

Additional File 1
Supplemental Analyses

**Identifying configurations of behavior change techniques in effective medication adherence
interventions: a qualitative comparative analysis**

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Appendix A

Truth Table for Main Analysis

Table A. Truth Table for Qualitative Comparative Analysis (QCA) of Configurations of Behavior Change Techniques (BCTs) for Improving Medication Adherence. Only rows with empiric cases are shown.

Behavior Change Technique ^a									Number of Studies With Configuration	Consistency (%)	Improved Adherence ^b (Outcome)	Study Citations
Knowledge	Awareness	Attitude	Self-efficacy	Intention Formation	Action Control	Maintenance	Facilitation	Motivational Interviewing				
1	1	0	0	0	1	0	1	0	1	0	0	Pyne et al. 2011[1]
0	0	1	1	1	0	0	0	0	1	100	1	Wolever et al. 2010[2]
1	1	0	0	0	0	0	0	0	5	60	0	Bender et al. 2010[3], Smith et al. 2008[4], Mann et al. 2010[5], Montori et al. 2011[6], Wakefield et al. 2011[7]
1	1	0	1	1	0	0	1	0	1	100	1	Bogner et al. 2010[8]
1	1	0	1	1	0	0	1	1	1	100	1	Wilson et al. 2010[9]
1	0	0	0	0	0	0	1	0	9	44	0	Carter et al. 2009[10], Okeke et al. 2009[11], Waalen et al. 2009[12], Rudd et al. 2009[13], Lee et al. 2006[14], Schnipper et al. 2006[15], Taylor et al. 2003[16], Nietert et al. 2009[17], Solomon et al. 1998[18]
1	1	0	1	0	0	0	0	0	2	100	1	Janson et al. 2009[19], Schaffer et al. 2004[20]
1	1	0	0	0	0	0	1	0	1	0	0	Hunt et al. 2008[21]
1	0	1	0	0	0	0	1	0	1	100	1	Bogner et al. 2008[22]
0	0	0	1	0	1	0	1	0	1	0	0	Pearce et al. 2008[23]
1	1	1	0	1	1	0	1	1	1	100	1	Bosworth et al. 2008[24]
1	0	0	0	0	0	0	0	0	3	33	0	Weymiller et al. 2007[25], Ross et al. 2004[26], Powell et al. 1995[27]
1	0	0	1	0	0	0	1	0	4	100	1	Murray et al. 2007[28], Katon et al. 1996[29], Katon et al. 1995[30], Katon et al. 1999[31]
0	0	0	0	0	0	0	1	0	1	0	0	Sledge et al. 2006[32]
1	1	1	1	0	0	1	0	0	1	100	1	Johnson et al. 2006[33]
1	1	0	0	0	0	0	1	1	1	0	0	Simon et al. 2006[34]
1	1	1	1	0	0	0	0	0	2	100	1	Johnson et al. 2006[35], Wu et al. 2012[36]

Behavior Change Technique ^a									Number of Studies With Configuration	Consistency (%)	Improved Adherence ^b (Outcome)	Study Citations
Knowledge	Awareness	Attitude	Self- efficacy	Intention Formation	Action Control	Maintenance	Facilitation	Motivational Interviewing				
0	0	0	0	1	0	1	0	0	1	0	0	Lin et al. 2006[37]
0	0	0	0	0	0	0	0	1	1	100	1	Berger et al. 2005[38]
1	1	0	0	1	1	1	1	0	1	0	0	Bosworth et al. 2005[39]
1	1	0	1	1	0	1	1	0	1	100	1	Rudd et al. [40]
1	1	0	1	0	0	1	0	0	1	100	1	Janson et al. 2003[41]
1	0	0	0	0	0	1	0	0	1	0	0	Grant et al. 2003[42]
1	0	0	0	0	1	0	0	0	2	50	0	Hoffman et al. 2003[43], Weinberger et al. 2002[44]
1	1	0	0	1	0	1	1	0	1	0	0	Vivian 2002[45]
1	1	0	0	0	1	0	0	0	1	0	0	Guthrie 2001[46]
1	1	0	1	1	1	1	0	1	1	100	1	Katon et al. 2001[47]
0	0	0	0	0	1	0	0	0	1	100	1	Fulmer et al. 1999[48]
1	0	0	1	0	0	0	0	0	1	100	1	Berg et al. 1997[49]
1	1	0	0	1	1	0	1	0	1	100	1	Rich et al. 1996[50]
0	1	0	1	0	0	0	1	0	1	0	0	Schectman et al. 1994[51]
1	1	1	1	1	0	1	0	0	1	100	1	Stacy et al. 2009[52]
1	1	0	0	1	0	0	1	0	2	0	0	Rickles et al. 2005[53], Capoccia et al. 2004[54]
1	1	1	0	0	0	0	0	0	1	0	0	Powers et al. 2011[55]
1	1	0	0	0	0	0	0	1	1	100	1	Friedman et al. 1996[56]
1	0	0	0	1	0	1	1	0	1	100	1	Bogner et al., 2012[57]
1	0	1	1	1	0	0	0	1	1	100	1	Ogedegbe et al. 2012[58]
1	1	1	0	0	0	0	1	1	1	0	0	Solomon et al. 2012[59]
1	0	0	1	1	0	0	1	1	1	100	1	Simon et al. 2004[60]

^a The presence of the behavior change technique (BCT) is indicated by a “1”, the absence of the BCT is indicated by a “0”.

^b A “1” indicates that studies with the configuration of BCTs demonstrate improvements in medication adherence. A “0” indicates that studies with the configuration of BCTs either did not demonstrate improvements in medication adherence, or the studies had contradictory results, with some demonstrating improvements and some not demonstrating improvements.

Appendix B

Complex and Parsimonious Solutions for Qualitative Comparative Analysis of Behavior Change Techniques and Outcome of Improved Medication Adherence

Table B-1. Fourteen Sufficient Configurations of Behavior Change Techniques (BCTs) for Improving Medication Adherence Identified in the Complex Solution^a

Behavior Change Technique Configuration ^b	Number of Studies Covered	Raw Coverage ^c (%)	Unique Coverage ^d (%)	Consistency ^e (%)	Studies Covered
KRfSicg	6	18	15	100	Schaffer et al. 2004[20] Johnson et al. 2006[35] Johnson et al. 2006[33] Wu et al. 2012[36] Janson et al. 2009[19] Janson et al. 2003[41]
KrSticmg	5	15	15	100	Katon et al. 1995[30] Berg et al. 1997[49] Katon et al. 1999[31] Katon et al. 1996[29] Murray et al. 2007[28]
KRfSTcMg	2	6	3	100	Stacy et al. 2009[52] Johnson et al. 2006[33]
KRfStIcg	1	3	3	100	Rudd et al. 2004[40]
KFStIcmG	2	6	6	100	Wilson et al. 2010[9] Simon et al. 2004[60]
krfstiCmg	1	3	3	100	Fulmer et al. 1999[48]
krfsticmG	1	3	3	100	Berger et al. 2005[38]
krfSTIcmg	1	3	3	100	Wolever et al. 2010[2]
KrFsTicmg	3	9	9	100	Bogner et al. 2008[22] Bogner et al. 2012[57] Bogner et al. 2010[8]
KRfsticmG	1	3	3	100	Friedman et al. 1996[56]
KRfStICmg	1	3	3	100	Rich et al. 1996[50]
KrfSTIcmG	1	3	3	100	Ogedegbe et al. 2012[58]
KRfSTICMG	1	3	3	100	Katon et al. 2001[47]
KRfSTICmG	1	3	3	100	Bosworth et al. 2008[24]
Solution Consistency (%) 100					
Solution Coverage (%) 76					
Overlapping Coverage (%) 6					

^a The complex solution represents the logical minimization of only the truth table rows that are covered by studies with the outcome present (N=19 rows). Logical remainders (empty truth table rows) are not included in the process of logical minimization.

^b An uppercase letter in the configuration indicates the BCT was used as part of the study intervention; a lowercase letter indicates the BCT was not used as part of the study intervention. BCTs not listed in the configuration were eliminated during the process of logical minimization.

^c Raw coverage is determined by dividing the number of studies covered by the configuration by the number of studies demonstrating improved adherence (34 in this analysis). Coverage can range from 0 to 100%.

^d Unique coverage is determined by dividing the number of studies that are only covered by the configuration by the number of studies demonstrating improved adherence (34 in this analysis). Coverage can range from 0 to 100%.

^e Consistency is determined by dividing the number of studies in the outcome set covered by the configuration by the number of studies covered by the configuration. Consistency can range from 0 to 100%. A consistency of 100% indicates that all studies covered by the configuration were also in the outcome set (i.e., had improved adherence).

Table B-2. Five Sufficient Configurations of Behavior Change Techniques (BCTS) for Improving Medication Adherence Identified in the Parsimonious Solution^a

Behavior Change Technique Configuration ^b	Number of Studies Covered	Raw Coverage ^c (%)	Unique Coverage ^d (%)	Consistency ^e (%)	Studies Covered
KS	17	50	44	100	Murray et al. 2007[28] Simon et al. 2004[60] Katon et al. 1996[29] Katon et al. 1999[31] Berg et al. 1997[49] Janson et al. 2003[41] Rudd et al. 2004[40] Janson et al. 2009[19] Wu et al. 2012[36] Johnson et al. 2006[33] Johnson et al. 2006[35] Stacy et al. 2009[52] Ogedegbe et al. 2012[58] Wilson et al. 2010[9] Katon et al. 1995[30] Katon et al. 2001[47] Schaffer et al. 2004[20]
rT	5	15	9	100	Bogner et al. 2008[22] Bogner et al. 2012[57] Wolever et al. 2010[2] Ogedegbe et al. 2012[58] Bogner et al. 2010[8]
fG	4	12	3	100	Katon et al. 2001[47] Ogedegbe et al. 2012[58] Berger et al. 2005[38] Friedman et al. 1996[56]
kfm	3	9	3	100	Wolever et al. 2010[2] Fulmer et al. 1999[48] Berger et al. 2005[38]
ICM	2	6	6	100	Bosworth et al. 2008[24] Rich et al. 1996[50]
<i>Solution Consistency (%) 100</i>					
<i>Solution Coverage (%) 76</i>					
<i>Overlapping Coverage (%) 11</i>					

^aThe parsimonious solution represents the automated, logical minimization of all truth table rows (N=512 rows) with simplifying assumptions about logical remainders made by the software to result in the most parsimonious number of solution terms. The plausibility of the simplifying assumptions made about logical remainders is not evaluated.

^bAn uppercase letter in the configuration indicates the BCT was used as part of the study intervention; a lowercase letter in the configuration indicates the BCT was not used as part of the study intervention. BCTs not listed in the configuration were eliminated during the process of logical minimization.

^cRaw coverage is determined by dividing the number of studies covered by the configuration by the number of studies demonstrating improved adherence (34 in this analysis). Coverage can range from 0 to 100%.

^dUnique coverage is determined by dividing the number of studies that are only covered by the configuration by the number of studies demonstrating improved adherence (34 in this analysis). Coverage can range from 0 to 100%.

^eConsistency is determined by dividing the number of studies in the outcome set covered by the configuration by the number of studies covered by the configuration. Consistency can range from 0 to 100%. A consistency of 100% indicates that all studies covered by the configuration are also in the outcome set (i.e., had improved adherence).

Appendix C

Analyses Relating to Configurations of Behavior Change Techniques in Studies Demonstrating *No* Improvements in Medication Adherence

Table C-1. Necessity and Sufficiency for Individual Behavior Change Techniques (BCTs) Used Within Studies Demonstrating *NO* Improvements in Medication Adherence

Behavior Change Technique (Abbreviation for analysis ^a)			Necessity	Sufficiency
	Number of Studies with BCT	Number of Studies with BCT from Among Those Studies Demonstrating <i>No</i> Improvements in Adherence (N=26) ^b	Of Studies Demonstrating <i>No</i> Improvements in Adherence(N=26) ^b , Percent with BCT	Of studies with BCT, Percent that Demonstrate <i>No</i> Improvements in Adherence
Knowledge (K)	53	22	85	42
Facilitation (F)	32	16	62	50
Awareness (R)	29	14	54	48
Self-efficacy (S)	20	2	8	10
Intention formation (I)	15	5	19	33
Action control (C)	10	5	19	50
Attitude (T)	11	2	8	18
Maintenance (M)	10	4	15	40
Motivational interviewing (G)	9	2	8	22

^a Abbreviations are used in the presentation of results.

^b 26 studies demonstrated no improvements in medication adherence out of a total of 60 included studies.

Table C-2. Eight Sufficient Configurations of Behavior Change Techniques (BCTs) Identified in the Parsimonious Solution^a for the Outcome of *NO* Improvements in Medication Adherence

Behavior Change Technique Configuration ^b	Number of Studies Covered	Raw Coverage ^c (%)	Unique Coverage ^d (%)	Consistency ^e (%)	Studies Covered
kF	3	12	12	100	Pearce et al. 2008[23] Sledge et al. 2006[32] Schectman et al. 1994[51]
RiC	2	8	8	100	Pyne et al. 2011[1] Guthrie et al. 2001[46]
sM	4	15	12	100	Lin et al. 2006[37] Bosworth et al. 2005[39] Grant et al. 2003[42] Vivian et al. 2002[45]
RFsc	6	23	15	100	Hunt et al. 2008[21] Simon et al. 2006[34] Vivian et al. 2002[45] Rickles et al. 2005[53] Capoccia et al. 2004[54] Solomon et al. 2012[59]
sTf ^f	1	4	0	100	Powers et al. 2011[55]
RsTg ^f	1	4	0	100	Powers et al. 2011[55]
RsTc ^f	2	8	0	100	Powers et al. 2011[55] Solomon et al. 2012[59]
RsTi ^f	2	8	0	100	Powers et al. 2011[55] Solomon et al. 2012[59]
<i>Solution Consistency (%) 100</i>					
<i>Solution Coverage (%) 58</i>					
<i>Overlapping Coverage (%) 35</i>					

^a The parsimonious solution represents the automated, logical minimization of all truth table rows (N=512 rows) with simplifying assumptions about logical remainders made by the software to result in the most parsimonious number of solution terms. The plausibility of the simplifying assumptions made about logical remainders is not evaluated.

^b An uppercase letter in the configuration indicates the BCT was used as part of the study intervention; a lowercase letter in the configuration indicates the BCT was not used as part of the study intervention. BCTs not listed in the configuration were eliminated during the process of logical minimization.

^c Raw coverage is determined by dividing the number of studies covered by the configuration by the number of studies demonstrating *no* improved adherence (26 in this analysis). Coverage can range from 0 to 100%.

^d Unique coverage is determined by dividing the number of studies that are only covered by the configuration by the number of studies demonstrating *no* improved adherence (26 in this analysis). Coverage can range from 0 to 100%.

^e Consistency is determined by dividing the number of studies in the outcome set covered by the configuration by the number of studies covered by the configuration. Consistency can range from 0 to 100%. A consistency of 100% indicates that all studies covered by the configuration were also in the outcome set (i.e., had *no* improved adherence).

^f These configurations are logically redundant, the parsimonious solution can have as few as five sufficient conditions if one of these configurations is preferred over any of the others, though we could identify no substantive reason to prefer one over any of the others.

Table C-3. Ten Sufficient Configurations of Behavior Change Techniques (BCTs) Identified in the Complex Solution^a for the Outcome of *NO* Improvement in Medication Adherence

Behavior Change Technique Configuration ^b	Number of Studies Covered	Raw Coverage ^c (%)	Unique Coverage ^d (%)	Consistency ^e (%)	Studies Covered
KRtsiCmg	2	8	8	100	Pyne et al. 2011[1] Guthrie et al. 2001[46]
KRtsicmFg	3	2	12	100	Hunt et al. 2008[21] Rickles et al. 2005[53] Capoccia et al. 2004[54]
KRsicmFG	2	8	8	100	Simon et al. 2006[34] Solomon et al. 2012[59]
KRtsIMFg	2	8	8	100	Bosworth et al. 2005[39] Vivian et al. 2002[45]
krtsicmFg	1	4	4	100	Sledge et al. 2006[32]
KrtsicMfg	1	4	4	100	Grant et al. 2003[42]
krtslcMfg	1	4	4	100	Lin et al. 2006[37]
KRTsicmfg	1	4	4	100	Powers et al. 2011[55]
kRtSicmFg	1	4	4	100	Schectman et al. 1994[51]
krtSicmFg	1	4	4	100	Pearce et al. 2008[23]
Solution Consistency (%) 100					
Solution Coverage (%) 58					
Overlapping Coverage (%) 0					

^a The complex solution represents the logical minimization of truth table rows that are covered by studies with the outcome absent (N=18 rows). Logical remainders (empty truth table rows) are not included in the process of logical minimization.

^b An uppercase letter in the configuration indicates the BCT was used as part of the study intervention; a lowercase letter indicates the BCT was not used as part of the study intervention. BCTs not listed in the configuration were eliminated during the process of logical minimization.

^c Raw coverage is determined by dividing the number of studies covered by the configuration by the number of studies demonstrating *no* improved adherence (26 in this analysis). Coverage can range from 0 to 100%.

^d Unique coverage is determined by dividing the number of studies that are only covered by the configuration by the number of studies demonstrating *no* improved adherence (26 in this analysis). Coverage can range from 0 to 100%.

^e Consistency is determined by dividing the number of studies in the outcome set covered by the configuration by the number of studies covered by the configuration. Consistency can range from 0 to 100%. A consistency of 100% indicates that all studies covered by the configuration were also in the outcome set (i.e., had *no* improved adherence).

Table C-4. Seven Sufficient Configurations of Behavior Change Techniques (BCTs) Identified in the Intermediate Solution^a for the Outcome of *NO* Improvement in Medication Adherence

Behavior Change Technique Configuration ^b	Number of Studies Covered	Raw Coverage ^c (%)	Unique Coverage ^d (%)	Consistency ^e (%)	Studies Covered
stMg	4	15	12	100	Lin et al. 2006[37] Grant et al. 2003[42] Bosworth et al. 2005[39] Vivian et al. 2002[45]
RFsicism	3	12	8	100	Simon et al. 2006[34] Hunt et al. 2008[21] Solomon et al. 2012[59]
RFstcg	4	15	8	100	Hunt et al. 2008[21] Vivian et al. 2002[45] Rickles et al. 2005[53] Capoccia et al. 2004[54]
RCistg	2	8	8	100	Pyne et al. 2011[1] Guthrie et al. 2001[46]
krFtimg	2	8	4	100	Sledge et al. 2006[32] Pearce et al. 2008[23]
kFitcmg	2	8	4	100	Pearce et al. 2008[23] Schechtman et al. 1994[51]
sTicfmg	1	4	4	100	Powers et al. 2011[55]
Solution Summary					
Solution Consistency (%) 100					
Solution Coverage (%) 58					
Overlapping Coverage (%) 0					

^a The intermediate solution represents the logical minimization of all truth table rows, based on researcher-directed simplifying assumptions about logical remainders to result in a more parsimonious solution than the complex solution. For the logical remainders in this analysis, we assumed the absence of a BCT would lead to the outcome of *no* improved adherence.

^b An uppercase letter in the configuration indicates the BCT was used as part of the study intervention; a lowercase letter in the configuration indicates the BCT was not used as part of the study intervention. BCTs not listed in the configuration were eliminated during the process of logical minimization.

^c Raw coverage is determined by dividing the number of studies covered by the configuration by the number of studies demonstrating *no* improved adherence (26 in this analysis). Coverage can range from 0 to 100%.

^d Unique coverage is determined by dividing the number of studies that are only covered by the configuration by the number of studies demonstrating *no* improved adherence (26 in this analysis). Coverage can range from 0 to 100%.

^e Consistency is determined by dividing the number of studies in the outcome set covered by the configuration by the number of studies covered by the configuration. Consistency can range from 0 to 100%. A consistency of 100% indicates that all studies covered by the configuration were also in the outcome set (i.e., had *no* improved adherence).

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