Effectiveness of smoking cessation methods among Chinese smokers: a systematic review and meta-analysis of randomized controlled trials

Shi Hongying¹, Yang Xinjun1*, Huang Chenping¹, Liu Ziwei¹, Xu Xinyun¹, Lin Chong¹, Weitkunat Rolf², Baker Gizelle², Sponsiello-Wang Zheng²

¹ Department of Preventive Medicine, School of Environmental Science and Public Health, Wenzhou Medical College, Wenzhou 325035, China

² Philip Morris Products S.A, Research & Development, Quai Jeanrenaud 5, 2000 Neuchatel, Switzerland

Corresponding author: Yang Xinjun (Email: xjyang@wzmc.edu.cn)

Introduction and Objectives

The World Health Organization (WHO) reports tobacco use as the leading cause of death and one of the main risk factors for a number of chronic diseases. China is the largest producer and consumer of tobacco products in the world. Approximately 49–67% of men and 2–5% of women are smokers, constituting one-third of the world's smokers. The successful cessation rate is extremely low in China. The majority of smoking cessation occurs without using evidence-based cessation treatments. Understanding the current situation of smoking cessation interventions in China will be very important in order to plan further cessation intervention studies, and to provide evidence-based information for smokers, tobacco control experts, health care professionals, and policy makers in China, thus promoting Chinese smokers to quit smoking and to reduce tobacco-related diseases.

The aim of this systematic review is to understand: (1) what kind of cessation interventions have been used in China, and (2) the effectiveness of pharmacotherapies and behavior interventions on abstinence over time after cessation among Chinese patient and non-patient smokers.

Materials and Methods

PUBMED, Chinese BioMedical Literature Database (CBM), China National Knowledge Infrastructures (CNKI) databases and the Cochrane Library were searched in December 2012 using MESH and keywords to identify randomized controlled studies comparing different smoking cessation methods conducted in mainland China. All included studies were assessed for methodological quality. Primary outcome was prevalence of abstinence by duration of follow-up. In total, 2286 articles were identified through systematic database and manual searches. After screening and additional searches, 28 articles were included in this systematic review. The information that was extracted from each study includes: 1) age, gender, health condition, smoking status, willingness to quit of study participants; 2) methods of smoking intervention, treatment dosages and follow-up frequencies; 3) the specific measurement of abstinence (continuous or point prevalence), and the methods of biochemical confirmation of smoking abstinence; 4) settings, sample size, language of publications, duration of follow-up; 5) primary results, including the treatment effects at different time points; and 6) risk of bias and methodological details. Meta-analysis was performed where possible to evaluate the effectiveness of different interventions at short-term (≤3 months), mid-term (3-6 months) and long-term (>6 months) follow-ups. The analyses were conducted with Rev Man 5.

Results

Twenty-eight randomized controlled studies (involving 6099 participants) were identified with at least one cessation outcome (sustained abstinence or point prevalence abstinence). Six studies were published in English journals, while 22 studies were published in Chinese journals. Twenty studies were published during 2010-2013. Fifteen studies (53.6%) were hospital-based and focused on patients, while the other 13 studies focused on non-patients. Eight studies (28.6%) evaluated the effects of pharmacotherapies, while the others focused on different non-pharmacotherapy interventions (i.e., behavior interventions). The cessation rates of pharmacotherapy and non-pharmacotherapy among patient and non-patient smokers were analyzed separately, stratified for follow-up duration. The number of behavior intervention studies at short-term, mid-term and long-term were 13, 12 and 10, respectively. The number of pharmacotherapy intervention studies at short term, mid term and long term were 8, 4, and 1, respectively.

	Behav	Usual Care		Risk Ratio		Risk Ratio	
Study or Subgroup	Events	Total	Events	Total	Weight	M-H, Random, 95% CI	M-H, Random, 95% CI
Short term (≤ 3m)							
Counseling -Zhang LJ, 2011	164	304	130	303	5.9%	1.26 [1.06, 1.48]	-
Sports - Liang Y, 2012	38	60	29	60	4.8%	1.31 [0.95, 1.81]	-
ENI - Cheng QR, 2011	56	96	42	100	5.1%	1.39 [1.04, 1.85]	
Psych - Wei YQ, 2011a	28	36	20	36	4.7%	1.40 [1.00, 1.97]	-
EDU - Li Q, 2010a	12	135	8	139	1.9%	1.54 [0.65, 3.66]	
5A - Tang QJ, 2011	42	50	27	50	5.1%	1.56 [1.17, 2.06]	-
Counseling - Shi XL, 2011	133	150	65	150	5.7%	2.05 [1.69, 2.48]	-
EDU - Chen X, 2010	66	72	12	58	3.5%	4.43 [2.66, 7.37]	
Counseling - Lin PR, 2013	14	74	2	52	0.8%	4.92 [1.17, 20.73]	
Subtotal (95% CI)		977		948	37.5%	1.69 [1.34, 2.12]	•
Total events	553		335				
Heterogeneity: Tau ² = 0.08; Chi		(P < 0.0001)		7%			
est for overall effect: Z = 4.46 (P < 0		(. (0.0001)	,	. , 0			
1 × 1	2.00001,						
Mid term (3 -6m)							
Counseling -Zhang LJ, 2011	145	304	123	303	5.8%	1.17 [0.98, 1.41]	-
Sports - Liang Y, 2012	41	60	29	60	4.9%	1.41 [1.03, 1.93]	-
ENI - Li XM, 2010	32	54	22	54	4.3%	1.45 [0.98, 2.15]	-
ENI - Cheng QR, 2011	68	96	40	100	5.2%	1.77 [1.35, 2.32]	-
Psych - Wei YQ, 2011a	27	36	15	36	4.0%	1.80 [1.17, 2.77]	
EDU - Li Q, 2010a	15	135	8	139	2.0%	1.93 [0.85, 4.40]	-
Counseling - Xia JZ, 2012	70	173	32	172	4.5%	2.17 [1.52, 3.12]	-
Counseling - Lin PR, 2013	13	74	2	52	0.8%	4.57 [1.08, 19.39]	
Other - Zhao J, 2011	24	70	4	70	1.5%	6.00 [2.20, 16.40]	
Subtotal (95% CI)		1002	•	986	33.1%	1.73 [1.37, 2.19]	•
Total events	435		275				
Heterogeneity: Tau ² = 0.07; Chi		(P = 0.002);		%			
Test for overall effect: $Z = 4.57$ (P < 0		, , , , , ,					
and tarm (>6m)							
.ong term (>6m) 5A - Wang YM, 2011	35	41	26	41	5.2%	1.35 [1.03, 1.75]	-
" wang mi, zom	00	• • •		54	4.3%	1.95 [1.33, 2.87]	
-NI - Li XM 2010	30	51	/11	JH	T.∪ /0	1.00 [1.00, 2.07]	
ENI - Li XM, 2010 ENI - Ma H I 2006	39 63	54 82	20		/ Ω0/	2 17 [1 50 2 00]	-
ENI - Ma HJ, 2006	63	82	29	82	4.9%	2.17 [1.58, 2.98]	
ENI - Ma HJ, 2006 ENI - Cheng QR, 2011	63 75	82 96	29 32	82 100	4.9%	2.44 [1.80, 3.31]	
ENI - Ma HJ, 2006 ENI - Cheng QR, 2011 5A - Tang QJ, 2011	63 75 40	82 96 50	29 32 16	82 100 50	4.9% 4.0%	2.44 [1.80, 3.31] 2.50 [1.63, 3.83]	
ENI - Ma HJ, 2006 ENI - Cheng QR, 2011 5A - Tang QJ, 2011 Counseling - Shi XL, 2011	63 75 40 123	82 96 50 150	29 32 16 44	82 100 50 150	4.9% 4.0% 5.3%	2.44 [1.80, 3.31] 2.50 [1.63, 3.83] 2.80 [2.16, 3.62]	
ENI - Ma HJ, 2006 ENI - Cheng QR, 2011 5A - Tang QJ, 2011 Counseling - Shi XL, 2011 Counseling - Lin PR, 2013	63 75 40	82 96 50 150 74	29 32 16	82 100 50 150 52	4.9% 4.0% 5.3% 0.8%	2.44 [1.80, 3.31] 2.50 [1.63, 3.83] 2.80 [2.16, 3.62] 3.86 [0.89, 16.71]	
ENI - Ma HJ, 2006 ENI - Cheng QR, 2011 EA - Tang QJ, 2011 Counseling - Shi XL, 2011 Counseling - Lin PR, 2013 Subtotal (95% CI)	63 75 40 123 11	82 96 50 150	29 32 16 44 2	82 100 50 150	4.9% 4.0% 5.3%	2.44 [1.80, 3.31] 2.50 [1.63, 3.83] 2.80 [2.16, 3.62]	
ENI - Ma HJ, 2006 ENI - Cheng QR, 2011 EA - Tang QJ, 2011 Counseling - Shi XL, 2011 Counseling - Lin PR, 2013 Subtotal (95% CI) Total events	63 75 40 123 11	82 96 50 150 74 547	29 32 16 44 2	82 100 50 150 52 529	4.9% 4.0% 5.3% 0.8%	2.44 [1.80, 3.31] 2.50 [1.63, 3.83] 2.80 [2.16, 3.62] 3.86 [0.89, 16.71]	
ENI - Ma HJ, 2006 ENI - Cheng QR, 2011 EA - Tang QJ, 2011 Counseling - Shi XL, 2011 Counseling - Lin PR, 2013 Subtotal (95% CI)	63 75 40 123 11 386 ² = 19.27, df = 6	82 96 50 150 74 547	29 32 16 44 2	82 100 50 150 52 529	4.9% 4.0% 5.3% 0.8%	2.44 [1.80, 3.31] 2.50 [1.63, 3.83] 2.80 [2.16, 3.62] 3.86 [0.89, 16.71]	
ENI - Ma HJ, 2006 ENI - Cheng QR, 2011 EA - Tang QJ, 2011 Counseling - Shi XL, 2011 Counseling - Lin PR, 2013 Subtotal (95% CI) Fotal events Heterogeneity: Tau ² = 0.07; Chi	63 75 40 123 11 386 ² = 19.27, df = 6	82 96 50 150 74 547	29 32 16 44 2	82 100 50 150 52 529	4.9% 4.0% 5.3% 0.8%	2.44 [1.80, 3.31] 2.50 [1.63, 3.83] 2.80 [2.16, 3.62] 3.86 [0.89, 16.71]	
ENI - Ma HJ, 2006 ENI - Cheng QR, 2011 EA - Tang QJ, 2011 Counseling - Shi XL, 2011 Counseling - Lin PR, 2013 Subtotal (95% CI) Fotal events Heterogeneity: Tau 2 = 0.07; Chi Fest for overall effect: Z = 6.22 (P < 0)	63 75 40 123 11 386 ² = 19.27, df = 6 0.00001)	82 96 50 150 74 547 (P = 0.004);	29 32 16 44 2 169 I ² = 699	82 100 50 150 52 529	4.9% 4.0% 5.3% 0.8% 29.5%	2.44 [1.80, 3.31] 2.50 [1.63, 3.83] 2.80 [2.16, 3.62] 3.86 [0.89, 16.71] 2.17 [1.70, 2.76]	
ENI - Ma HJ, 2006 ENI - Cheng QR, 2011 EA - Tang QJ, 2011 Counseling - Shi XL, 2011 Counseling - Lin PR, 2013 Subtotal (95% CI) Total events Heterogeneity: Tau ² = 0.07; Chi Test for overall effect: Z = 6.22 (P < 0) Total events	63 75 40 123 11 386 ² = 19.27, df = 6 0.00001)	82 96 50 150 74 547 (P = 0.004);	29 32 16 44 2 169 I ² = 699	82 100 50 150 52 529 %	4.9% 4.0% 5.3% 0.8% 29.5%	2.44 [1.80, 3.31] 2.50 [1.63, 3.83] 2.80 [2.16, 3.62] 3.86 [0.89, 16.71] 2.17 [1.70, 2.76]	
ENI - Ma HJ, 2006 ENI - Cheng QR, 2011 EA - Tang QJ, 2011 Counseling - Shi XL, 2011 Counseling - Lin PR, 2013 Subtotal (95% CI) Fotal events Heterogeneity: Tau ² = 0.07; Chi Fest for overall effect: Z = 6.22 (P < 0)	63 75 40 123 11 386 ² = 19.27, df = 6 0.00001)	82 96 50 150 74 547 (P = 0.004);	29 32 16 44 2 169 I ² = 699	82 100 50 150 52 529 %	4.9% 4.0% 5.3% 0.8% 29.5%	2.44 [1.80, 3.31] 2.50 [1.63, 3.83] 2.80 [2.16, 3.62] 3.86 [0.89, 16.71] 2.17 [1.70, 2.76]	

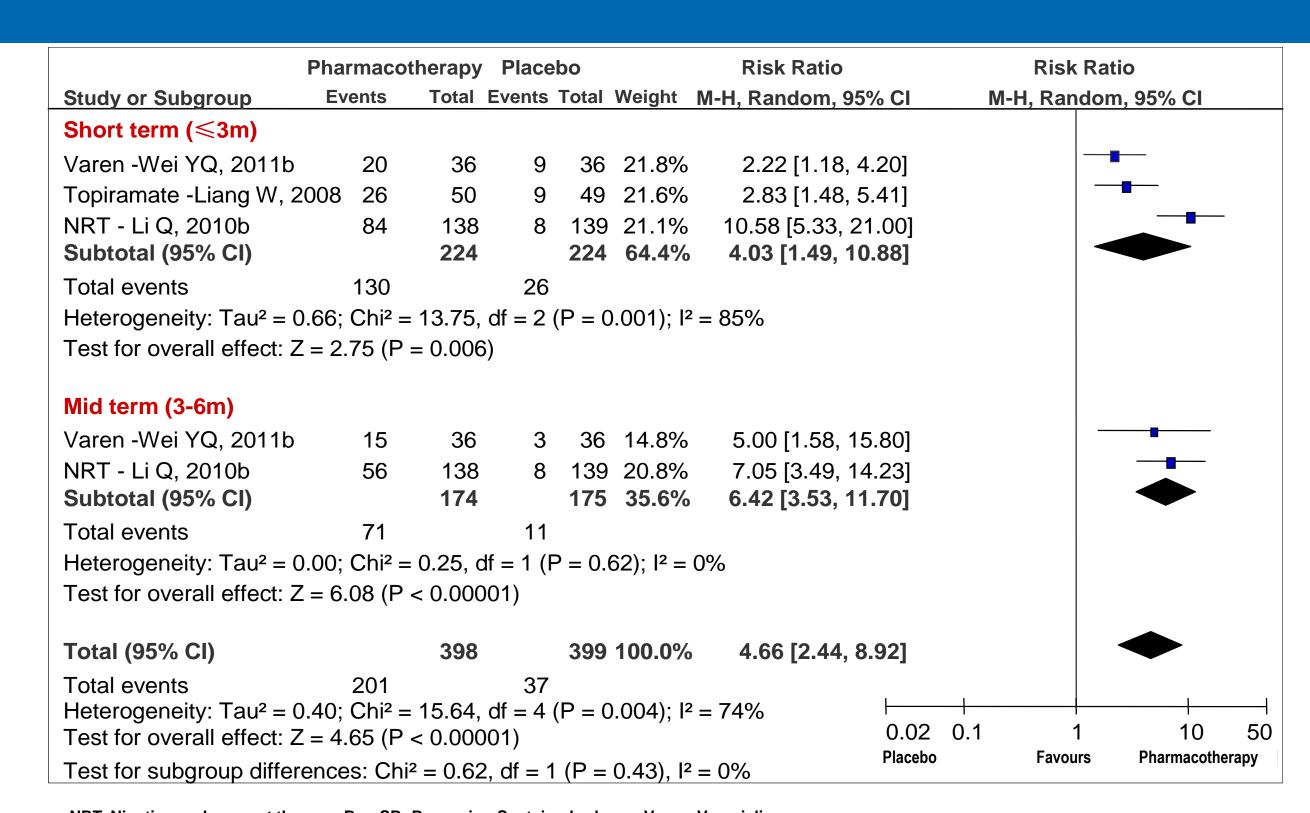
ENI: Extended Nursing Intervention; EDU: Education intervention; 5A: ask, advice, assess, assist, arrange follow-up; Psych: Psychological intervention

igure 1. Effects of behavioral intervention for Chine	se patient smokers.
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	Behavior		Usual Care			Risk Ratio	Risk Ratio	
Study or Subgroup	Events	Total	Events	Total	Weight	M-H, Random, 95% CI	M-H, Random, 95% CI	
Short term (≤3m)								
Other - Jin WT, 2011	28	48	30	67	13.4%	1.30 [0.91, 1.86]	 ■	
Phone - Yu CY, 2010	9	92	6	87	6.7%	1.42 [0.53, 3.82]	- 	
Psych - Yu HX, 2006	13	30	8	30	9.2%	1.63 [0.79, 3.34]	 •	
EDU -Liao GX, 2011	40	60	10	60	10.6%	4.00 [2.21, 7.24]		
Subtotal (95% CI)		230		244	40.0%	1.88 [1.04, 3.40]		
Total events	90		54					
Heterogeneity: Tau² = 0.25;	$Chi^2 = 10.9$	95, df =	3 (P = 0)	0.01);	$I^2 = 73\%$			
Test for overall effect: $Z = 2$	0.08 (P = 0.0)	04)						
Mid term (3-6m)								
Counseling-Zhu SH, 2012	110	359	55	370	14.1%	2.06 [1.54, 2.75]	-	
Group - Lin YF, 2008	27	83	7	73	8.7%	3.39 [1.57, 7.32]		
Group - Zheng PP, 2007	33	118	3	107	5.6%	9.97 [3.15, 31.58]		
Subtotal (95% CI)		560		550	28.4%	3.54 [1.56, 8.01]		
Total events	170		65					
Heterogeneity: Tau ² = 0.38;	$Chi^2 = 8.1$	6, $df = 2$	(P = 0.	02); I ²	$^{2} = 75\%$			
Test for overall effect: $Z = 3$	6.03 (P = 0.0)	002)						
Long term (>6m)								
Counseling -Loke AY, 2005	23	380	16	378	10.3%	1.43 [0.77, 2.66]		
Counseling-Zhu SH, 2012	53	359	22	370	12.0%	2.48 [1.54, 3.99]	_ 	
EDU- Liao GX, 2011	38	60	7	60	9.2%	5.43 [2.64, 11.18]		
Subtotal (95% CI)		799		808	31.5%	2.62 [1.33, 5.14]		
Total events	114		45					
Heterogeneity: Tau ² = 0.26;	$Chi^2 = 7.5$	5, df = 2	(P = 0.	02); I ²	$^{2} = 74\%$			
Test for overall effect: $Z = 2$	1.80 (P = 0.0)	005)						
Total (95% CI)		1589		1602	100.0%	2.44 [1.73, 3.43]	•	
Total events	374		164					
Heterogeneity: $Tau^2 = 0.19$;	$Chi^2 = 31.3$	27, df =	9 (P = 0	0.000	3); $I^2 = 71$	l%	1 1 1 7	
Test for overall effect: $Z = 5$						0.02		
Test for subgroup difference	es: Chi² = 1	.59, df =	= 2 (P =	0.45)), $I^2 = 0\%$	Usual Care	Favours Behavior	

Figure 2. Effects of behavioral intervention for Chinese non-patient smokers.

EDU: Education intervention; Psych: Psychological intervention



NRT: Nicotine replacement therapy; Bup SR: Bupropion Sustained-release; Varen: Varenicline

Figure 3. Effects of pharmacotherapy intervention for Chinese patient smokers.

Pha	armaco	therapy	Place	bo		Risk Ratio		Risk Ratio	
Study or Subgroup E	vents	Total I	Events	Total	Weight	M-H, Random, 95%	CI IV	I-H, Random,	95% CI
Short term (≤3m)									
Diazepam - Hao W, 1992b	15	34	15	35	13.8%	1.03 [0.60, 1.7	76]	-	
Varen - Jiang B, 2011a	1	21	1	24	1.5%	1.14 [0.08, 17.	 16]		
Clonidine - Hao W, 1992a	29	38	15	35	16.0%	1.78 [1.17, 2.7	71]	-	
NRT - Sun H, 2012	60	125	22	124	16.0%	2.71 [1.78, 4.1	12]	_	_
BupSR - Sheng LX, 2012	56	123	16	125	14.6%	3.56 [2.16, 5.8	35]	-	
BupSR - Guo XF, 2005	6	24	1	24	2.4%	6.00 [0.78, 46.	14]		
Subtotal (95% CI)		365		367	64.3%	2.13 [1.35, 3.3	89]		•
Total events	167		70						
Heterogeneity: Tau ² = 0.18	3; Chi² :	= 14.99,	df = 5	(P = 0)	0.01); I ² =	= 67%			
Test for overall effect: $Z = \frac{1}{2}$	3.22 (P	r = 0.001)						
Mid term (3-6m)									
Diazepam - Hao W, 1992b	14	34	14	35	13.2%	1.03 [0.58, 1.8	32]	_	
Varen - Jiang B, 2011a	1	21	1	24	1.5%	1.14 [0.08, 17.	16] <u></u>	<u> </u>	
Clonidine - Hao W, 1992a	24	38	14		15.0%	1.58 [0.98, 2.5	-		
Subtotal (95% CI)		93		94	29.7%	1.32 [0.92, 1.9	90]		
Total events	39		29						
Heterogeneity: $Tau^2 = 0.00$); Chi² :	= 1.30, c	df = 2 (d)	P = 0.	52); $I^2 =$	0%			
Test for overall effect: Z =	1.52 (P	r = 0.13							
L (- 0)									
Long term (>6m)									
Varen - Jiang B, 2011a	5	21	4			• ′	_		_
Subtotal (95% CI)		21		24	6.0%	1.43 [0.44, 4.6	54]		
Total events	5		4						
Heterogeneity: Not applica									
Test for overall effect: $Z = 0$	υ.59 (P	y = 0.55							
Total (95% CI)		479		195	100.0%	1.79 [1.28, 2.5	311		
Total (95% CI)	244	413	400	400	100.070	1.79 [1.20, 2.0	,		
Total events	211	_ 21 /10	103	(D _ (∩	- 59%	1		
Heterogenoity: Tau2 - 0.17		40	$\cdots = 9$	T = 0	J.U I J. I~ =	- JU /0	•	•	•
Heterogeneity: $Tau^2 = 0.14$ Test for overall effect: $Z = 3$		•		(,	,, :		0.02 0.1	1	10 5

Figure 4. Effects of pharmacotherapy intervention for Chinese non-patient smokers.

Summary and Conclusions

Smoking cessation interventions, including pharmacotherapy and behavioral intervention, increased smoking cessation among both Chinese patient smokers and non-patient smokers. However, effects were different for different interventions among different populations and at different follow-up periods. Most studies on pharmacotherapy intervention had shorter follow-up periods (up to 6 months), while studies on behavioral intervention had relatively longer follow-up durations.

Behavioral interventions increased reported abstinence rates among Chinese smokers at short-term, mid-term, and long-term follow up period. Pharmacotherapy was clearly effective only at short-term, while the mid-term and long-term effects could not be definitively demonstrated.

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