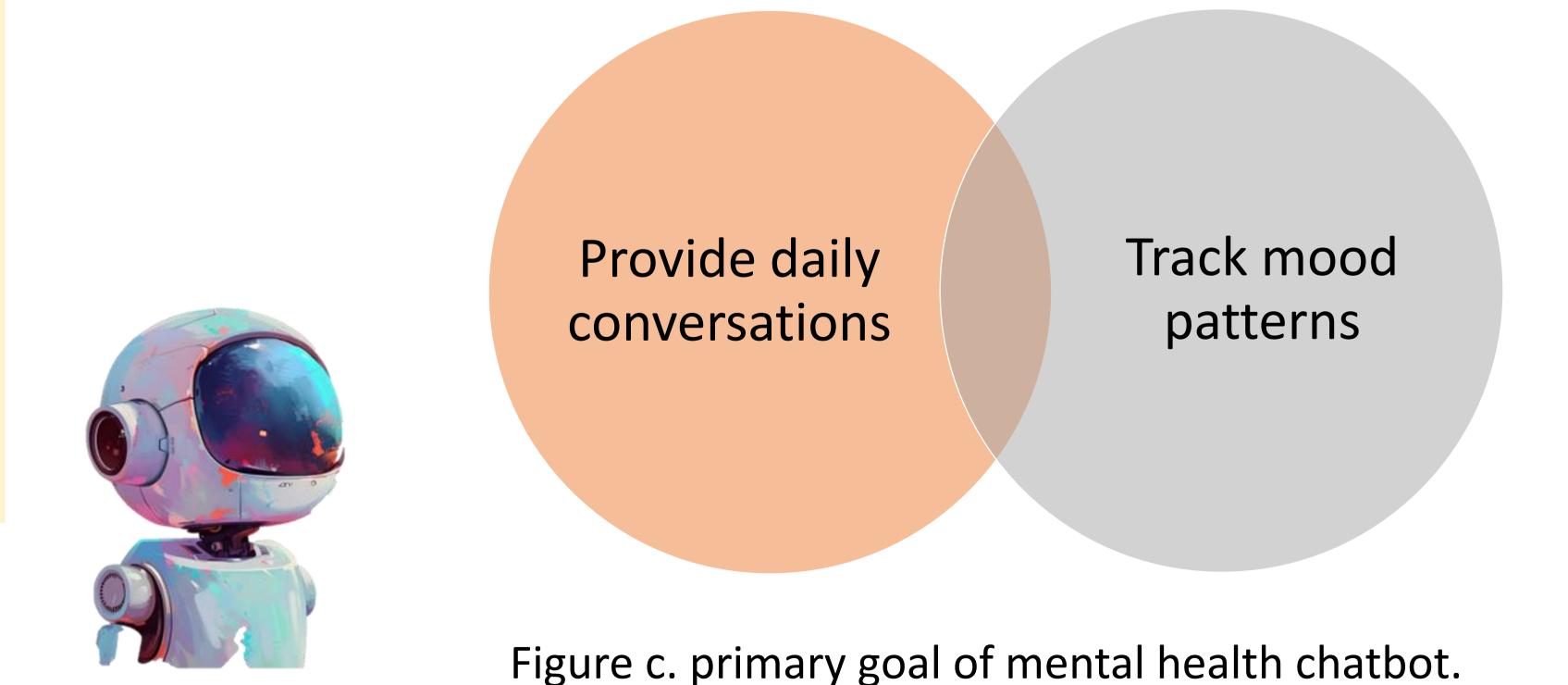


Study or Subgroup Mean SD Total Mean SD Total Weight IV, Fixed, 95% CI IV, Fixed, 95% CI Burton et al. 13.9 8.1 12 17.6 6.8 9 0.5% -3.70 [-10.08 , 2.68] Fitzpatrick et al. 11.14 3.95 31 13.67 4.05 25 4.2% -2.53 [-4.64 , -0.42] Fulmer et al. 6.13 5.1183 26 8.77 5.1183 25 2.3% -2.64 [-5.45 , 0.17] Greer et al 58.2 8.8 16 57.7 6.1 17 0.7% 0.50 [-4.70 , 5.70] He et al. 7.58 2.1 49 8.62 2.1 49 26.8% -1.04 [-1.87 , -0.21] Kleinau et al. 2.72 3.52 215 2.99 4.04 296 42.7% -0.27 [-0.93 , 0.39] Nicol et al. 6.8 6.9 10 12.9 5.4 7 0.5% -6.10 [-11.96 , -0.24] Sabour et al. 16.15 5.58 72 16.65 5.39 105 6.8% -0.50 [-2.15 , 1.15] Suharwardy et al. 3.09 3.02 68 3.23 3.84 84 15.6% -0.14 [-1.23 , 0.95]		Experimental			Control				Mean difference		Mean differen	nce
Fitzpatrick et al. 11.14 3.95 31 13.67 4.05 25 4.2% -2.53 [-4.64 , -0.42] Fulmer et al. 6.13 5.1183 26 8.77 5.1183 25 2.3% -2.64 [-5.45 , 0.17] Greer et al 58.2 8.8 16 57.7 6.1 17 0.7% 0.50 [-4.70 , 5.70] He et al. 7.58 2.1 49 8.62 2.1 49 26.8% -1.04 [-1.87 , -0.21] Kleinau et al. 2.72 3.52 215 2.99 4.04 296 42.7% -0.27 [-0.93 , 0.39] Nicol et al. 6.8 6.9 10 12.9 5.4 7 0.5% -6.10 [-11.96 , -0.24] Sabour et al. 16.15 5.58 72 16.65 5.39 105 6.8% -0.50 [-2.15 , 1.15] Suharwardy et al. 3.09 3.02 68 3.23 3.84 84 15.6% -0.14 [-1.23 , 0.95]	Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Fixed, 95% CI		IV, Fixed, 95%	6 CI
Fulmer et al. 6.13 5.1183 26 8.77 5.1183 25 2.3% -2.64 [-5.45 , 0.17] Greer et al 58.2 8.8 16 57.7 6.1 17 0.7% 0.50 [-4.70 , 5.70] He et al. 7.58 2.1 49 8.62 2.1 49 26.8% -1.04 [-1.87 , -0.21] Gleinau et al. 2.72 3.52 215 2.99 4.04 296 42.7% -0.27 [-0.93 , 0.39] Nicol et al. 6.8 6.9 10 12.9 5.4 7 0.5% -6.10 [-11.96 , -0.24] Gabour et al. 16.15 5.58 72 16.65 5.39 105 6.8% -0.50 [-2.15 , 1.15] Suharwardy et al. 3.09 3.02 68 3.23 3.84 84 15.6% -0.14 [-1.23 , 0.95]	Burton et al.	13.9	8.1	12	17.6	6.8	9	0.5%	-3.70 [-10.08 , 2.68]	←		
Sereer et al 58.2 8.8 16 57.7 6.1 17 0.7% 0.50 [-4.70 , 5.70] He et al. 7.58 2.1 49 8.62 2.1 49 26.8% -1.04 [-1.87 , -0.21] Cleinau et al. 2.72 3.52 215 2.99 4.04 296 42.7% -0.27 [-0.93 , 0.39] Nicol et al. 6.8 6.9 10 12.9 5.4 7 0.5% -6.10 [-11.96 , -0.24] Sabour et al. 16.15 5.58 72 16.65 5.39 105 6.8% -0.50 [-2.15 , 1.15] Suharwardy et al. 3.09 3.02 68 3.23 3.84 84 15.6% -0.14 [-1.23 , 0.95]	itzpatrick et al.	11.14	3.95	31	13.67	4.05	25	4.2%	-2.53 [-4.64 , -0.42]			
He et al. 7.58 2.1 49 8.62 2.1 49 26.8% -1.04 [-1.87 , -0.21]	Fulmer et al.	6.13	5.1183	26	8.77	5.1183	25	2.3%	-2.64 [-5.45 , 0.17]			
Kleinau et al. 2.72 3.52 215 2.99 4.04 296 42.7% -0.27 [-0.93 , 0.39]	Greer et al	58.2	8.8	16	57.7	6.1	17	0.7%	0.50 [-4.70 , 5.70]			
Nicol et al. 6.8 6.9 10 12.9 5.4 7 0.5% -6.10 [-11.96 , -0.24]	He et al.	7.58	2.1	49	8.62	2.1	49	26.8%	-1.04 [-1.87 , -0.21]			
Sabour et al. 16.15 5.58 72 16.65 5.39 105 6.8% -0.50 [-2.15 , 1.15] —— Suharwardy et al. 3.09 3.02 68 3.23 3.84 84 15.6% -0.14 [-1.23 , 0.95] ——	Kleinau et al.	2.72	3.52	215	2.99	4.04	296	42.7%	-0.27 [-0.93, 0.39]		-	
Suharwardy et al. 3.09 3.02 68 3.23 3.84 84 15.6% -0.14 [-1.23 , 0.95] ——	Nicol et al.	6.8	6.9	10	12.9	5.4	7	0.5%	-6.10 [-11.96 , -0.24]			
	Sabour et al.	16.15	5.58	72	16.65	5.39	105	6.8%	-0.50 [-2.15 , 1.15]		-	
Total (95% CI) 499 617 100.0% -0.66 [-1.09 , -0.23]	Suharwardy et al.	3.09	3.02	68	3.23	3.84	84	15.6%	-0.14 [-1.23 , 0.95]		+	
	Total (95% CI)			499			617	100.0%	-0.66 [-1.09 , -0.23]		•	
	Test for overall effect:	Z = 3.02 (P	0.003							-10	-5 0	

Figure a. Forest plot for the mental health chatbot interventions on depressive symptoms

	Experimental			Control				Mean difference	Mean difference		
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Fixed, 95% CI	IV, Fixed, 95% CI		
Fitzpatrick et al.	17.35	3.34	31	16.84	3.35	25	7.4%	0.51 [-1.25 , 2.27]			
Fulmer et al.	6.13	5.9016	26	9.85	5.9016	25	2.2%	-3.72 [-6.96, -0.48]	VI 100 11 11 11 11 11 11 11 11 11 11 11 11		
Greer et al	61.9	7.7	16	63.5	5.5	17	1.1%	-1.60 [-6.19, 2.99]			
Kleinau et al.	2.93	3.31	215	2.89	3.63	296	62.7%	0.04 [-0.57, 0.65]			
Nicol et al.	7.4	6.5	10	11.7	4.8	7	0.8%	-4.30 [-9.67, 1.07]			
Sabour et al.	14.69	4.75	72	14.45	4.08	105	12.7%	0.24 [-1.11 , 1.59]			
Suharwardy et al.	3.32	3.85	68	3.63	4.45	84	13.2%	-0.31 [-1.63 , 1.01]	-		
Total (95% CI)			438			559	100.0%	-0.08 [-0.56 , 0.40]	•		
Heterogeneity: Chi ² =	8.55, df = 6	6 (P = 0.20	0); I ² = 30	%					_ I		
Test for overall effect:	Z = 0.33 (P	0.74							-10 -5 0 5 1		
Test for subgroup diffe	rences: No	t applicat	ole						s [experimental] Favours [cont		

Figure b. Forest plot for the mental health chatbot interventions on anxiety symptoms



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Data analysis:

All meta-analyses were performed in RevMan Version: 6.1 (Nordic Cochrane Center, Cochrane Collaboration, Copenhagen, Denmark) for outcomes that were evaluated in at least 2 of the included RCTs. As all extracted data were continuous, the standard mean difference and weighted mean difference with a 95% confidence interval were calculated to summarize the effect estimates for continuity data.

Results:

Ten randomized controlled trials focused on an acute population, mainly females and university students. The majority studies were predominantly targeting female participant university students. Chatbots designed for daily conversations and mood monitoring, using cognitive behavioral therapy techniques, showed efficacy in treating depression (95% CI = -1.09 to -0.23; p = .003). However, it is essential to highlight that these interventions utilizing chatbots for mental health were not found to be efficacious in managing symptoms of anxiety (95% CI = -0.56 to 0.4; p = .74).

Conclusions:

Evidence supports the effectiveness of mental health chatbots in treating depression, but further exploration and refinement are needed to optimize their efficacy in managing anxiety.

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