Sustained effects of faculty leadership development modules for clinical instructors of core competences education in Taiwan: a four-year explanatory case study

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Abstract

Background: The Accreditation Council for Graduate Medical Education (ACGME) core competencies (CC) in general medicine-based primary care are essential for junior medical trainees. In this country, a regular faculty development (FD) program aimed at training faculty in instructing (teaching and assessing) these CC had operated. However, leadership was not emphasized. In a new intervention module, the roles and associated responsibilities of clinical instructors to conduct, design, and lead CC-based education were emphasis.

Aims: This follow-up explanatory case study compares the effectiveness of intervention module with that of the previous regular module.

Methods: The regular group (n = 28) comprised clinical instructors who participated in the FD module during the 2013–2014 year while the intervention group (n = 28) was composed of 2015–2016 participants. Prior to the formal (hands-on) training, participants in the intervention group were asked to study the online materials of the regular module. These participants then received a 30-h hands-on training in conducting, designing, and leading skills. Finally, they prepared a 10-h reflective end-of-module presentation of their real-world practices.

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Results: Following the training, a higher degree improvement in participants self-reported familiarity with CC education, self-confidence in their ability to deliver CC education and sustained involve CC education were noted among the intervention FD group, compared with the regular FD group. In the intervention group, senior academicians (associate and full professor) are more substantially involved in designing and leading CC-based courses than junior academicians (lecturers and assistant professors). Among non-teaching award winners of the intervention FD group, the follow-up degree of sustained involvement in delivering, designing and leading CC-based courses was significantly higher than that of the regular group.

Conclusions: Our study demonstrated that leadership training in the intervention FD modules substantially motivated clinical instructors to become leaders in CC education.

Keywords: Clinical instructor, Core competence education, Leadership, Sustainability

Background
The Accreditation Council for Graduate Medical Education (ACGME) core competencies (CC), in general medicine-based primary care are essential for junior medical trainees. They included medical knowledge, interpersonal and communication skills, system-based practice, practice-based learning and improvement, professionalism and patient care. Clinical instructors must teach and assess junior medical trainees in CC before they enter sub-specialties. In 2003, the outbreak of the severe acute respiratory syndrome (SARS) in this country exposed serious deficiencies of CC-based primary care by junior trainees due to a lack of appropriate education. Accordingly, there is an urgent educational need to train faculty to educate junior medical trainees in CC-based primary care. Faculty development (FD) refers to activities that clinical instructors or organization pursue to improve their knowledge, skills, and behaviors in response to specific educational needs [1, 2].

In 2003, during the post-SARS era, Executive Yuan of the Department of Health (DOH), announced a nationwide pilot FD program to cultivate clinical instructors whose are familiar with, have confidence in, and are substantially involved in CC-based education (teachings and assessments) [1–5]. In 2009, the DOH began to regularly fund “FD programs” in nationwide organizations to strengthen clinical instructors’ skills for delivering CC education [5]. The regular FD model supported by situated and experiential learning theories that emphasized on-site observational learning and guided reflection had been continuously utilized in our hospital [6, 7]. In general, clinical instructors had reported that our regular FD module familiarizes them with CC-based teaching and assessment and thus, increases their confidence [8, 9].

Moreover, since 2013, clinical instructors in this country have been facing new challenges, including the extension of postgraduation training from 3 months to 2 years, an amendment in the number of years of medical school study from seven to six, and limitation on work hours for all residents [10–12]. Accordingly, clinical instructors are expected to competently show the way in delivering, designing and leading CC education that fits the need of a system in the midst of reform [13–15].

However, a survey of participants revealed that our previous regular FD module did not effectively cultivate their ability to play multiple roles (instructors and leaders) or to take on corresponding responsibilities (delivering, designing and leading CC education) [14, 15]. The aims of implementing leadership in FD is to train leaders who can solve challenges in medical practice and education [14, 15]. In addition to train in delivering skills as in the regular FD module, the intervention module emphasized the training of designing and leadership skills [16, 17]. After participating in the intervention FD module, clinical instructors are expected to competently show the way in CC education deliver, design, and leadership.

This study aimed to compare the effects of the intervention and regular FD modules on participants’ familiarity with CC education, confidence in their delivery, and sustained involve in instruction and leadership roles in CC education following training. Moreover, the various impacts of this intervention module on participants with different academic positions and teaching performance were compared.

Methods
Study design
An explanatory case study is an in-depth exploration and explanation of an intervention in a real-life context, opposing to hypothesis testing [18, 19]. This research involved an explanatory case study that evaluated how and why the new intervention worked [20]. Age and sex-matching of new clinical instructors were voluntarily included for comparison between regular and intervention groups.

Setting
Previous regular FD module for training clinical instructors
With respect to CC-based teaching and assessment delivery skills, the major training topics focused on principles of identifying learning objectives, adult learning,
creating and maintaining a positive learning environment, developing and using interactive audiovisual tools, and on-site observational learning and guided reflection.

As our previous report indicated [8, 21], the regular FD module comprised 40 h across 3 months. It consisted of brief expository lectures and small group discussions. The first 30 h included an introduction to educational theory, and on-site observation of CC education delivering skills. On the final 10 h, as part of the end-of-module presentation, presenter reflected their skills in delivering CC education and received paper and face-to-face feedback from senior facilitators and peers (Fig. 1 and Table 1), following an interactive discussion.

After participating in the regular FD module, clinical instructors are expected to be competent in the delivery of CC-based teaching clinics, circuit and itinerant bedside teaching as well as case-based discussion (CBD), mini-clinical evaluation exercise (mini-CEX) and the objective structured clinical examination (OSCE) [8, 21].

All topics in the course were video recorded and edited by teaching assistants for self-directed learning.

**Background to the development of the new leadership-enhanced intervention FD module**

With the reform of the education system, the 2013 and 2014 surveys revealed that trained clinical instructors’ familiarity with the skills of designing and leading CC-based education and their confidence in delivering it was insufficient. Therefore, during the 2015–2016 year, the educational committee organized a new intervention FD module emphasizing leadership. Case-control studies sometimes use historical controls, if controls are not permitted, based on special conditions such as the learning right of participants and educational ethics [22, 23]. Therefore, historical regular FD cohorts were used in this study between 2013 and 2016 as controls for the intervention FD cohorts. Notably, both the regular and intervention FD cohorts (n = 81) had similar characteristics (Table 2) and were taught by some senior faculty.
teams. Of 81 invited clinical instructors, 66 (81.4%) agreed to participate in this study.

**Intervention FD module for training of clinical instructors in the leadership**

In the intervention FD module, prior to hands-on sessions, participants were asked to study the online materials of the regular module [8, 21]. With respect to training leadership, the first 30 h of the intervention module focused on delivering, designing and leading CC-based teachings and assessments. For example, participants received hands-on experience with delivering, designing and leading OSCE through the assessment of six aspects of CCs at different stations with well-designed scenarios and checklists. Different from the delivery skills-focused regular module, the end-of-module presentation during the last the 10 h of intervention module highlighted reflection on delivering, designing and leading skills.

**Sustained effects of the three-month training course**

After the training, follow-up surveys (at 1 year) were conducted and compared between groups to evaluate whether the newly trained clinical instructors were substantially involved in delivering, designing and leading CC-based education.

**Table 1** comparison between regular and intervention faculty development (FD) modules

|                              | Regular FD module                                                                 | Intervention FD module                                                                 |
|------------------------------|----------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|
| Teaching strategies          | brief expository lectures, on-site observational learning and small group discussions | Pre-module online SDL, on-site observational learning and small group hands-on practicing |
| Pre-module preparation       | *No need for preparation, knowledges and skills for CC-based education are introduced and discussed in formal lectures | Materials of 30 h of delivering skill-focused materials were studied online by participants of regular module before class |
| Assignments (End-of-module presentation) | each new clinical instructor present within 15 min. and will receive 5 min. Feedback from peer and facilitator | Guided reflection of real world practicing of delivering skills for CC education and future plan |
| Used discussion questions for guided self-reflection at the end of module | *I am familiar with … . *delivering, designing, and leading CC-based teachings in teaching clinics, itinerant bedside, circuit bedside as well as CC-based assessments in CBD, mini-CEX and OSCE | *I am familiar with … . *delivering, designing, and leading CC-based teachings in teaching clinics, itinerant bedside, circuit bedside as well as CC-based assessments in CBD, mini-CEX and OSCE |
|                             | *I feel confident about … . *delivering, designing, and leading CC-based teachings in teaching clinics, itinerant bedside, circuit bedside as well as CC-based assessments in CBD, mini-CEX and OSCE | *I feel confident about … . *delivering, designing, and leading CC-based teachings in teaching clinics, itinerant bedside, circuit bedside as well as CC-based assessments in CBD, mini-CEX and OSCE |
|                             | *I am sustainably … . within 1 year *involve in delivering, designing and leading CC-based courses as well as incorporate CC in delivering, designing and leading courses | *I am sustainably … . within 1 year *involve in delivering, designing and leading CC-based courses as well as incorporate CC in delivering, designing and leading courses |

SDL self-directed learning, CC (Core competencies) indicated the six core ACGME competencies including medical knowledge (MK), interpersonal and communication skills (ICS), system-based practice (SBP), practice-based learning and improvement (PBLI), professionalism (P), Patient care (PC)

**Table 2** Basal characteristics of participants of regular and intervention FD modules (n = 28 in each group)

|                              | regular FD module participants | intervention FD module participants |
|------------------------------|--------------------------------|------------------------------------|
| Age, years, mean (SD)        | 43.8 (5.9)                     | 46.3 (8.6)                         |
| Male, (%)                    | 67%                            | 64%                                |
| Junior academician (lecturer/assistant professor, overall, %) | 34/33/67%                      | 36/27/63%                         |
| Senior academician (associate/full professor, overall, %)     | 26/7/33%                      | 30/6/37%                          |
| Teaching-award winner within 3 years before training (%)    | 29%                            | 33%                                |
| Specialty of new trained instructors (%)                       |                                |                                    |
| Internal medicine/Surgery/Gynecology/Pediatrics/Emergency medicine/ others (Neurology, Psychiatrics, Rehabilitation, Family Medicine, etc) (%) | 36/13/13/15/12/11%            | 32/10/13/15/16/14%                |
| Prior participation in training of clinical teaching or assessment | 52%                            | 48%                                |
| Junior attending physician (%) | 64%                            | 70%                                |
| Senior attending physician (%) | 35%                            | 30%                                |

Annual teaching-award for teaching performance of teachers are online selected by learners to receive the award; junior or senior attending physician indicated teacher with less than or more than 15 years of being as attending physician
Study outcomes
At the pre-module, end-of-module and follow-up stages of this study, the intervention FD module was evaluated and compared with the regular FD module. Using a five-point Likert-type self-assessed questionnaire, the degree of familiarity with, self-confidence and sustained involvement in delivering, designing and leading CC-based education was evaluated (Tables 2, 3 and 4, Fig. 1). The questionnaire was based on levels 2 (participants’ familiarity with and confidence their own delivery of in CC-based education) and 3 (participants’ sustained involvement in CC-based education) of Kirkpatrick’s framework to evaluate the effectiveness of the two FD modules. Meanwhile, the participants were encouraged to provide descriptive feedback and discuss with the program director freely. In the subgroup analysis, the impact of academic position and teaching performance (teaching award winner or non-teaching award winner) on the degree of sustained involvements in CC-based teachings and assessments were analyzed the designed in the context of.

Statistics
The end-of-module and follow-up degrees of familiarity, confidence and sustained involvement in CC-based teachings and assessments between the regular and intervention groups were analyzed using student \( t \) tests. The effects of academic position and teaching performance (teaching-award winners or non-teaching-award winners) on the degree of sustained involvements in CC-based education in the regular and intervention groups were also analyzed using student \( t \) tests. Additionally, ANOVA was used for the comparison of data among multiple time points. This study was approved by the Ethics Committee of Taipei Veteran General Hospital with ID numbers 2014–02-007 AC and 2015–12-015 BC and performed in compliance with the Declaration of Helsinki [24]. In agreement with these standards, written informed consent was obtained from each participant.

Results
Participant characteristics
Of the 66 enrolled clinical instructors, six of them (three regular and three intervention module participants) were not included in the study because they did not complete all the training. An additional four clinical instructors did not complete all the surveys; yielding a final sample of 56 subjects (\( n = 28 \) in each group) for final analysis.

Table 2 shows there were no difference in average age, gender distribution, academic level distribution, percentage of teaching award winners, percentage of senior academicians (associate and full professor), percentage of distribution of participants from different specialties, and the number of end-of-module, pre-module and follow-up dataset from each participant.

Table 3 serial evaluation of participants’ familiarity with core competency (CC) teachings and assessments (\( n = 28 \) in each group)

| Questions | regular FD module participants | intervention FD module participants |
|-----------|---------------------------------|-----------------------------------|
| I am familiar with delivering CC-based teachings | | |
| - Teaching clinics | 3.5 ± 0.4 (20%) | 4.3 ± 0.1 (23%) | 3.4 ± 0.8 | 4.6 ± 0.9 (35%)* |
| - Itinerant bedside | 3.6 ± 0.2 (19%) | 4.6 ± 0.7 (28%) | 3.7 ± 0.3 | 4.3 ± 0.5 (16%) |
| - Circuit bedside | 3.7 ± 0.4 (24%) | 4.5 ± 0.6 (22%) | 3.8 ± 0.2 | 4.2 ± 0.7 (11%) |
| 2. Delivering CC-based assessments | | | | |
| - Case-based discussion (CBD) | 2.9 ± 0.5 (21%) | 3.7 ± 0.4 (28%) | 2.8 ± 0.3 | 4.2 ± 0.5 (50%)* |
| - mini-CEX | 3.3 ± 0.2 (15%) | 3.8 ± 0.3 (15%) | 3.1 ± 0.4 | 4.4 ± 0.6 (42%)* |
| - OSCE | 2.7 ± 0.6 (22%) | 3.2 ± 0.4 (19%) | 2.9 ± 0.2 | 4.3 ± 0.3 (48%)* |
| 3. Designing CC-based teachings | 1.9 ± 0.4 (47%) | 3.0 ± 0.4 (57%) | 2.1 ± 0.2 | 4.2 ± 0.5 (100%)* |
| 4. Designing CC-based assessment | 2.2 ± 0.8 (14%) | 2.5 ± 0.7 (14%) | 2.3 ± 0.5 | 3.9 ± 0.3 (70%)* |
| 5. Leading CC-based teachings | 1.9 ± 0.6 (16%) | 2.7 ± 0.2 (42%) | 2.1 ± 0.3 | 3.5 ± 0.6 (67%)* |
| 6. Leading CC-based assessments | 2.1 ± 0.3 (10%) | 2.2 ± 0.5 (5%) | 1.9 ± 0.8 | 3.8 ± 0.9 (100%)* |

Statistics
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Data were expressed as mean ± SD; agreement to questions are rated by 5-point Likert scale; 5 = very agree; 3 = neutral; 1 = very not agree; mini-CEX mini-clinical evaluation exercise; OSCE objective structural clinical examination; *, \( p < 0.05 \) vs. corresponding data of regular FD group that analyzed using student \( t \) tests; # \( t \) test’s effect size for compared data between groups that with significance on \( t \) test.
percentage of teachers with prior training in clinical teaching or assessment, or percentage of senior physicians (≥ 15 years as attending physician) between regular and intervention FD module participants.

The intervention FD module increased clinical instructors’ familiarity with the skills of delivering, designing and leading CC-based education
At the pre-module stage, there was no difference in baseline familiarity with the skills of delivering, designing and leading CC-based teachings (teaching clinics and, itinerant, or circuit bedside skills) and assessments (CBD, mini-CEX, or OSCE) between the regular and intervention groups (Table 3). However, at the end of the module, the intervention group exhibited higher degree of familiarity with the above-mentioned skills than the regular group. The follow-up data in Table 3 reveal that the participants’ familiarity was sustained for one year.

The Intervention FD module increased clinical instructor’s confidence in the skills of delivering, designing and leading CC-based education
At the pre-module stage, there was no difference in baseline confidence concerning delivering, designing or leading CC-based teachings and assessment between the regular and intervention FD module participants (Table 4). However, at the end-of-module and follow-up stages, the level of confidence exhibited by the intervention group in the above-mentioned skills was higher than that of the regular group.

In the intervention group, the participant’s baseline confidence was already high with respect to delivery skills. Following the training, at the end-of-module and follow-up stages, the intervention group’s CC-based design and leadership skills were effectively enhanced (Table 4). In other words, the intervention FD module effectively trained new clinical instructors as leaders in CC-based educations.

The Intervention FD module encouraged new clinical instructors to sustain their involvement in delivering, designing and leading CC-based teaching and assessment
In Table 5, at the pre-module and end-of-module stages, there was no difference in the degree of delivering CC-based courses between the regular and intervention groups. Nevertheless, at the follow-up stage, the intervention group exhibited a high degree of sustained involvement in designing and leading CC-based courses than the regular group. These results show that the intervention FD module stimulated the participants’ desire to practice complex skills such as designing and leading CC-based teachings and assessments after the training. Table 6 reveals that the powers (60.7–100%) of the significant parameters at end-of-module and follow-up stages were acceptable with sample size of 28 in both the regular and intervention groups and a significance level of 0.05 (α, type I error).

Senior academicians and non-teaching award winners in the intervention group were more sustainably involved in designing and leading CC education
Generally, program directors have more opportunities to design and lead CC-based teachings or assessments. In fact, most program directors at our institution are senior academicians. In the regular group, there was no difference in the follow-up degree of sustained involvement in delivering, designing and leading CC-based teachings or assessments between senior (n = 11) and junior (n = 17) academicians (Fig. 2a). In other words, the regular training did not further increase the senior academicians’ degree of sustained involvement in designing and leading education.
CC-based teachings or assessments as expected. By contrast, in the intervention group, senior academicians (n = 18) had more sustained involvement in designing and leading CC-based teachings or assessments than junior academicians (n = 10) (Fig. 2b).

Among non-teaching award winners of both groups, the follow-up degree of sustained involvement in designing and leading CC-based teachings or assessments was higher than the degree of involvement in delivering CC-based course (Fig. 3a&b). Among non-teaching-award winners, the follow-up degree of sustained involvement in delivering, designing and leading CC-based teachings or assessments in the intervention group was significantly higher than regular group (Fig. 3a&b). These results indicate that the intervention module effectively motivated non-teaching award winners toward more sustained involvement in delivering, designing and leading of CC-based teachings or assessments.

### Discussion

Today, clinical instructors need to be multifaceted cope with rapid changes in the medical educational system [10–12, 25]. Our one-year longitudinal study reveals that the intervention FD module motivated new clinical instructors to incorporate the trained skills to fit roles of instructors and leaders in CC education [6, 26]. Through the initial peer-supported learning-based exposure of 40-h course across 3 months and continued follow-up, our participants developed enthusiasm for CC education by forming a learning community of individuals whose having similar educational interests [6, 16, 27–29]. Our study suggests that the leadership-enhanced intervention module is feasible and acceptable for long-term faculty development.

**Teaching clinics**, are a more ideal environment than bedside for CC-based teaching. In our study, the effectiveness of intervention FD module was confirmed by a higher self-reported degree of familiarity with the skills

### Table 5

| Questions                                                                 | regular FD module' participants | intervention FD module' participants |
|----------------------------------------------------------------------------|----------------------------------|---------------------------------------|
| I am sustainably ... ... within 1 year                                     | pre-module end-of-module (Δ% from pre-module) | pre-module end-of-module (Δ% from pre-module) |
| 1. involve in delivering CC-based education                               | 3.1 ± 0.2 3.8 ± 0.2 (23%)         | 3.9 ± 0.3 (26%)                       |
| 2. incorporate CC in delivering courses                                   | 3.3 ± 0.1 3.6 ± 0.1 (9%)          | 3.7 ± 0.7 (12%)                       |
| 3. involve in designing CC-based education                                | 2.4 ± 0.3 2.9 ± 0.2 (21%)         | 3.0 ± 0.3 (25%)                       |
| 4. incorporate CC in designing courses                                    | 2.4 ± 0.2 3.1 ± 0.2 (29%)         | 3.2 ± 0.4 (32%)                       |
| 5. involve in leading CC-based education                                  | 2.3 ± 0.1 3.0 ± 0.2 (30%)         | 3.1 ± 0.6 (35%)                       |
| 6. incorporate CC in leading courses                                      | 2.5 ± 0.2 3.2 ± 0.3 (28%)         | 3.3 ± 0.4 (32%)                       |

| Follow-up (Δ% from pre-module)                                            | 2.8 ± 0.1 3.8 ± 0.2 (36%)         | 4.0 ± 0.9 (43%)                       |
| #4.33                                                                     | 3.1 ± 0.2 3.6 ± 0.1 (16%)         | 3.9 ± 0.4 (26%)                       |
| #2.75                                                                     | 3.2 ± 0.2 4.1 ± 0.2 (28%)         | 4.3 ± 0.2 (34%)*                      |
| #2.75                                                                     | 2.9 ± 0.1 4.0 ± 0.3 (38%)         | 4.1 ± 0.3 (41%)                       |
| #2.75                                                                     | 2.7 ± 0.2 4.3 ± 0.2 (59%)         | 4.3 ± 0.4 (59%)*                      |
| #2.75                                                                     | 2.6 ± 0.3 4.2 ± 0.2 (62%)         | 4.4 ± 0.5(69%)*                      |

### Table 6

| Significant parameters | Data of end-of-module stage | Data of follow-up stage |
|------------------------|-----------------------------|-------------------------|
| I am familiar with delivering CC-based teaching - Teaching clinics       | 60.7%                       | 100%                    |
| I am familiar with delivering CC-based assessment - Case-based discussion (CBD) | 100%                       | 99.9%                   |
| I am familiar with delivering CC-based assessment-mini-CEX               | 99.2%                       | 99.9%                   |
| I am familiar with delivering CC-based assessment- OSCE                  | 100%                       | 100%                    |
| I am familiar with designing CC-based teaching and assessments           | 100%                       | 100%                    |
| I am familiar with leading CC-based teaching and assessments             | 100%                       | 100%                    |
| I feel confident in delivering CC-based teachings                        | 100%                       | 100%                    |
| I feel confident in leading CC-based teachings and assessments           | 100%                       | 100%                    |
| I am sustainably involve in designing and leading CC-based education within 1 year | 100%                       | 100%                    |
| I am sustainably incorporate CC in leading courses within 1 year         | 100%                       | 100%                    |
of delivering CC-based teaching clinics in the intervention group than in the regular group (Table 3). However, our intervention FD module did not appropriately increase participants’ familiarity with delivering CC-based itinerant and circuit bedside teaching. In general, it is more challenging to train to delivery CC-based bedside teaching, as it is a more complex clinical environment than a teaching clinics. In bedside teaching, faculties must alternate among the roles of doctor, instructor and leader [30–32]. Accordingly, in future versions of the intervention module, it will be necessary to increase the proportion of training on aspects of delivering skills of CC-based bedside teaching.

In our institution, teaching awards winners are selected online by junior medical trainees according to the annual performance of teachers. Consequently, teaching award winners are considered to be more high teaching performance teachers than non-teaching award winners. Besides encouraging high teaching-performance teachers, teaching awards provide opportunities for teachers and program directors to review their teaching and programs. Teaching awards also motivate low teaching-performance teachers to improve themselves by receiving more training. In general, educational leaders in CC education tend to be high teaching-performance teachers as opposed to low teaching-performance teachers. Baroffio et al. have suggested that the ideal leadership FD program will to help the teaching performance and leadership of low teaching-performance teachers [33]. Engagement and serial evaluations have been reported as successful strategies for improving the teaching performance of low teaching-performance faculty [34, 35]. Thus, our intervention FD module, which emphasized hands-on experiences, guided reflection and serial evaluations, successfully motivated non-teaching award winners (low teaching performance teacher) to evolve substantially as leaders in CC education.

The Kirkpatrick Model is a well-known model for evaluating the effects of FD programs. Level 1 (reaction) of the Kirkpatrick Model measures participants’ satisfaction; level 2 (earning) analyzes whether the FD increases participants’ knowledge or skills (participants’ familiarity with and confidence in CC education); level 3 (behavior) looks at whether participants utilize what they learn at work (participants’ sustained involvement in CC education), and level 4 (results) determines whether the FD had a positive impact on the organization.
Strengths and limitations
The limitations of this study include the following. First, it did not assess outcomes at level 4 of the Kirkpatrick Model such as whether the intervention FD module improved clinical education or decreased medical errors [14, 15, 36–39]. Therefore, it will be necessary to assess such parameters in the future. On the other hand, self-reporting data is valuable for obtaining subjects’ perspectives and views, but it has potentially selection and recall bias [40]. To avoid such bias, in our study, the self-reported questionnaires were completed by voluntary participants immediately before and after the training and that can be avoided from. Usually, voluntary participants have stronger motivation than other participants which can result in a selection bias. Nevertheless, the similar questionnaires, follow-up duration and criteria selection for enrollment of participants between regular and intervention groups in our study can partially overcome the possible bias of self-reported data. A second limitation was the fact that the intervention FD group completed leadership training and some of the questions on the surveys were leadership-related. To have comparable results, both the regular and intervention FD groups used similar questionnaires for self-assessment in our study. Still, the multiple self-assessment time points in the current study indicated sustained effects of the intervention FD module on leadership training of clinical instructors in delivering, designing and leading CC-based teaching and assessment.

Conclusions
Faced with continuous changes in medical education and practice, the new generation of medical educators is required to be not only clinical instructors but also educational leaders. Despite some limitations, the present study confirmed the effectiveness of leadership-enhanced intervention FD modules to motivate new clinical instructors to become substantially involved as leaders in ACGME CC-based education.

Abbreviations
CC: Core competence; ACGME: Accreditation Council for Graduate Medical Education; CBD: Case-based discussion; mini-CEX: Mini-clinical evaluation exercise; OSCE: Objective structured clinical examination

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Authors' contributions
YY, LYY, FYL, SYK, and LJJ have made substantial contributions to conception and design, or acquisition of data, or analysis and interpretation of data. CCH, IFL, CJC, HCH and YYY have been involved in drafting the manuscript or revising it critically for important intellectual content. BS, WSL, CCH, IFL, CJC and HCH and YYY have given written consent for the version to be published.

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Availability of data and materials
The datasets used and/or analysed during the current study available from the corresponding author on reasonable request.

Ethics approval and consent to participate
This study was approved by the Ethics Committee of Taipei Veteran General Hospital with ID number of 2014-02-007 AC and 2015-12-015 BC and performed in compliance with the Declaration of Helsinki (24). It complied with informed voluntariness, and all participants have given their written consent for participation.

Consent for publication
Not applicable, as the manuscript does not contain any individual person's data.

Competing interests
The authors declare that they have no competing interests.

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