The Evolution of Mobile Health (mHealth) Application in Weight Management Among Overweight/Obese Population in China: A Systematic Review and Meta Analysis

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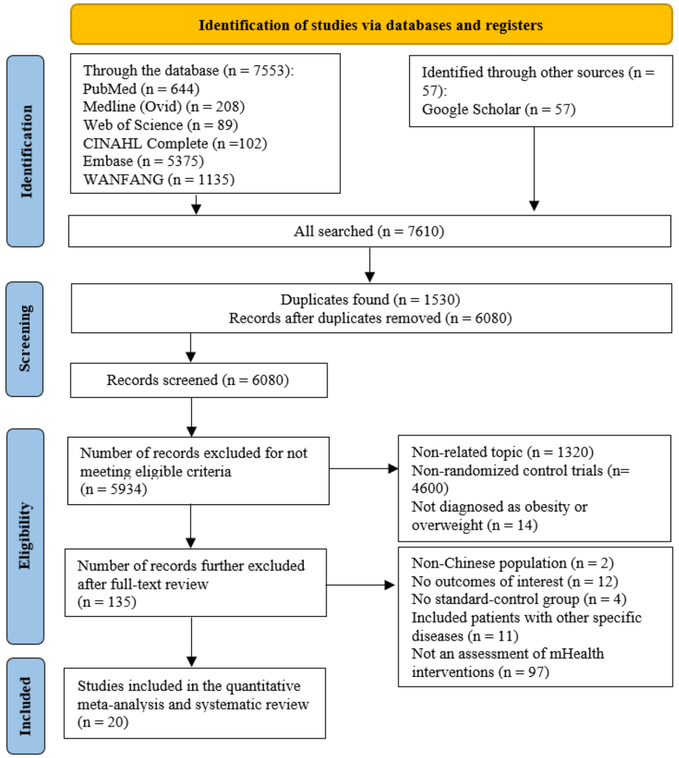
Background & Objectives

China has experienced an alarming rise in obesity in the past decades. The rising rates of obesity and number of people affected, as well as the related health and economic consequences, place a huge burden on China's health-care system. Mobile health (mHealth) provides promising options for low-cost and effective health promotion. This study aimed to describe the evolution of the application of mHealth (from traditional to intelligent mHealth interventions) in weight management in China and examined the effectiveness of mHealth interventions for obesity treatment among Chinese population.

Methods

We searched studies conducted among overweight/obese Chinese population via six online databases up to July 1, 2021. Three independent reviewers screened studies and extracted data. Inclusion criteria were (1) participants in studies were overweight or obese patients in China (BMI ≥ 24 kg/m^2 is overweight, BMI ≥ 28 kg/m^2 is obesity); (2) mobile devices, such as mobile phones and/or wearable monitoring devices with the functions of receiving text messages, phone calls, emails and installing apps, were used in the health intervention or care delivery; (3) weight-related behaviors and outcomes were evaluated such as Body Weight (BW), Body Mass Index (BMI), Waist Circumference (WC), Body Fat Percentage (BFP), etc.; (4) the study design should be a randomized control trial (RCT). The risk of bias was evaluated in accordance with the Risk of Bias 2 from the Cochrane Quality Assessment Tool for Quantitative Studies. Review Manager 5.3 and R Studio were used to conduct the meta-analysis. Mean differences, confidence interval, and study heterogeneity (I^2) were estimated for weight measures including BW (kg), BMI (kg/m^2), WC (cm), and BFP (%).

Figure 1: PRISMA Flow Chart of Study Selection Process



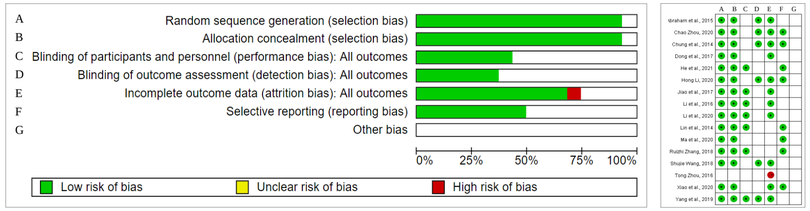
Results

In total, 7610 studies were identified. After the duplicates (n = 1530) were removed, of the 6080 relevant citations retrieved, 20 trials of 18006 randomized participants were finally included in this review (**Figure 1.**). The average age of the participants ranges from 14 years to 68 years. All the included studies are randomized control trials, published between 2013 and 2021.

Assessment of Risk of Bias

In general, the reviewed studies were considered to constitute high-quality evidence (**Figure 2)**. All the 20 studies showed a low risk of selection bias. Only one study had blinding of the outcome assessment.

Figure 2: Risk bias assessment of the included studies



Meta-analysis

4 studies examined the effects of the traditional interventions, and 16 studies assessed the intelligent interventions in reducing BW, BMI, WC and BFP (**Table 1**). **Table 2** showed the pooled effects in reducing BMI among the traditional and intelligent interventions, and the traditional mHealth services seemed more effective than the intelligent ones. **Table 3** described the pooled effects in reducing WC and the intelligent mHealth services worked better than the traditional ones.

Table 1: Effectiveness of Intelligent and Traditional mHealth Interventions

	BW (kg)	BMI (kg/m^2)	WC (cm)	BFP (%)
1.1 Intelligent mHealth interventions				
Social media-based	MD: -4.25 95% CI: [-6.01, -2.50] I^2 index: 85% Z=4.82, P<0.00001	MD: -2.45 95% CI: [-3.45, -1.46] I^2 index: 85% Z=4.82, P<0.00001	MD: -3.63 95% CI: [-6.00, -1.26] I^2 index: 83% Z=3.00, P=0.003	MD: -3.00 95% CI: [-5.41, -0.59] I^2 index: N/A Z=2.44, P=0.01
Self-management-based	MD: -2.59 95% CI: [-4.72, -0.46] I^2 index: 85% Z=4.82, P<0.00001	MD: -1.75 95% CI: [-2.22, -1.28] I^2 index: 0% Z=7.26, P<0.00001	MD: -3.95 95% CI: [-6.33, -1.57] I^2 index: 29% Z=3.25, P=0.001	MD: -3.89 95% CI: [-7.57, -0.22] I^2 index: 90% Z=2.08, P=0.04
Web-based platform	MD: -0.10 95% CI: [-9.91, 9.71] I^2 index: N/A Z=0.02, P=0.98	MD: -1.12 95% CI: [-2.09, -0.14] I^2 index: 0% Z=2.25, P=0.02	MD: -0.30 95% CI: [-3.66, 3.06] I^2 index: N/A Z=3.18, P=0.001	MD: -2.37 95% CI: [-5.06, 0.31] I^2 index: 0% Z=1.73, P=0.08
Wearable devices	MD: -1.68 95% CI: [-2.30, -1.06] I^2 index: N/A Z=5.28, P<0.00001	MD: -0.68 95% CI: [-0.93, -0.43] I^2 index: N/A Z=5.23, P<0.00001	MD: -3.46 95% CI: [-5.60, -1.32] I^2 index: N/A Z=3.18, P=0.001	MD: -0.02 95% CI: [-0.03, -0.01] I^2 index: N/A Z=5.00, P<0.00001
Pooled results	MD: -2.62 95% CI: [-3.85, -1.40] I^2 index: 37% Z=4.21, P<0.0001	MD: -1.88 95% CI: [-2.61, -1.14] I^2 index: 90% Z=5.02, P<0.00001	MD: -3.36 95% CI: [-4.68, -2.05] I^2 index: 61% Z=5.01, P<0.00001	MD: -2.51 95% CI: [-4.68, -2.05] I^2 index: 91% Z=2.57, P=0.01
1.2 Traditional mHealth interventions				
Pooled results (SMS and Telephone follow-ups)	NA	MD: -3.05 95% CI: [-7.71, 1.60] I^2 index: 100% Z=1.28, P=0.20	MD: -2.17 95% CI: [-3.17, -1.17] I^2 index: 73% Z=4.24, P<0.0001	NA

Table 2: Forest Plot of the Comparison Regarding BMI

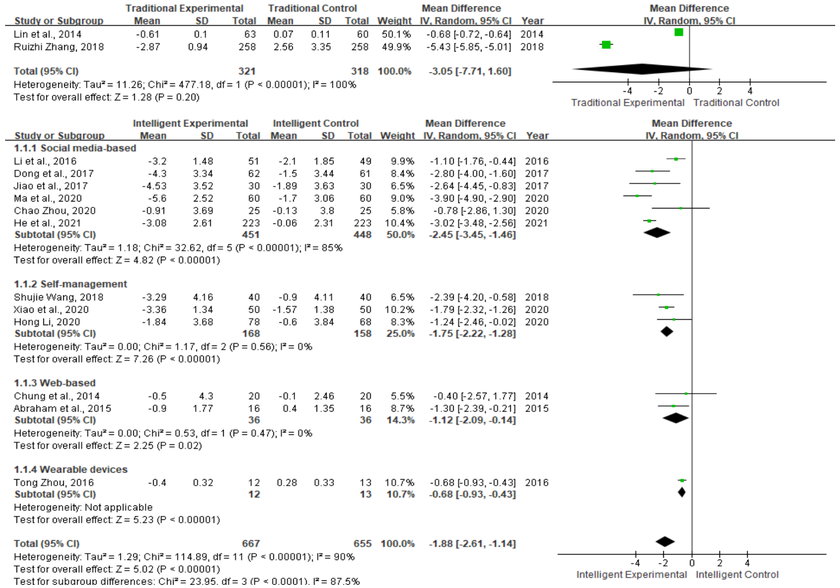
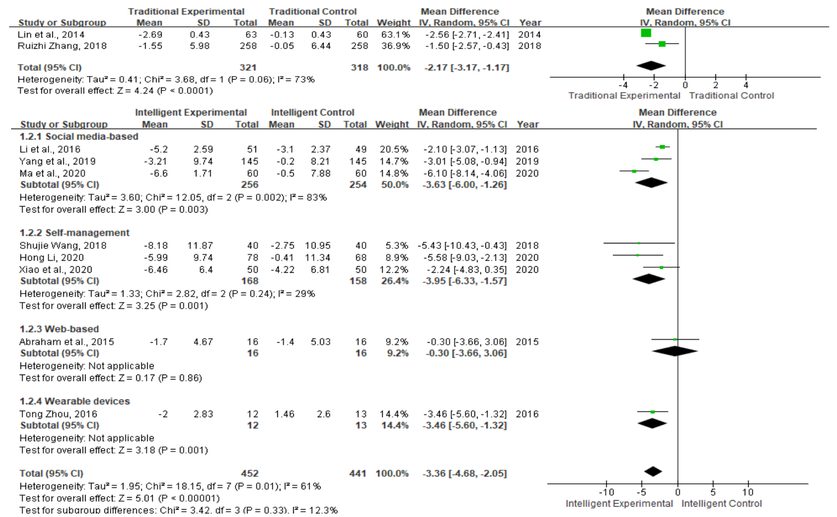


Table 3: Forest Plot of the Comparison Regarding WC



Conclusion

Mobile Health using intelligent services seemed to be more effective in weight loss, compared to the traditional mHealth interventions. More studies examining the effects of mHealth in weight management among vulnerable and elderly population are needed.