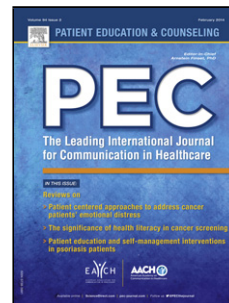


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Training Physicians in Behavioural Change Counseling: A Systematic Review

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Highlights

- 100% of studies reported improvements in BCC skills among physicians;
- Reporting quality was spectacularly poor (Downs & Black score =17/28);
- 78% of studies included for analyses had no comparison group;
- **Overall, 26% of skills taught were measured, and 56% of skills measured were not taught;**
- None of the studies reported information on trainer fidelity or trainee adherence.

Abstract

Background: Poor health behaviours (e.g., smoking, physical inactivity) represent major underlying causes of non-communicable chronic diseases (NCDs). Prescriptive behaviour change interventions employed by physicians show limited effectiveness. Physician training in evidence-based behavior change counselling (BCC) may improve behavioural risk factor management, but the efficacy and feasibility of current programs remains unclear.

Objective: (1) To systematically review the efficacy of BCC training programs for physicians, and (2) to describe program content, dose and structure, informing better design and dissemination.

Methods: Using PRISMA guidelines, a database search up to January 2018, yielded 1889 unique articles, screened by 2 authors; 9 studies met inclusion criteria and were retained for analysis.

Results: 100% of studies reported significant improvements in BCC skills among physicians, most programs targeting provider-patient collaboration, supporting patient autonomy, and use of open questions to elicit “change-talk”. Limitation included: poor reporting quality, high program heterogeneity, small sample sizes, 78% of studies having no comparison group, and less than 30% of skills taught being formally assessed.

Conclusion: Training programs were efficacious, but methodological weaknesses limit the ability to determine content and delivery. **Caution is necessary when interpreting the results.**

Practice Implications: Further research emphasizing rigorous training program development and testing is warranted.

Key words: behavioural change counseling, physician training, counseling,

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Background

Currently, over 60% of deaths worldwide result from non-communicable chronic diseases (NCDs), including cardiovascular diseases (CVD, 17.5 million deaths/year, worldwide), cancer (8.2 million), chronic lung diseases (CLD: 4.0 million) and diabetes (1.5 million)[1]. Major factors accounting for the development and progression of NCDs are poor health behaviours such as smoking, poor diet, excessive alcohol consumption, physical inactivity/increased sedentary time, and among those being treated for risk factors - medication non-adherence[1-7].

Physicians play a crucial role in facilitating health behaviour change with their patients. Traditionally, they have employed prescriptive, informative/educative or “advice-giving” interventions to encourage their patients to change their health behaviours[8]. Because these approaches do not take patient motivation perceived ability to change into account, they have typically been met with patient resistance, ambivalence or apathy[9], ultimately limiting their effectiveness[10]. Behaviour change in the context of NCD prevention and/or treatment involves a complex interaction between the provider’s counseling style and a patient’s level of motivation and ability to change.

Evidence suggests that successful behaviour change counseling (BCC) can be enhanced by engaging the patient as an active collaborator in their treatment[11, 12]. However, only 9% of patients report being active participants in therapeutic decisions, and 50% of patients report leaving their physician’s office confused by the information received and poorly equipped to follow treatment recommendations[11].

Interest in training physicians in BCC has increased in recent years[13, 14]. However, many of these programs were not designed to teach evidence-based BCC, tending to rely upon didactic teaching of theoretical concepts rather than improving physician attitudes and skills needed to effectively engage patients in their care[13]. A 2011 systematic review[13] examined 10 studies aimed at training various healthcare professionals (including physicians) in BCC skills. The review showed that on average, 9 hours of training involving a didactic instruction, supervised practice and consultation in “motivational counseling” was effective in improving

BCC skills[13]. This review included a mix of healthcare professionals (physicians, nurses, dietitians and social workers) and the BCC skills were mostly measured using self-reported instruments, **increasing the risk of biased self-assessments. Indeed, evidence suggests that physicians may have a limited ability to accurately self-assess their clinical competence, so it may preferable to focus on objective or expert-rated assessments[15].**

To our knowledge, no study has systematically reviewed the literature on the efficacy of BCC training programs targeting physicians using objective measures competency post-training (i.e., interviews or expert-rated physician-patient interactions).

The primary objective of this study was to systematically review the literature on the efficacy of BCC training programs targeting physicians using objective measures of BCC skills competency pre to post-training. The secondary objective was to describe the content, dose and structure of training programs associated with the best post-training competency scores in order to help inform the design and delivery of future physician training programs.

Methods

PRISMA's checklist was followed to ensure the transparent and comprehensive reporting of this systematic review[16]. The review was registered with the International Prospective Register of Systematic Reviews (PROSPERO: CRD42017048991)[17].

Inclusion criteria

Studies that objectively assessed physicians' competency in BCC skills before and after participating in a BCC training program were included. The review focused specifically on studies that primarily (>90%) included medical doctors (general practitioners, specialists, or residents). Studies that primarily enrolled other healthcare professionals (e.g., dentists, social workers or pharmacists) were excluded. BCC was operationalized to include any type of health behaviour or lifestyle counseling training program aimed at reducing poor health behaviours (e.g., smoking, over-eating, sedentariness, etc.) or increasing good health behaviours (e.g., eating a healthier diet, engaging in more physical activity). The following additional inclusion criteria were used:

1. Peer reviewed journals published in English or French;

2. Randomised and non-randomised controlled trials and pre-post intervention studies, **with or without comparison groups**;
3. Training programs focusing on increasing BCC skills using established approaches (e.g., motivational communication/interviewing or behavior change/lifestyle counseling strategies);
4. Outcome measures of BCC skills competency had to be assessed pre and post training using an objective, validated rating scale (e.g., expert-rated/coded patient-physician interactions). Studies with exclusive use of self-reported BCC competency assessments were excluded.

Search strategy and review process

Searches up to 24th January 2018 were conducted in the following electronic databases: Cochrane, EMBASE, PsycINFO and PubMed. The following keyword terms were applied: “doctor”, “physician”, “medical resident” AND “education”, “training” AND “counseling”, “motivational interviewing”, “motivational communication”, “behavior change counseling”. Full electronic research strategy available upon request.

Reference lists of selected publications and previous systematic reviews[13, 18] were screened to identify additional studies. This search process yielded 1793 unique and potentially eligible abstracts. Study authors were contacted to retrieve additional (missing) information where applicable. As seen in Figure 1, application of the inclusion/exclusion criteria resulted in nine articles[19-27] being selected based on fulfilling all eligibility criteria (See Table 1). The following information was extracted from each study: Participants (number and type of physicians included in final sample); Country where study took place; Behavioural targets of interest to NCDs (e.g. smoking cessation, increasing physical activity) or clinical outcomes (e.g. weight loss); Training characteristics (type of training, duration and number of sessions, follow-up period, trainer characteristics/qualifications, fidelity assessments); Comparison group characteristics (when applicable); and training outcome measure used (competency evaluation tool), not all of which is reported below.

Study quality

Study quality was assessed, by two independent evaluators, for all selected studies using the Downs and Black checklist, a rating the methodological quality of randomised and non-randomised health care interventions[28]. **This checklist provides a quick profile of the paper it evaluates, alerting reviewers to its particular methodological strengths and weaknesses on topics such as: clear description of study outcomes and blinding procedures or reporting of study power.**

Results

Study Characteristics

Selected studies were published between 1995 and 2016, all but one being published after 2000. Samples were generally small, ranging from 12[19] to 60[23] participants, and were composed of general practitioners and specialists (e.g., internal medicine, pediatrics, psychiatry). The clinical application of the training program varied from providing general BCC skills to providing treatment adherence counseling among HIV patients. Despite training programs varying significantly in terms of duration, content and delivery mode, just over half of the studies (5) described their training program as being “Motivational Interviewing” (MI) or MI-derived[19-21, 24, 25]. Training duration varied from one 3-hour session [20] to workshops lasting over 20 hours[23, 26] (Mean = 10.4 hours). Most studies (7/9) did not have a comparison group or did not report post-training competency results in the comparison group[19-21, 24, 25, 27, 29]. The Motivational Interview Treatment Integrity (MITI, Version 2.0, 3.0 or 3.1) was the competency assessment tool used in 4/9 studies[19, 20, 24, 25], but authors were inconsistent in their reporting of global scores and specific component scores. Time to post-training evaluations was short (range = 0-365 days, median = 42), only one study assessing participants’ performance every year, over 4 years[26].

Training Components

Individual training components of the programs differed between studies. A *component* was defined as any training target (implicitly or explicitly stated by the original study) which could complete the statement: “by the end of this training program, the trainee will be able to...” To facilitate comparison of their content, and in accord with PRISMA guidelines, the first (A.I.D) and second reviewer (C.A.J) identified each training program’s unique components and

linked them to an element of an established theory or taxonomy (see Table 2 for a summary) [30-38]. The five most popular training components were: MI spirit; questioning/open questions; collaboration; eliciting “change-talk”; and use of the 5 A’s.

Most of these skills are part of a traditional MI curriculum: a client-centred non-judgemental counseling style, derived from other BCC theories, designed to help patients explore and resolve ambivalence about behaviour change [39]. The typical MI curriculum includes lessons on the use of specific techniques (i.e.: OARS), such as: open-ended questions (O), active listening (A), reflections (R), summaries (S), as well as recognizing ambivalence and eliciting change talk. The 5-As is a set of evidence-based guidelines, initially developed by the American Agency for Healthcare Research and Quality, to assist with smoking cessation[40]. This model provides a simple structured approach to behaviour change, and includes: 1) Asking about risky behaviour, 2) Alerting about the risk, 3) Assessing readiness to change, 4) providing practical Assistance, and 5) Arranging a follow-up[24].

Delivery mode

Table 3 summarizes the delivery mode of each study’s training program.

Structure. Most of the training programs were delivered in person, with the exception of one study[25] where training was delivered via an online virtual platform (using the Second Life gaming infrastructure). Another study[26] supplemented in-person lessons with online modules.

Format. All studies included a didactic component. Six studies employed some form of modeling of the approach taught[19, 20, 22, 24, 25, 27]. All but one[24] employed role-playing exercises and four studies used exercises with simulated patients[21, 22, 25, 27]. Four studies offered supervision or coaching[20, 22, 24, 25].

Materials. Six studies provided audio/video[19-23, 27] or written educational materials to the participants[20, 22, 23, 26, 27]. Participants in four studies completed self-evaluations of their performance [19, 22, 23, 26]. Two studies gave their participants video of patient-provider interactions to study[25, 27], while for two others trainees participated in in-vivo observations of interactions between their mentors and patients[23, 26].

Trainer Qualifications and Assessments of Training Fidelity

Six[19-21, 23, 25, 26] of the nine studies reported limited information about the qualifications and experience of the individuals delivering the programs (See Table 4). No studies reported information on training fidelity (i.e., the extent to which programs were delivered as intended) and less than half of the studies[20, 22, 25, 26] assessed and/or reported trainee adherence (which was usually measured by assessing trainee attendance rather than engagement or participation level).

Competency Outcome Measures and Time to Post-Training Evaluation

There was a large amount of heterogeneity in the expert-rated evaluation tools used. Four studies[19, 20, 24, 25] used the Motivational Interview Treatment Integrity (MITI, version 2.0, 3.0 or 3.1), a validated[41] behavioural coding of patient-provider interactions[42]. The *Helpful Response Questionnaire (HRQ) for Primary Care*, a validated tool developed to assess listening skills and empathy [43], was used by one study[21]. One study[23], used the *Roter Interaction Analysis System (RIAS)* pre and 5-months post intervention. Another study[26] used the *Objective Structured Clinical Examinations (OSCE)* evaluation of video-taped interactions with standardized patients[44]. Two studies developed their own assessment tools: one[22], being a comprehensive coding system which determined the percent of audio-recorded provider-patient interactions that included the key elements of the *Teachable Moment Communication Process*; the other[27] being a 14-item instrument used to code audiotaped patient-provider interactions with simulated patients.

Time to post-training evaluations was typically short (range = 0-365 days, median = 42)[26, 45].

To facilitate comparison of the different outcome measures across the nine studies, a similar method to that employed to compare training components was adopted. Each study's unique outcome measures were identified and linked them to an element of an established theory or taxonomy (See Table 5 for the results of this exercise).

Training results

Due to the heterogeneity of the training programs and assessment tools used across studies **and the outcomes not being expressed in a standardised format**, we were unable to perform a

formal meta-analysis[46]. However, the overall efficacy of the BCC training programs assessed in this review was positive (See Table 1).

In general, all studies demonstrated significant improvements in participants BCC skills from pre-post training across a variety of outcomes except two, which saw a significant decrease in the use of open-ended questions[21] and no change in the use of “direction” as a skill, post-training[25]. The two most common outcomes (five studies) were “asking open-ended questions” and “using reflections or summaries or reformulations”. “Goal setting and planning” and “partnership and collaboration” were assessed by 4 studies, while “general questioning techniques”, “eliciting readiness for change”, “offering information/ education”, “empathy”, and “MI Global Score” were assessed by three studies. However, careful examination of these studies revealed discrepancies between the components included in the training programs and the outcomes measured. On average, less than thirty percent of the skills taught were measured and some studies assessed skills which were never explicitly listed as being part of the training program components.

Study Quality

A formal assessment of study quality using the Downs and Black Checklist was performed by two authors (A.I.D. and C.A.J.). The studies meeting our eligibility criteria varied greatly in terms of quality[19-27], with the average score being 17.2 (range: 15-24) out of 28, which is considered *fair*[47]. No individual study received an excellent rating (26-28) (see Table 1). The overall low quality score of the studies was mostly due to the lack of comparison groups[28]. Moreover, the majority of studies failed to report potential confounders, none reported adverse effects, and most (7/9) did not perform or report power analyses.

Discussion

This study conducted a systematic review of the literature on the efficacy of BCC training programs for physicians (where competency was measured using expert-rated pre-/post-training evaluations), and described the content, dose and structure of these programs. Overall, the results suggest that BCC training programs targeting physicians have been successful, as demonstrated by mostly statistically significant increases in competency, using a variety of measures, across various medical specialties.

This review also shows that most training programs focused on teaching physicians how to adopt a “MI spirit” (defined as: evocation, collaboration and autonomy support). The “use of open-ended questions” and “eliciting change-talk” were the most frequently taught components. The most measured competency outcomes were shown to be “asking open-ended questions” and “using reflections or summaries or reformulations”, followed by “goal setting and planning” and “partnership and collaboration.”

Limitations of this review

The results from this review must be considered within the context of certain limitations. Given the heterogeneity of the outcome measures used across studies, it was impossible to perform a meta-analysis to estimate the effect size of BCC training programs aiming for physicians. However, we have attempted to synthesize the data qualitatively, with the goal of providing recommendations for future research. Another limitation is the small number of studies that met our inclusion criteria, which lead to a small overall sample of physicians (n=200). This is largely due to our inclusion criteria that targeted BCC training programs in physicians only, and the requirement that competency be measured using an expert-rated evaluation tool. **Moreover, most participants were residents and not established physicians, which might reflect the difficult nature of recruiting established MDs into research and motivate them to change their own behaviour. Therefore, results may be more generalizable to residents as opposed to more experienced physicians.**

Limitations of the studies included in the review

While results of the studies included in this review were overwhelmingly positive, this should be interpreted with caution given important methodological limitations across this literature. First, studies failed to achieve high standards in terms of methodology and research rigour, as demonstrated by their low scores on the Downs and Black checklist. In fact, transparent and adequate reporting was a major limitation across studies. None of the trials reported using any standardized guidelines for reporting, such as the Transparent Reporting of Evaluations with Nonrandomized Designs (TREND, CDC [48]) or Consolidated Standards for Reporting Trials (CONSORT [49]) **and CONSORT Non-Pharmacological Extension[50]**, which emphasize description of the intervention design and information needed to assess possible biases.

Second, none of the studies reported basing their training program on any recognized behavioral intervention development process such as the MRC's *complex intervention guideline* or the ORBIT (Obesity-Related Behavioral Intervention Trials) Model [51, 52]. The strength of these models is providing a systematic framework for developing interventions, using an iterative process to define and refine components through structured testing. This ensures the clinical relevance, feasibility and acceptability of the intervention/training program.

Third, only three studies[20-22] explicitly reported basing their training program on an established theory of behaviour change in the context of changing physician practice behaviour, such as Social Cognitive Theory[38] or the Transtheoretical model[53]. While basing interventions on theories does not necessarily guarantee their success, this does allow to improve upon them in a more structured way[54]. Health education interventions (e.g.,[55-57]) have shown limited and varied efficacy[58, 59], which may be due, in part, to a lack of theoretical basis for the intervention choice, and the use of inappropriate methods to design and test the interventions[59, 60].

Fourth, there were major discrepancies between what was taught in the various training programs, and what was measured. Only 26% of skills taught across programs were measured, and 53% of skills that were measured were not taught. Due to the overall poor quality of the reporting, it is unclear if this represents a systemic design issue, a lack of understanding of how to measure the skills being taught, a lack of availability of appropriate assessment tools, or simply poor reporting. **This limitation further makes it difficult to affirm with confidence that the positive results reported by the studies included in this review are representative of true competency achieved in the participants.** Future studies are encouraged to conduct valid assessments of the full range of skills being taught and to ensure transparent reporting of all methods and assessment procedures in order to facilitate the interpretation of study findings.

Fifth, most studies failed to measure and/or report on trainer qualifications, expertise and experience, nor did they assess trainee adherence (attendance and/or engagement), all of which are critical to report to ensure intervention reproducibility and feasibility [61]. No studies reported assessing training program fidelity, which is the extent to which training programs were delivered per-protocol. This is critical to successful translation of evidence-based interventions into practice, as well as to a study's validity and reliability[62-64]. Despite the trainings being

generally successful, without assessing fidelity, it is impossible to conclude that the training effects were due to the program and not spurious[62, 65, 66].

Finally, there was a high heterogeneity of training programs in terms of duration, dose, and delivery mode. Though most of the trials delivered training across two sessions, dose varied from 3 hours to 12 hours, and one study delivered one training session every year for 4 years. We were not able to determine the optimal dose or duration of training associated with achieving long-term competency in BCC among physicians. However, the literature has shown that programs offering supervision or coaching to their participants, as well those using role-play or interactive group exercises that give participants the opportunity to practice skills with simulated patients (as opposed to a purely didactic approach), are preferable[67-69].

Research Implications

In light of these limitations, future studies in this area are encouraged to consider the following recommendations to improve both the design of training programs and methods for testing their efficacy:

- Consider developing training programs using a standardized framework such as the ORBIT model [51] and potentially exploring the effectiveness of traditional didactic teaching, experiential learning exercises (e.g., role play), ongoing supervision, coaching (with feedback) and follow-up assessments[67-69].
- It is recommended that reporting follow standardized reporting guidelines, such as the CONSORT [49, 50] for randomized or TREND[48] for non-randomized trials, to facilitate interpretation of results and study quality and to improve reproducibility.
- Studies are encouraged to recruit larger samples of physicians to enhance generalizability and increase power. **This may be achieved by recruiting through medical associations (who can partner with research teams to co-develop training programs and provide wide access to many physicians via email and annual conferences) and offering Continuing Medical Education (CME) accredited training programs.**
- Efficacy trials should incorporate assessments of training program fidelity to ensure that trainers/facilitators deliver the training program per-protocol[70].

- Studies should ensure that the skills taught in the training program are also assessed and vice versa.
- Regarding competency assessment tools, many studies in this area do not use expert-rated competency measures. However, existing objective measures also suffer from certain limitations such as: requiring invasive procedures like audio or video-recording of patient-provider interactions; necessitating the involvement of “experts” to code; and being time consuming to administer and score. Future studies should consider the development of more user-friendly competency assessment tools, for example, the use of e-technologies **incorporating machine-learning and eliminating the need for an expert-rater altogether**[71-73].

Conclusion

Training programs aimed at improving BCC skills among physicians in the context of NCD management seem to be generally efficacious according to expert-rated evaluation tools. Training physicians in BCC is of high clinical importance as facilitating behaviour change is arguably one of the most important and, when done correctly, effective strategies for NCD prevention. Unfortunately, studies to date have notable limitations which make it difficult to adequately inform exactly *how* and *what* should be delivered as part of BCC curriculums. Designing, testing and implementing rigorous and feasible programs is critical to ensuring the success of these trials, to maximising physician competency to effectively counsel NCD patients to change their lifestyles, and ultimately to improve healthcare services and health outcomes.

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Author’s contributions: AID, KLL and SLB worked on the conception and design of this study. AID and CAJ performed the literature search and the data extraction; KLL resolved any discrepancies/disagreements to arrive at a consensus. AID and KLL were involved in the drafting of the manuscript; all authors (AID, CAJ, SLL, VGB and KLL) were involved in the interpretation and the presentation of the data as well critical revision of this manuscript, and approved the final version. The authors would like to thank the entire team of Montreal

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Competing interest statement

All authors have completed the ICMJE uniform disclosure form and declare: no support from any organisation for the submitted work, no financial relationships with any organisations that

might have an interest in the submitted work in the previous three years, no other relationships or activities that could appear to have influenced the submitted work.

Transparency declaration

The lead author (the manuscript's guarantor) affirms that the manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned (and, if relevant, registered) have been explained.

No ethical approval was required for this study.

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Figure

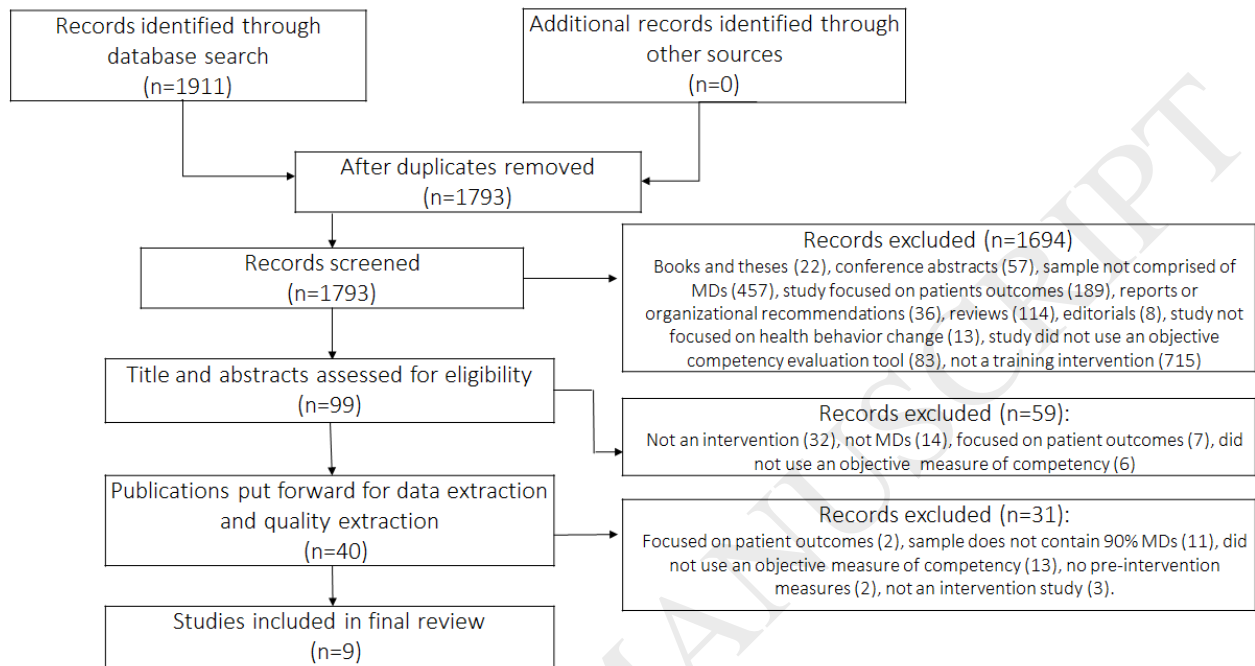


Figure 1

Table

Table 1. Behavioural Change Counseling Training Studies Details

1st Author	Country	Target	Sample (MDs)	Intervention Group	Comparison Group	Post-eval	Outcome Measure	Result	Summary results	Quality Assessment Score (Downs & Black Checklist)
1 Bofill, 2015	Argentina (Buenos Aires)	Counseling for HIV care	12 HIV care physicians	<p>Motivational Interviewing (MI):</p> <p>2X3.5-hours= 7 hours + revision.</p> <p>(1) Lecture on principles of MI (OARS), Practical examples (videos). Review of own pre-workshop video. (2) Group discussion and Role play exercises.</p> <p>OARS: O: open questions A: affirmations R: reflections S: summaries</p>	NA	1-2 months	<p>Video coded provider-patient interactions for use of MI techniques AND Standard Of Care (SOC) checklist</p> <p>Comprised of 5 subscales, 34 items ("Yes, No, Don't Know") assessing standard of care delivered at the site.</p>	<p>9/12 participants showed appropriate utilization of at least one MI technique: 9/12 used open ended questions and active listening, 6/12 used positive feedback and reformulations, 6/12 used guiding style, 2/12 quantified readiness of change, 2/12 did not apply any MI techniques.</p> <p>1 recording was unreadable.</p> <p>SOC: There was a significant increase in education ($t = 3.59, p = .006$) and support in consecutive visits ($t=3.29, p=.009$) and a trend for increase in planning and general support</p>	<p>Most participants showed increased pre-post competency on outcome measures.</p>	15

2	Burton, 2016	USA	Obesity prevention counseling	86 Internal medicine and Paediatric residents	<p>MI: 3 hours,</p> <p>4 sections:</p> <p>(1)Lecture on obesity epidemic and Current obesity treatment guidelines.</p> <p>(2)Spirit of MI and communication techniques (OARS).</p> <p>(3) Practical exercises.</p> <p>(4) Role play</p>	NA	Immediate	<p>Motivational Interview Treatment Integrity 3.1 (MITI 3.1): coding system developed and used to assess competence in MI skills: Evocation, Collaboration, Autonomy/Support, Direction and Empathy, Open/Closed Questions, Reflections and MI Adherent MI non-adherent statements</p>	<p>Results available for 52 residents. Mean[SD]</p> <p>Global score PRE: 15.29 [3.88], POST: 19.73 [3.58], p<.001</p> <p>Open/Closed Question PRE: 0.56 [0.34], POST: 0.83 [0.97], p=.03</p> <p>No. of Reflections PRE: 4.04 [2.80], POST: 4.90 [2.81], p=.05</p> <p>No. MI adherent statements: PRE: 2.88, POST: 5.42, p<.001</p> <p>No. MI non-adherent statements: PRE: 6.74, POST: 2.33, p<.001</p>	<p>Significant pre-post increase in competency on 4 of the 5 outcome measures.</p>	16
3	Childers, 2012	USA	Health behaviour change counseling	19 Medical residents	<p>MI: 12 hours</p> <p>Didactic sessions, DVD examples, role play exercises and written examples teaching: MI spirit, patient-centered communication skills (OARS), change talk and responding to resistance</p>	NA	Immediately after the training	<p>Helpful Responses Questionnaire – Primary Care (HRQ): long-development questions on clinical vignettes developed to assess listening skills and empathy. Analyzed on five dimensions: open/close-ended questions, %reflections, MI roadblocks, MI-consistent statements</p>	<p>Mean [SD] Closed-ended questions: PRE: 1.13 [1.39], POST: 0.37 [0.62], p=.036</p> <p>MI roadblocks: PRE: 4.00 [2.09], POST: 1.08 [0.9], p<.001</p> <p>Reflections: PRE: 1.87 [1.89], POST: 4.87 [1.55]. p<.001</p> <p>MI adherence strategies: PRE: 0.45 [0.71], POST: 0.97 [0.68], p=.017</p> <p>Open-ended questions: 1.97 [1.88], POST: 1.05 [1.58], p=.023</p> <p>Also, residents rated behavior change counseling skills as more important post-training.</p>	<p>Significant pre-post increase in competency on all 5 outcome measures.</p>	17
4	Flocke, 2014	USA	Smoking cessation counseling	31 Primary care clinicians (94% Internal + Family med, 6% Nurses)	<p>Teachable moment communication process (TCMP): 2X3 hours + 1 hour = 7 hours (Intervention group N=16)</p> <p>Didactics in 5 skills (identify salient concern and link to smoking, provide brief</p>	<p>Attention control (multimedia educational resource for colon cancer screening; N=15)</p>	35 days after the training	<p>Coding system determines rates (%) TMCP elements (e.g.: brief advice statements, eliciting readiness, responding in alignment with readiness) that are present in the audio-recorded visits.</p>	<p>One participant withdrew from intervention group (N=15)</p> <p>INT: Intervention; CTRL: Control;</p> <p>Linking smoking to patient's concern PRE: INT: 39%, CTRL: 39%, p=.99; POST: INT: 58%, CTRL: 44%, p=.01</p> <p>Brief advice skills (Mean %): Quit Statement: PRE: INT: 34, CTRL: 33, p=.83; POST: INT: 38, CTRL:44, p=.50</p> <p>Concern: PRE: INT: 1, CTRL: 2, p=.40; POST: INT:18, CTRL: 2, p=.007</p>	<p>Pre-post increase in competency on all outcomes measured, for both the intervention and the control</p>	24

				intervention, assess and respond in alignment with readiness of change), video demos, practice exercises, role play,				Optimism: PRE: INT: 6, CTRL: 2, p=.18; POST: INT: 36, CTRL: 3, p<.001 Partnership: PRE: INT: 9, CTRL: 10, p=.94; POST: INT: 40, CTRL: 12, p=.003 Engage: PRE: INT: 15, CTRL: 20, p=.51; POST: INT: 51, CTRL: 22, p=.005 Eliciting readiness: Pre: INT: 68, CTRL: 63, p=.64; POST: INT: 84, CTRL: 65, p=.006 Responding in alignment to readiness (Mean [SD]) PRE: INT: 4.2 [2.0], CTRL: 4.6 [1.9], p=.36; POST: INT: 5.3 [2.2], CTRL: 4.1 [1.8], p<.001	groups.	
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5	Kim, 2012	Mexico	Interpersonal communication in primary care	60	Resident doctors	<p>Interpersonal Communication & Counseling (IPC/C) : 2 day workshop+1/2 day refresher = total 20 hours</p> <p>Aimed at developing skills in counseling, verbal and non-verbal communication, interviewing, listening and helping with decision making. Included supervision, self-assessment and self-learning activities.</p>	<p>Received IPC/C course but no follow-up, supervision, self-assessment or self-learning activities.</p>	<p>Audiotaped consultations coded with</p>	<p>CROSS-SECTIONAL (INT: Intervention N=36, CTRL: Control N=24)</p>	<p>Roter Interaction Analysis System (RIAS).</p>	<p>Frequency of Facilitative communication: INT: 47.7%, CTRL: 29.6%, p<.001</p>	<p>Analysis of doctor utterance on 48 coding categories e.g.: giving medical info, asking open-ended questions, showing concern.</p>	<p>Freq. of Bio-medical information-giving: INT: 27.5% , CTRL: 16.6%, p<.001</p>	<p>Specific skills: Partnership: INT: 12.7%, CTRL: 7.3%, p<.001</p>	<p>Acknowledge/Empathy: INT: 12.3%, CTRL: 6.2%, p<.001</p>	<p>Significant pre-post increase in competency on one of the 2 outcomes measured longitudinally, in the intervention group.</p>	19	
								<p>Additional longitudinal results:</p>	<p>Personal/Social: INT: 10.5%, CTRL: 8.6%, NS</p>	<p>The number of supervisions, of audiotapes sessions, of self-assessments performed and of times the homework log was used, were associated with more use of Facilitative communication.</p>	<p>Positive emotion/Reinforcement: INT: 5.9%, CTRL: 2.9%, p<.001</p>	<p>Psychosocial info: INT: 5%, CTRL: 3.5%, NS Psychosocial questions: INT:1.3%, CTRL: 1.1%, NS</p>	<p>LONGITUDINAL (Intervention N=21, Control N=7)</p>	<p>Facilitative communication rise was significant in intervention group (β=0.23, p<.001) not for control (β=0.20, NS).</p>	<p>Bio-medical info rose significantly in both the intervention (β=0.44, p<.001) and control (β=0.42, p<.05) groups.</p>			
								5 months later										

6	Malan, 2016	South Africa	Health behaviour change Counseling	18 Primary care doctors	Integrated the 5-As and a guiding style derived MI: 4X2hrs sessions=8hrs Each session provided evidence of the deficiencies and the need for a new approach, modeled the approach and participants practiced the 5 skills: ask about behavior, alert about the risk, assess readiness, provide practical assistance, arrange follow-up.	NA	Immediately and 6 weeks later	Motivational Interviewing Treatment Integrity (MITI 3.1)	Mean [SD] compared to baseline %Complex Reflection: post: +4.9[1.8], p=.008; post-6weeks: +3.33[1.81], p=.06 %MI Adherent: post: +35[8.2], p<.001; post-6w: +18[8.2], p=.03 %Open Questions: post: +9[5.7], p=.17; post-6w: +5.2[5.7], p=.36 Global: post: +1.2[0.22], p<.001; post-6w: +0.74[0.22], p<.001 Reflection/Question: post:+0.17[0.08], p=.03; post-6w: +0.09[0.08], p=.26	Post: Significant increase in competency on 3 of the 5 outcome measures. Post 6-weeks: Significant increase in competency on two of the 5 outcome measures.	18
7	Mitchell, 2011	USA	Counseling for colorectal cancer screening	13 Primary care residents and physicians	Virtual-world platform delivered MI training: 8 to 10 hours Mixed educational approaches (didactic, role play, observation, coaching and feedback) focusing on MI skills, eliciting change talk, developing empathetic partnership.	NA	Immediately after training	Motivational Interviewing Treatment Integrity (MITI 3.0)	Post-training, 12/13 participants scored above proficiency (score 3.5/5) Compared to baseline, MI skills scores increased significantly in 4 of the 5 component skills and global score. Empathy (+0.73, p=.001), Autonomy (+0.78, p<.001), Collaboration (+0.58, p=.02), and Evocative response or eliciting change talk (+0.81, p=.008), Direction (No change). Global score: (+0.75, p=.001).	Significantly pre-post increase in competency on 5 of 6 outcome measures.	15

8	Nawaz, 2016	USA	Health behaviour change counseling	20 Preventative and Internal Medicine Residents	<p>Didactics + Institute of Lifestyle Medicine (ILM) Rotations: 6h/year for 4 years (total=24hours)</p> <p>(Preventative med residents, N=20)</p> <p>Program included didactics on health behaviors and lifestyle medicine skills, practical tips and role play.</p>	<p>Internal med residents participated in didactics but not</p> <p>ILM rotations (N=??)</p>	Once every year for 4 years	<p>Objective Structured Clinical Examinations (OSCE). Videotaped assessments with standardized patients evaluated by a patient-centered assessment tool each year. Score was reported as a percentage.</p>	<p>15% increase in residents' discussions of lifestyle issues with patients. Performance on OSCEs increased each year (score: Y1=73%, Y2=83%, Y3=87%, Y4=91%, p<.01). Control group lower average (76% vs. 80%, p=0.11).</p>	<p>Higher pre-post increase in competency, year after year, in the intervention group.</p>	16
9	Ockene, 1995	USA	Nutrition counseling for lipid lowering	27 Physicians	<p>Lipid Intervention Physician Training (LIPT: grounded in social learning theory)</p> <p>3 hours of counseling</p>	<p>Usual care comparison group, outcome data not reported</p>	6 weeks	<p>14 item scoring instrument used to code audiotaped physician-patient interaction with simulated patient.</p>	<p>Increase in 7/14 dietary counseling skills: ask about past experiences (p=.004), review diet (p=.005), written assessment (p<.001), prioritize areas of fat intake (p<.001), reinforce positive habits (p<.001), ask about expected problems (p<.001) and solutions (p<.001).</p> <p>Non-significant increases in the other 7 counseling skills:</p> <p>Advise to lower cholesterol, ask about previous problem and solutions, define cholesterol goals, summarize dietary goal, provide written goal handout, and plan for follow-up.</p>	<p>Significant pre-post increase in competency in half (7/14) outcome measures. Non-significant increases in the other half.</p>	15

Table 2: Training components according to theory

THEORY	SKILL	Bofill et al., 2015	Burton et al., 2016	Childers et al., 2012	Flocke et al., 2014	Kim et al., 2002	Malan et al., 2016	Mitchell et al., 2011	Nawaz et al., 2016	Ockene et al., 1995	TOTAL
Core Communication Conditions (Rogers, 1957 and 1987)	empathy			√		√		√			3
	acceptance and warmth		√			√		√			3
	active listening	√		√	√	√					4
Interpersonal Communication (Hargie, 1987)	opening interaction					√					1
	non-verbal communication		√			√					2
	questioning	√	√	√	√	√		√		√	7
	reflections	√	√	√		√					4
	positive reinforcement		√	√	√	√					4
Behaviour Change Technique Taxonomy (Michie, 2013)	goals and planning			√	√				√	√	4
	natural consequences of poor behaviour				√	√	√			√	4
	regulation								√		1
5 A's (US Department of Health and Human Services, 2000)	5 As		√	√		√	√			√	5
	ask						√				1
	advise			√		√				√	2
	assess										0
	assist						√				1
	arrange					√	√			√	3
Transtheoretical Model (Prochaska, 1987)	assessing readiness for change			√	√		√		√		4
	responding according to readiness			√	√						2
Motivational Interviewing (Miller & Rollnick, 1983)	recognize ambivalence	√		√				√			3
	eliciting change talk/ elicit readiness for change	√		√	√	√		√		√	6
	MI spirit	√	√	√	√		√	√	√	√	8
	evocation	√	√	√						√	4
	collaboration	√	√	√	√	√	√		√		7
	autonomy support	√	√	√			√				4
	honor patient autonomy	√									1
	open-ended question	√	√	√	√	√		√		√	7
	affirmations		√	√	√	√					4
reflections	√	√	√		√					4	

	summaries	✓	✓	✓		✓					4
	rolling with resistance			✓							1
	information-giving					✓					1
Experiential Learning Theory (Kolb, 1984)	experiential learning								✓		1
Social learning theory (Bandura, 1977; Miller & Rollnick, 1983)	support self-efficacy									✓	1
TOTAL		13	14	21	12	19	9	7	6	11	

Table 3: Training delivery Modes and Methods

	Delivery Mode	Bofill et al., 2015	Burton et al., 2016	Childers et al., 2012	Flocke et al., 2014	Kim et al., 2002		Malan et al., 2016	Mitchell et al., 2011	Nawaz et al., 2016		Ockene et al., 1995
						INTERVENTION	COMPARISON			INTERVENTION	COMPARISON	
Structure	1 session		✓									
	2 sessions	✓		✓	✓	✓	✓	✓	✓			✓
	More than 2 sessions									✓	✓	
	In person	✓	✓	✓	✓	✓	✓	✓		✓	✓	
	Remote / Virtual								✓	✓	✓	
	Duration (hr/day)	2 half days: 8 hours	3	12	6	2 days + half day refresher: 20 hours		8	8 to 10	24		3
Learning methods / activities	Didactic lectures	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Modeling of the approach taught	✓	✓		✓			✓	✓			✓
	Group discussions	✓		✓	✓				✓	✓		✓
	Role play / real play/ Group practice	✓	✓	✓	✓				✓	✓	✓	✓
	Simulated patient exercises			✓	✓				✓			✓
	Interactive exercises on material learned		✓					✓		✓	✓	✓
	Written exercises			✓								
	Specific supervision					✓						
	Supervision/coaching provided		✓		✓		✓		✓	✓		
	Evaluate video-taped patient-provider examples								✓			✓
	In vivo observations (mentors interacting with patients)						✓	✓		✓		
Self-assessments	✓			✓	✓	✓			✓			
Materials	Video education material provided	✓	✓	✓	✓							✓
	Audio education material provided		✓									
	Written education material provided		✓		✓					✓		✓
	Tutorial											✓
	Legend											
	1 day: 8 hours											
	Half-day: 4 hours											

Tables 4: Trainer characteristics, training program fidelity and trainee attendance

		Bofill et al., 2015	Burton et al., 2016	Childers et al., 2012	Flocke et al., 2014	Kim et al., 2002		Malan et al., 2016	Mitchell et al., 2011	Nawaz et al., 2016		Ockene et al., 1995
						INTERVENTION	COMPARISON			INTERVENTION	COMPARISON	
Trainer Characteristics	Qualifications (degrees)	Clinical psychologists and psychiatrists	MDs	Internist (MD)	NA	NA	NA	NA	MI expert trainer	Faculty Member	Faculty Member	NA
	Received training to deliver intervention	√		√		√	√		NO			
	Type of training	Motivational Interview		MI		Interpersonal communication			MI			
	Received training in person	√		√		√	√					
	Received training virtually	√										
	Received education material											
	If received training: duration (hr/day)	7 hours					3 day	3 day				
Training Program Fidelity	Assessed training program fidelity (trainer)											
	Reported training program fidelity (trainer)											
Trainee Adherence	Assessed trainee adherence to the program				√				√			
	Reported trainee adherence to the program		√		√				√	√		

Table 5: Outcome measures

	Bofill et al., 2015	Burton et al., 2016	Childers et al., 2012	Flocke et al., 2014	Kim et al., 2002	Malan et al., 2016	Mitchell et al., 2011	Nawaz et al., 2016	Ockene et al., 1995	TOTAL
Questioning		√						√	√	3
Closed-ended question			√							1
Open-ended question	√	√	√			√		√		5
Active listening								√		1
Positive feedback/ Reinforcement/ Affirmation	√			√					√	3
Reformulations/ Reflections/ Summaries	√	√	√			√		√		5
Elicit readiness				√	√		√			3
Respond with readiness				√						1
Education/ Information	√				√			√		3
Goals and Planning	√			√				√	√	4
Empathy				√			√	√		3
Acceptance and warmth								√		1
MI Global score		√				√	√			3
MI Adherent		√				√				2
MI non-adherent		√	√							2
MI roadblocks/ Rolling with resistance			√							1
MI spirit	√									1
Partnership / Collaboration	√			√			√	√		4
Autonomy				√			√			3
Arrange follow-up	√								√	2
Advise (5As)									√	1
Opening statement								√		1
Closing statement								√		1
Natural consequences				√				√		2
Direction							√			1
Non-verbal communication								√		1
TOTAL	8	6	5	8	2	4	6	13	5	

ACCEPTED MANUSCRIPT

Table 6: Taught versus measured training components

	Bofill et al., 2015	Burton et al., 2016	Childers et al., 2012	Flocke et al., 2014	Kim et al., 2002	Malan et al., 2016	Mitchell et al., 2011	Nawaz et al., 2016	Ockene et al., 1995	Average (%)
total skills taught	13	14	21	12	19	9	7	6	11	
total skills measured	11	8	7	8	2	7	6	15	5	
taught and measured	6	5	6	6	1	0	0	2	4	
measured not taught	5	3	1	2	1	7	6	13	1	
taught not measured	7	9	15	6	18	9	7	4	7	
% taught and measured	46	37	28.6	50	5.26	0	0	33	36.4	26.2
% measured but not taught	45.5	37.5	14.3	25.0	50.0	100.0	100.0	86.6	20	53.21
% taught but not measured	53.85	64.29	71.43	50.00	94.74	100.00	100.00	66.67	63.64	73.80