Motivational interviewing training for medical students: A pilot pre-post feasibility study

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A R T I C L E   I N F O

Article history:
Received 28 February 2018
Received in revised form 5 June 2018
Accepted 20 June 2018

Keywords:
Motivational interviewing
Communication skills
Continuing medical education
Interdisciplinary medical education

A B S T R A C T

Objective: To evaluate the impact of brief training in motivational interviewing (MI) from a non-specialist professional for medical students.

Methods: Students (n = 20) received three four-hour sessions of MI training over one week. They interviewed caregivers acting as patients in two standardised medical situations, six weeks before and three weeks after training. Global scores from the MITI-3.1.1 code, including "MI-Spirit", were attributed to the audiotaped interviews by two independent coders, blind the pre- or post-training status of the interview. Secondary outcomes were: caregivers’ perception of students’ empathy (CARE questionnaire), students’ evaluation of self-efficacy to engage in a patient-centred relationship (SEPCQ score), and students’ satisfaction with their own performance (analogue scale).

Results: MI-Spirit score increased significantly after training (p < 0.0001, effect size 1.5). Limited improvements in CARE score (p = 0.034, effect size 0.5) and one of the SEPCQ dimensions (sharing information and power with the patient; p = 0.047, effect size 0.5) were also noted. Students’ satisfaction score was unaffected (p = 0.69).

Conclusion: These findings suggest that brief MI training can improve communication skills in medical students.

Practice implications: Such an intervention is feasible and could be generalised during medical studies.

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1. Introduction

Current ideas in medical ethics favour the promotion of greater patient autonomy, placing patients at the heart of the healthcare system[1]. Practitioners must seek to establish a therapeutic alliance with patients, encouraging them to accept care or adopt healthier behaviours. The practitioner’s empathy towards the patient is a determining factor in therapeutic management[2–4]. The use of patient-centred communication by physicians and the training of medical students in communication skills are also associated with higher levels of satisfaction and lower levels of psychological distress in patients, especially in cancer patients, and even better adherence to treatment[5–8]. Conventional approaches, which tend to be directive, may not be sufficiently effective, or even counterproductive if they impinge on the patient’s sense of freedom or need for shared decisions. Several models of change, taking into account the patients’ perception of their illness, readiness to change and self-efficacy, have been developed to assist practitioners[9]. Motivational interviewing (MI), for example, was developed by WR Miller at the start of the 1980s, initially for alcoholic patients[10]. It is defined as a collaborative, goal-oriented style of psychotherapy, to elicit and strengthen the motivation of the individual to move towards specific health goals by resolving ambivalence[11]. MI occurs within a relational context of empathy and acceptance, this dependence on interpersonal communication being an essential component[12]. Another crucial element of MI sessions is the focus on evoking and strengthening a particular style of language.
The training of medical students currently focuses heavily on the delivery of technical, biological and pathophysiological information, and shifting from this traditional, paternalistic approach to a patient-centred approach remains challenging [13]. The education of future doctors could be optimised through MI training programmes [14,15], as in some English-speaking and Swiss universities [16–19]. More than 200 randomised clinical trials on MI and several meta-analyses have shown MI to be effective for chronic disease management, and for promoting the therapeutic alliance, treatment adherence and changes to healthy behaviour [15,16,20]. Pre- and post-training studies have evaluated the impact of very brief (around 2 h) training in MI for medical studies. They concluded that MI training increased the students’ knowledge and confidence regarding their medical practice [21–23]. A randomised trial by Daepen et al. reported improvements in MI performance after an eight-hour training workshop, with higher scores for empathy and “MI Spirit”, although the observed increase was not sufficiently large for MI practice. However, as there was no before-after comparison, no information was provided about students’ performance before training [19].

Our study specifically compared the MI skills of medical students during simulated interviews with standardised patients, before and after a short programme of MI training with a non-professional trainer. We thus evaluated the responsiveness of students to such interventions, which could easily be included in the medical curriculum. This study also measured changes in student empathy, as perceived by the “patients”, the students self-perceived self-efficacy to engage in a patient-centred relationship, and their satisfaction with their own performance relative to the goals fixed.

2. Methods

The research protocol and ethical aspects were approved by the Educational Committee of the Faculty of Medicine of Paris-Sud University.

2.1. Design and participants

All the students in clinical internships (fourth or fifth year of medical courses) at the Immunology-Infection-Inflammation-Endocrinology Division of Bicêtre Hospital, Assistance Publique Hôpitaux de Paris, with no prior training in MI, were eligible for this study. They were fully informed about the study procedures and gave written consent.

Two weeks before and two weeks after training, students took part in a simulated 15-minute interview. Two caregivers were instructed, two weeks before the training, to play the role of a patient consulting his doctor for the follow-up of either HIV infection or a chronic obstructive pulmonary disease (COPD). Students were informed of the target behaviour before the interview: improving treatment adherence for the HIV-infected patient and stopping smoking for the patient with COPD. They were assigned, on the basis of their academic timetables and internship constraints, to two training groups. The order of the pre/post training interviews for each group was randomly determined: HIV patient first and COPD patient second, or vice versa (Fig. 1).

2.2. Measurements

The capacity of a practitioner to use MI was evaluated with the Motivational Interviewing Treatment Integrity (MITI 3.1.1) Code, an instrument currently in development [24]. It includes five global scores, for which the coder must assign a single number from a five-point scale (1=poor, 5=excellent) to characterize the entire interaction. The Evocation score measures the extent to which the practitioner evokes the patient’s own arguments for change, rather than imposing his/her own arguments. The Collaboration score measures the extent to which the practitioner places himself in the position of the patient’s partner, rather than as an expert. The Autonomy/support score measures the extent to which the practitioner supports and actively fosters the patient’s perception of choice, as opposed to attempting to control that choice. These three scores are averaged to obtain the “MI Spirit” score. The Empathy score measures the extent to which the practitioner tries to understand the patient’s point of view and to respond to it. The Direction score measures the extent to which the practitioner focuses on the target behaviour. The coding system also involves several “Behavioural counts” (open and closed questions, simple and complex reflections etc.). Only the global scores were calculated for this study [19,24]. Audiotaped recordings of the consultations were rated by two independent researchers (PB,CL). PB received training in the use of MITI-3.1.1 in 2010 from Gaume and Fortini [19,25] and in the use of MITI–4.2 in 2014, from the authors themselves [24,26]. Both these researchers received 36 h of training in the use of the Motivational Interviewing Skill Code (MISC) [27] from Gaume in 2014, and had already participated in several analyses using the MITI code. Coders were blind to the order of the interviews they analysed (before or after MI training). The average score attributed by the two coders was calculated.

Communication skills were also evaluated with the Self-Efficacy in Patient-Centeredness Questionnaire (SEPCQ), completed by the students [28]. SEPCQ quantifies the ability of a health professional to engage in patient-centred, rather than disease-centred, relationships. It provides a global score and three factorial subscores: “exploring the patient’s perspective”, “sharing information and power” and “dealing with communication challenges”. Cronbach internal consistency reliability estimates for factorial and total score ranged from 0.74-0.93 and 92–95, respectively; the test-retest correlations were 0.62, 0.47, 0.69, and 0.87 [28].

Students’ empathy, as perceived by the caregivers playing the role of the “patients” during the simulated consultations, was measured with the Consultation And Relational Empathy (CARE) Questionnaire [29]. The Cronbach reliability and test-retest correlation scores were 0.92 and 0.70, respectively [29,30].
Finally, at the end of the simulated consultation, students were asked to assess their self-satisfaction with the interview (“Do you feel, at the end of this meeting with your patient, that you performed well in your attempts to achieve the defined goal with your patient?”) on a visual analogue scale (0–10).

2.3. Training

Students received three four-hour sessions of basic MI training in French, over a one-week period. The trainer (SMC) was a Professor of Psychiatry from a Faculty of Medicine different from that at which the students were enrolled. He did not belong to an association of MI trainers, but was used to teaching doctor-patient relationship and communication skills as part of the medical curriculum and to graduate physicians. He had also been involved in “consultation-liaison psychiatry”, and his intervention was frequently requested to help patients with difficulties adhering to medical treatments, but also by care teams confronted with difficult patients or situations of relational blocking. He was therefore used to dealing with resistance and ambivalence on the part of patients or practitioners. Training was largely inspired by books on MI [11], and by the training kit developed by Fortini and Daeppen at Lausanne University Hospital [25]. Training was based on four types of teaching aids:

1) Viewing and commenting on video clips illustrating motivational and non-motivational doctor-patient interactions, in various types of medical conditions: quitting smoking, alcohol dependence, being overweight, non-compliance with antiretroviral regimens.

2) Lectures and the distribution of memory aids, in the form of printed documents taken from the slides used during the training sessions, including “take-home messages”.

3) Practical exercises: asking open-ended questions; making simple and complex “reflections”; exploring ambivalence; dealing with patient resistance; expressing empathy; affirming the patient’s initiatives and skills; supporting the patient’s self-efficacy; supporting the patient’s discourse about change to encourage changes in behaviour; summarising.

4) Role-playing, based on several situations, each involving two students. We deliberately chose a non-medical situation (conflict between a mother and a student asking her for pocket money to go out for fun, the day before a university examination) for the first situation. This first situation was chosen so as to allow students to begin with an informal, fun situation, to encourage them to relax and to avoid confronting students with performance anxiety related to their professional roles from the outset. The 10-minute role-playing sequences were filmed and then analysed with the students, who were given constructive feedback, supporting, as far as possible, the comments made by the students themselves and valuing their knowledge to encourage movement in the direction of the motivational mindset. All the other situations concerned changes to healthier behaviour in a medical setting, but with a goal different from that used for the first or the second simulated interview, before or after MI training: compliance in hypertension or diabetes, or increasing physical activity.

5) Both groups thus encountered the same MI situations during role playing, which were independent of the target behaviour for the two clinical situations of the simulated interviews, to prevent one group being favoured over the other.

2.4. Statistical analysis

Sample size was calculated for the primary objective of this study: the assessment of the effect of training on students’ MI Spirit scores. In an ongoing intervention study on the effect of a MI training of nurses involved in an HIV patient-education programme lasting six months, an increase of 0.5 was observed for MI Spirit score between baseline and the six-month visit in the control group of nurses, in the absence of any MI training (the intervention group of this study consisted of the same nurses following different HIV patients after having been provided with specific MI training by professional trainers, but with other patients).

Referring to such a floor effect of time and personal involvement on MI Spirit, we calculated that a sample size of 16 students had a power of 84% to detect a minimum difference in means of 0.5 between ‘before’ and ‘after training’ scores, assuming a standard deviation of 1.0 and a correlation between scores of 0.8, in a two-tailed paired t-test with an alpha risk of 5%. The effect size (Cohen’s $d_z$) is 0.8, which may be interpreted as large (0.8) rather than small.
(0.2) or moderate (0.5) [31]. The sample size was increased to 20 to allow for students withdrawing from the study. Confounding due to order effects was minimised by balancing the order of MI situations (COPD/HIV or HIV/COPD) between two groups of 10 students.

Data were analysed with t-tests; correlations and effect sizes were also calculated. The effects of the order of MI situations and differences between the two coders were assessed in a repeated-measures analysis of variance (ANOVA). Reliability was assessed by calculating intraclass correlation coefficients (ICC) between the two coders. Principal component analysis (PCA) was performed on post- minus pre-training differences, to assess relationships between MI Spirit (MITI), Empathy (MITI), Empathy (CARE), Self-efficacy to engage in a patient-centred relationship (SEPCQ) and the visual analogue scale score for self-satisfaction.

We also performed a repeated-measures ANOVA with sociodemographic characteristics. All analyses were conducted with SAS 9.3 software.

3. Results

3.1. Study population

All but one of the eligible students agreed to participate in the study and conducted the interviews, completed the questionnaires and attended all the MI training sessions (Fig. 1). The sociodemographic characteristics of the students did not differ between the two groups (defined on the basis of the order of MI situations: COPD/HIV or HIV/COPD); median age was 23 years (22–34 years), and 70% of the students were women. All but two of the students were in their 5th year of medical training (Table 1).

3.2. Comparisons of MITI global scores before and after MI training

Mean MI Spirit score increased from 2.0 to 2.9 (p < 0.0001) between the two interviews (Table 2), showing that the students’ performance was significantly better after training. The three subscales making up the MI Spirit score (Evocation, Collaboration, Autonomy/Support) and Empathy score also increased between the two interviews. Direction score did not improve, but was already good before training. Correlations between each global score measured before and after training were positive, but moderate and non-significant (except for Evocation). Effect size exceeded 1.5 for MI Spirit score.

3.3. Comparisons of MITI scores between the two groups

As shown in Table 3, for MI Spirit, the interaction between group and time was significant (p = 0.038). The significant main effect of time (p < 0.0001) must therefore be interpreted in the light of this interaction. The MI Spirit scores for students in the HIV/COPD group increased by 1.2, whereas those for students in the COPD/HIV group increased by only 0.6. However, this interaction effect was not as clear-cut for the subscales other than Evocation. Using the same model with individual data from the two coders, the difference between coders was found to be non-significant for MI Spirit scores (p = 0.23) and there was no coder-by-group interaction (p = 0.66).

3.4. Coding reliability

The reliability of the series of scores obtained before training for the two coders was fair to excellent [31], with ICCs of 0.46 and 0.63 for Direction; 0.55 and 0.71 for Autonomy/Support; 0.60 and 0.75 for Collaboration; 0.77 and 0.87 for Evocation; 0.82 and 0.90 for Empathy and 0.67 and 0.81 for MI Spirit, for single measures and mean values, respectively, highlighting the similarity of the MITI scores attributed by the two coders.

3.5. Effect of sociodemographic covariates on MI spirit

The sociodemographic covariates had no impact on the effect of training on MI Spirit score (Appendix Table A1). There was a similar impact of training on the increase in empathy for both men and women.

3.6. Comparisons of CARE, SEPCQ and self-satisfaction analogue scale scores before and after MI training

No significant global improvement in these scores was noted, due to high variability between students. For example, the mean increase in SEPCQ score was 5.05 but the standard deviation was 14.07 (Tables 2 and 3). The exceptions were a limited increase in CARE score (p = 0.034) and self-estimated capacity to share information and power (SEPCQ subscale) (p = 0.047), both of which displayed moderate effect sizes of 0.5. No significant interaction between time and group was detected other than for the SEPCQ dimension ‘sharing information and power’ (p = 0.013), which increased for the students of the HIV/COPD group (mean difference=+7.2) but not for those of the other group (mean

Table 2

<table>
<thead>
<tr>
<th></th>
<th>Before Training</th>
<th>After Training</th>
<th>After-Before Difference</th>
<th>Correlation</th>
<th>Effect size</th>
<th>t test</th>
</tr>
</thead>
<tbody>
<tr>
<td>MI Spirit</td>
<td>1.98</td>
<td>0.51</td>
<td>2.88</td>
<td>0.53</td>
<td>0.90</td>
<td>0.37</td>
</tr>
<tr>
<td>Evocation</td>
<td>1.70</td>
<td>0.62</td>
<td>2.75</td>
<td>0.85</td>
<td>1.05</td>
<td>0.78</td>
</tr>
<tr>
<td>Collaboration</td>
<td>2.08</td>
<td>0.59</td>
<td>3.03</td>
<td>0.53</td>
<td>0.95</td>
<td>0.67</td>
</tr>
<tr>
<td>Autonomy/Support</td>
<td>2.15</td>
<td>0.71</td>
<td>2.85</td>
<td>0.71</td>
<td>0.70</td>
<td>0.77</td>
</tr>
<tr>
<td>Direction</td>
<td>4.55</td>
<td>0.43</td>
<td>4.6</td>
<td>0.42</td>
<td>0.05</td>
<td>0.51</td>
</tr>
<tr>
<td>Empathy</td>
<td>2.15</td>
<td>0.86</td>
<td>3.00</td>
<td>0.69</td>
<td>0.85</td>
<td>0.95</td>
</tr>
<tr>
<td>CARE Score</td>
<td>24.05</td>
<td>6.80</td>
<td>30.90</td>
<td>9.69</td>
<td>6.85</td>
<td>13.38</td>
</tr>
<tr>
<td>SEPCQ Score</td>
<td>62.55</td>
<td>10.90</td>
<td>67.60</td>
<td>9.31</td>
<td>5.05</td>
<td>14.07</td>
</tr>
<tr>
<td>Exploring the patient’s perspective</td>
<td>26.20</td>
<td>5.24</td>
<td>26.90</td>
<td>3.45</td>
<td>0.70</td>
<td>4.86</td>
</tr>
<tr>
<td>Sharing information and power</td>
<td>21.95</td>
<td>5.08</td>
<td>25.35</td>
<td>5.40</td>
<td>4.30</td>
<td>7.16</td>
</tr>
<tr>
<td>Dealing with communication challenges</td>
<td>14.40</td>
<td>4.36</td>
<td>15.35</td>
<td>3.28</td>
<td>0.95</td>
<td>4.61</td>
</tr>
<tr>
<td>Self-satisfaction with the odds of achieving the target goal</td>
<td>6.23</td>
<td>1.55</td>
<td>6.43</td>
<td>2.01</td>
<td>0.20</td>
<td>2.19</td>
</tr>
</tbody>
</table>

No. of participants = 20.
Correlations: Pearson coefficient for the correlation between the scores obtained before and after training (n = 20). *All non-significant except for Evocation (p = 0.03).
Effect size: d = mean difference/SDmean; p = P-value of t test for After-Comparison (paired data).
difference = -0.4). A significant strong correlation was found between the improvements in MI Spirit and its empathy subscale (Pearson r = 0.61, p = 0.004) but there was no correlation between MI and SEPCQ. In the principal component analysis, the first dimension was mainly related to MITI “MI Spirit”, “MITI” empathy global score and CARE empathy score. The second dimension was associated with self-efficacy (SEPCQ) score and self-satisfaction score on a visual analogue scale (Fig. 2).

4. Discussion and conclusion

4.1. Discussion

This pilot study indicated a potential improvement in motivational interviewing skills in the short term, following a brief training course, among students representative of the population in which the intervention might be applied. These findings are consistent with those of previous studies targeting medical students [19,21]. Our objective was not to prove that students would be able to apply MI to their future patients without any further supervision after such a short training intervention, but to show that they were able to improve their relationship skills and their ability to apply the principles of MI. Students’ skills improved in terms of encouraging support and autonomy, evoking patient’s problems and working with the patient to initiate the process of change in health behaviour.

The observed difference was significant, regardless of the students’ sociodemographic characteristics, and of the coder. It was large, exceeding a Cohen’s d effect size of 1.5 on average for MI Spirit score, corresponding to an effect twice that anticipated. However, mean post-intervention MI Spirit score was lower than that obtained in studies on medical students from Switzerland or English-speaking countries [16,19,32]. It would be interesting to determine the reasons for this difference and the contributions of the nature of training, cultural variables and academic background.

The change in MI Spirit score depended on group (HIV/COPD or COPD/HIV) and was related to the target behaviour of the second, post-training, simulated consultation with a patient. The target behaviour “stop smoking” was derived from the field of addiction, and the objective was to resolve the ambivalence linked to tobacco addiction [33]. This was clearly a health issue better understood by the students than treatment adherence in HIV infection.

Our students were already at an advanced stage of their medical training, and thus had a clear understanding of health objectives, resulting in a high score for Direction, not affected by training. This score measures the degree to which clinicians maintain appropriate focus on a specific target behaviour but, unlike the other global scales, high scores for clinicians on this scale do not necessarily reflect better use of MI [19,24]. However, we were unable to investigate the effect of study year on scores, due to the presence of only two fourth-year students. An ability to determine which types of healthier behaviour would benefit patients in different medical conditions seemed to have been well acquired by these students after several years at university, highlighting the deficiencies in the learning of other skills important for MI, and thereby identifying key requirements for their incorporation into future medical training.

Empathy is a major indicator of the nature of the therapeutic relationship [34], and a key determinant in therapeutic management [2,34]. The MITI Empanathy score does not contribute to the “MI Spirit” score, but it was assessed among the five global MITI scores. It significantly improved after the intervention. One of the original features of this work was its measurement of the benefits of MI training in terms of both the students’ empathic abilities, as
assessed by the coders listening to audio recordings of the simulated interviews, and through the evaluations made by the “patients” immediately after the interviews, with a good covariation, as shown by the PCA. Despite the predominance of female students in this study and the known tendency of women to be more empathic than men [35,36], similar benefits were observed in students of both sexes. Kelm reported a lack of empathy among medical students and a decline of empathy during medical training [37]. The nature of modern medical education, with its emphasis on emotional detachment, affective distance and clinical neutrality, may have contributed to this decline [38,39]. Regardless of this debate, our results indicate that this training made it possible to strengthen the capacity of students to empathise with the patient for the well-being of both patients and physicians [40].

The change in students’ self-efficacy was significant in terms of their ability to share information and power with the patient. These results are consistent with those of two studies conducted with students in their third year of medical training, demonstrating positive changes in students’ confidence after eight hours of training [41], and a shorter training period of two hours [21]. The global score and the other two dimensions of the SEPCQ (the ability to adopt the patient’s perspective, and the ability to manage relational conflicts), and students’ satisfaction with the odds of achieving the target goal during the simulated interviews were not affected by our training. The absence of correlation between MI Spirit and self-efficacy might be explained by the students’ interest in and commitment to the MI training, which may have led them to a certain form of modesty and awareness of the work that remains to be done to be “good” in this field. This is an important aspect to take into account, to limit students’ feelings of worthlessness and failure in future training. Their improvement may have required more prolonged training, the implementation of repeated supervision sessions or a gratifying return in this sense from real patients.

Our MI training programme resembled other programmes in many ways [16,18,22]. A satisfaction survey found that 90% of students were satisfied with the MI training (data not shown) and appreciated this course of three half-days of training in the same week, whereas 10–14 hours of training delivered as a block was deemed to be excessive in a previous study [32].

This is the first intervention study using different validated instruments simultaneously to evaluate the effects of motivational interviewing training during medical education. A simple ‘before-and-after’ design, with no control group and with the subject as his/her own control, was used in this pilot study, as this approach can separate between–subject variability from the effect of the training. Some uncertainty will always remain about whether the effect observed was definitely due to the training, because measurements were not made for a group not receiving the training, so we can only assume that the training may have made the difference. Acceptability was maximal in this representative population of students, with no missing data, allowing a straightforward analysis without the pitfalls of handling drop-outs and with no loss of statistical power. This design was useful for measuring the immediate impact of a short-term intervention but we did not carry out short-term monitoring-reinforcement and maintenance interventions for the acquired knowledge and we did not check the potential effectiveness of the skills acquired by students with real patients. We cannot rule out the possibility that the improvement in the relational and communication skills of the 20 students could also be explained by factors independent of the MI intervention: an effect of practical training after several years of theoretical teaching, of incentives relating to identification with a model provided by the seniors supervising the students. However, although these effects are also plausible, an effect over such a short time (a few weeks) seems unlikely.

Indeed, caregivers did not have to follow a specific script (scenario) and the patient’s change discourse was not evaluated. It cannot be ruled out that simulated patients faced with more empathetic students in simulated consultations after training would display less resistance to change. These significant results were obtained thanks to the intervention of a non-specialist MI trainer, suggesting that such training is both feasible and easy to implement. However, they raise the question as to whether someone specifically trained to teach other MI techniques would have a greater positive effect on the acquisition of relationship skills.

4.2. Conclusion

Our findings show that a simple course of basic training in MI, easy to implement, even with a health professional who is not specifically a dedicated MI trainer, can increase medical students’ communication skills and empathy. The integration of sustained training in MI early in medical studies would be beneficial for both medical students and patients. Confirmatory studies could be carried out, at a larger scale, on the effects of such training on both the students’ relationship abilities and health behaviour changes in real patients.

4.3. Practice implications

Our findings show that simple basic training in MI with a non-specialist MI trainer, can increase the relationship scores of medical students and improve their communication strategies. They demonstrate the feasibility and ease of implementation of this type of intervention in medical training and encourage the generalisation of MI training during medical studies. Nevertheless, the benefits of this type of training should be maintained and increased by the long-term supervision of students, with MITI used as a feedback tool [18,42], to ensure that a sufficiently high level is reached for the use of MI in practice.

Authors’ contributions

AC, CD, KB and SMC came up with the original idea and designed the study. AC, CD, KB and SMC developed the search strategy for the study and performed the search and screening processes. PB and CL analysed audio tapes. EH and CDA played the role of the patients. All the authors developed the thematic coding and data analysis was performed by CD, AC, SMC. AC, CD, and SMC wrote the first draft of the manuscript. All the authors reviewed and revised the manuscript and all the authors approved the final version.

Ethics approval

This study was approved by the Educational Committee of the Faculty of Medicine of Paris-Sud University.

Conflicts of interest

None

Funding

This research was funded by the Infection, Immunology, Endocrinology Inflammation and Geriatric Units, Bicêtre Hospital, Assistance Publique Hôpitaux de Paris, France, and the French General Medical Council, which provided feedback on clarity and approved the manuscript for publication.
Statement

We confirm that all patient/personal identifiers have been removed or disguised so the patient(s)/person(s) described are not identifiable and cannot be identified through the details of the story.

Acknowledgements

We thank the students and the University Paris Sud XI Faculty of Medicine, Prof. J.L. Teboul (medical education co-ordinator at Paris)

Table A1
MT Spirit analysis of sociodemographic variable effects (Covariables: Sex, Age in 2 classes, BMI in 3 classes, Marital status, Assistant nurse. Physical activity, Current smoker).

<table>
<thead>
<tr>
<th>Group</th>
<th>HIV/COPD Before</th>
<th>COPD/HIV Before</th>
<th>After</th>
<th>After Covar</th>
<th>Group Time</th>
<th>Group Covar</th>
<th>Covar Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>N 10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>20</td>
<td>20</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>Mean 1.9</td>
<td>3.07</td>
<td>2.05</td>
<td>2.68</td>
<td>1.98</td>
<td>2.88</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>SD 0.5</td>
<td>0.51</td>
<td>0.53</td>
<td>0.51</td>
<td>0.51</td>
<td>0.53</td>
<td>-</td>
</tr>
<tr>
<td>SEX Female</td>
<td>N 6</td>
<td>6</td>
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<td>8</td>
<td>14</td>
<td>14</td>
<td>0.93</td>
</tr>
<tr>
<td></td>
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