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The Taiwan Version of the Milestones 2.0 Project for Physical Medicine and Rehabilitation Residents

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The Taiwan Version of the Milestones 2.0 Project for Physical Medicine and Rehabilitation Residents

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Abstract

Background: Milestones provide a framework for evaluating the trajectory of residency performance, which is one of the important works promoted by the Joint Commission of Taiwan for improving the quality of residency training. The current report aims to (1) introduce the translation and modification of the Taiwan version of the Milestones 2.0 Project for Physical Medicine and Rehabilitation Residents (Taiwan PMR Milestones 2.0 Project), (2) document the preliminary data in the first year and (3) highlight the ongoing and future plan.

Methods: In January 2022, the Taiwan Academy of Physical Medicine and Rehabilitation organised a Milestones working group consisting of up to 20 members comprising clinical instructors, former or present residency training programme directors or directors of the rehabilitation department of various residency training hospitals. The translation and modification of the Taiwan PMR Milestones 2.0 Project was divided into two stages each having a duration of 6 months. Moreover, 6 competencies and 24 sub-competencies were completed at the end of the second stage. Two pilot tests were then conducted to evaluate the residency competencies at 12 teaching hospitals.

Results: It was found that the Taiwan PMR Milestones 2.0 Project had high internal consistency and time-dependent progression of residency performance. The feedback from the assessors reflected five domains of suggestions, including the context of assessment, evaluation method, time cost, standard of competencies, teaching and learning plan.

Conclusion: Our suggestions in this study could serve as a reference to further modify and improve the implementation of the Taiwan PMR Milestones 2.0 Project.

Keywords: Competence, Milestones 2.0, Physiatrist, Physical medicine and rehabilitation

1. Introduction

1.1. Introduction of physical medicine and rehabilitation (PMR) milestones in the US

Milestones are one of the assessment tools used for evaluating residency performance in accordance with competence-based medical education.¹ In the US, the Milestones Project had been initially developed by the Accreditation Council for Graduate Medical Education (ACGME) and the American Board of Medical Specialties in 1999.² The second revision of the PMR Milestones Project (otherwise known as ‘Milestones 2.0’) was published in 2020–2021^{5,6} after gathering sufficient feedback from the first version (called ‘Milestones 1.0’) of the PMR Milestones Project in the US published in 2013–2014.^{3,4}

To implement and use Milestones effectively, the ACGME suggested several practical guidelines: (1) introduce residents to and educate them on Milestones self-assessment upon residency programme entry; (2) suggest learning plans for residents based on the Milestones framework; (3) encourage residents to compare their self-assessment with rating scales prepared by their trusted adviser; (4) conduct

Milestones assessment every 6 months to determine the competency progress of the resident.⁷

1.2. Framework and assessment process of the PMR milestones

The framework of PMR Milestones includes 6 core competencies, 19 sub-competencies in Milestones 1.0 and 24 sub-competencies in Milestones 2.0.^{3–6} These six core competencies include Patient Care (PC), Medical Knowledge (MK), Systems-Based Practice (SBP), Practice-Based Learning and Improvement (PBLI), Professionalism (PROF) and Interpersonal and Communication Skills (ICS).^{4,5}

A comparison of the number of sub-competencies in each core competence between these two revisions is presented in [Supplementary Tables 1](#).^{3,5} In each sub-competence, the rating scale can be divided into ‘Level 1’, ‘Level 2’, ‘Level 3’, ‘Level 4’ and ‘Level 5’.^{3–6} Level 4 indicates that the residents’ performance has reached graduated levels, whereas level 5 indicates that their performance has reached aspirational levels.⁷ In each level, 1–3 items (called ‘Milestones’) should be assessed.^{4–6} A demonstration of the Milestones worksheet is presented in [Supplementary Table 2](#).

The original PMR Milestones 2.0 can be downloaded from the official website of the ACGME (<https://www.acgme.org/globalassets/pdfs/milestones/pmrmilestones.pdf>). When the residents' performance satisfies all the items at and below a certain level (e.g. Level 3), their rating scale would indicate this level (Level 3).^{3,5} When the residents' performance satisfies all the items at the lower level (e.g. Level 2) but only some items at the higher level (e.g. Level 3), their rating scale would indicate a midpoint between these two levels (e.g. between Level 2 and Level 3).^{3,5} When the residents' performance does not achieve 'Level 1', their rating would indicate 'Has Not Yet Achieved Level 1' in Milestones 1.0 version³ but 'Not Yet Completed Level 1' or 'Not Yet Assessable' in Milestones 2.0 version.⁵

In the supplemental guide for PMR Milestones 2.0, some examples of each level in each sub-competence and assessment tools are provided.⁶ This information assists the assessor to evaluate the residency performance in a concise and objective manner.⁶

1.3. Development of the milestones project in Taiwan

The Taiwanese Ministry of Health and Welfare established the Residency Review Committee (RRC) in 2012 to organise the residency training programme for 23 medical specialties. This committee aimed to improve residency training quality following current trends set by the ACGME.⁸ In Taiwan, emergency medicine was the specialty for which Milestones were first developed.⁹ Based on Milestones 1.0 by the ACGME, the Taiwan Society of Emergency Medicine (TSEM) developed the first version of the TSEM Milestones Project in November 2016.⁹ Later, the Taiwan Society of Anesthesiologists, Taiwan Neurological Society and Taiwan Society of Internal Medicine also developed Milestones for their specialties.⁹ The Taiwan Academy of Physical Medicine and Rehabilitation (TAPMR) is currently developing the Taiwan version of the Milestones 2.0 Project for Physical Medicine and Rehabilitation Residents (Taiwan PMR Milestones 2.0 Project). However, the numerous assessments needed throughout the residency programme and the failure to

create a user-friendly digital platform for collecting these data has remains a challenge. Hence, the Joint Commission of Taiwan held a meeting to collect the digital requirements and suggestions for the training of 23 medical specialties in August 2022.

1.4. Aims

The current report aimed to (1) introduce the translation and modification of the Taiwan PMR Milestones 2.0 Project in Taiwan; (2) document the preliminary data from the first year of the Taiwan PMR Milestones 2.0 Project; and (3) highlight the ongoing and future planning of this project.

2. Methods

To develop the Taiwan PMR Milestones 2.0 Project, the TAPMR organised a TAPMR Milestones working group (TAPMR-MWG) via a webinar held on January 22, 2022. In this first meeting, Professors Jin-Shin Lai and Tsan-Hon Liou introduced the importance and the aims of the Taiwan PMR Milestones 2.0 Project in Taiwan to former or present residency training programme directors/directors of rehabilitation departments from different residency training hospitals. The important consensus included (1) translating and modifying the Taiwan PMR Milestones 2.0 Project based on ACGME Milestones 2.0; (2) organising the TAPMR-MWG consisting of former or present residency training programme directors/department directors of PMR, experts of medical education and clinical instructors of physiatrists. The members of TAPMR-MWG were up to 20 physiatrists till February 2023 and were listed in [Table 1](#).

The translation and modification of the Taiwan PMR Milestones 2.0 Project was divided into two stages, with each lasting approximately 6 months. The PC (8 sub-competencies) and MK (2 sub-competencies) competencies were completed in the first stage, whereas the SBP (4 sub-competencies), PBLI (2 sub-competencies), PROF (5 sub-competencies) and ICS (3 sub-competencies) competencies were completed in the second stage. Pilot tests for the first and second stages were conducted in June 2022 and December 2022, respectively. This study was approved by the Institutional Review

Table 1. The members of Taiwan Academy of Physical Medicine and Rehabilitation Milestones Working group (TAPMR-MWG) listed alphabetically according to their roles and names.

	Role in TAPMR-MWG	Role in the residency training hospital ^a	Name
(1)	Chairman	1,4	Jin-Shin Lai
(2)	Executive secretary and member	3,4	Kai-Hua Chen
(3)	Member	2,4	Chung Chao Liang
(4)	Member	2,4	Chung-Lan Kao
(5)	Member	4	Co Yih Siow
(6)	Member	4,6	Huan-Jui Yeh
(7)	Member	3,4	Hung Yu Cheng
(8)	Member	2,4	Hung-Chou Chen
(9)	Member	4,6	Jan-Wei Chiu
(10)	Member	4,5	Jiunn-Horng Kang
(11)	Member	2,4	Ming-Miau Tsai
(12)	Member	3,4,5	Nai-Hsin Meng
(13)	Member	4,6	Shin-Liang Pan
(14)	Member	3,4	Simon Tang
(15)	Member	4,5	Tsan-Hon Liou
(16)	Member	3,4	Wai-Keung Lee
(17)	Member	4,6	Wen-Hsuan Hou
(18)	Member	2,4	Yen-Nung Lin
(19)	Member	2,3,4	Yu-Chi Huang
(20)	Member	4	Yu-Tai Chang

Note: ^a The role of the residency training hospital:

1. Programme chief consultant.
2. Department chief director.
3. Programme director.
4. Clinical instructors.
5. Former department chief director.
6. Former programme director.

Board (IRB) of Chang Gung Memorial Hospital (IRB No. 202300263B1).

3. Results

3.1. Preliminary data for the first year

The following sections documented some experiences and preliminary data of the Taiwan PMR Milestones 2.0 Project.

3.1.1. First stage of the Taiwan PMR milestones 2.0 project

The basic report worksheet and PC and MK competencies were completed by May 2022 through one in-person meeting and three webinars. The first version of the Taiwan PMR Milestones 2.0 Project was completed on May 23, 2022 (version 20220523), which, at this stage, consisted of eight sub-competencies for PC and two sub-competencies for MK. The framework of the basic report worksheet is presented in [Table 2](#). The sub-competencies for PC and MK and their initial drafters are listed in [Supplementary Table 3](#). Regarding the

assessment tools, items mentioned in both competencies of the ACGME Milestones 2.0 and those frequently used in Taiwan were included in the Taiwan PMR Milestones 2.0 Project (version 20220523). A response item named 'other' was created to allow the participants to fill in any other assessment tools not listed. In June 2022, the first pilot test conducted at 12 volunteer residency training hospitals. A total of 55 residents of first to fourth year had accomplished the self-assessment of the Taiwan PMR Milestones 2.0. From the below mentioned assessment methods, any one was implemented to obtain 85 assessments of the Taiwan PMR Milestones 2.0 from the residents' clinical instructors or programme directors: (1) both the clinical instructors of the resident and programme directors performed the assessment separately; (2) only one of the clinical instructors of the resident performed the assessment, and (3) each resident had one assessment obtained after the clinical instructor had consensus with the resident accordingly. Additionally, two of the participating hospitals discussed and

modified the final assessment results after the decision of the Clinical Competency Committee (CCC). Meanwhile, qualitative feedback was also collected from this pilot test, which promoted modifications in the development process of the next stage.

The initial analysis of the first pilot test is summarised below.

(1) Levels of residency sub-competencies from different training years

The radar chart showed the progression of sub-competency's levels in different training year residents (Fig. 1). The difference among different training year residents was analysed by mixed model analyses. We found that the levels of all PC and MK sub-competencies in first year residents were

significantly lower than those for training year residents.

(2) Correlation between sub-competency levels and board certification examination scores among fourth-year residents

The Spearman rank correlation test was used to analyse the association between sub-competency levels and board certificate examination scores among fourth-year residents. A total of 14 fourth-year residents completed the board certification examination in June 2022, which consists of a written examination, a nine-station oral examination (central nervous system, paediatric rehabilitation, amputation, spinal cord injury, musculoskeletal system, cardiopulmonary

Table 2. The framework of the basic Milestones worksheet in the Taiwan version of Milestones 2.0 Project for Physical Medicine and Rehabilitation Residents (Taiwan PMR Milestones 2.0 Project).

Milestones 2.0 Project for Physical Medicine and Rehabilitation Residents (Taiwan PMR Milestones 2.0 Project).						
Name	Competency: sub-competency					
Level	Has Not	Level 1	Level 2	Level 3	Level 4	Level 5
	Achieved					
	Level 1					
Milestone		Milestone 1	Milestone 3	Milestone 5	Milestone 7	Milestone 9
		Milestone 2	Milestone 4	Milestone 6	Milestone 8	Milestone 10
Supplementary						
summary						
Specifications,						
operational						
definitions, or						
examples						
Result of	<input type="checkbox"/> Not Yet	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
assessment	Completed					
	Level 1					
	<input type="checkbox"/> Not Yet					
	Assessable					
Assessment	<input type="checkbox"/> Assessment tool 1					
tool	<input type="checkbox"/> Assessment tool 2					

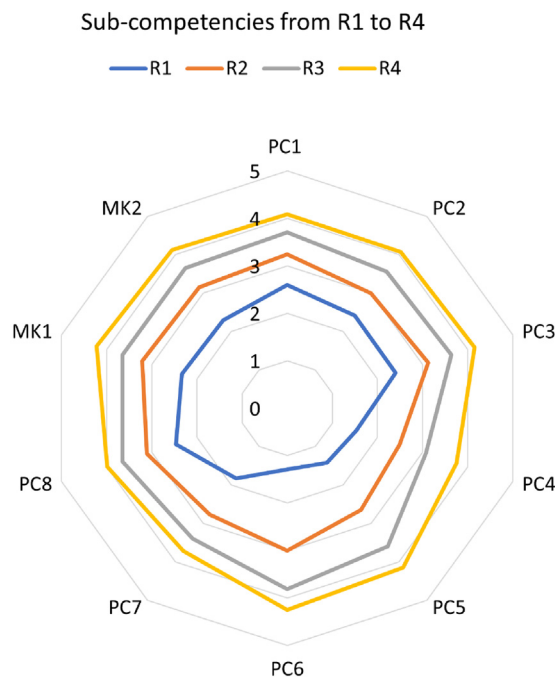


Fig. 1. Eight sub-competencies for Patient Care and two sub-competencies for Medical Knowledge in different training year residents during the first stage of the Taiwan version of Milestones 2.0 Project for Physical Medicine and Rehabilitation Residents (Taiwan PMR Milestones 2.0 Project). Note: The value of each sub-competency was the average level of different training year residents. Abbreviation: MK, medial knowledge; PC, patient care; R1, first year residents; R2, second-year residents; R3, third-year residents; R4, fourth-year residents.

system, electrodiagnostic study, musculo-skeletal ultrasound and physical modality). Therefore, one written score, one total oral score and nine subtotal oral scores were used for analysis.

Overall, 14 self-assessed Milestones reports were evaluated by the fourth-year residents, whereas 21 matched Milestones reports were evaluated by their corresponding clinical instructors or programme directors. In addition to the individual score of the sub-competencies, three different scores had been reported, including one total score of PC (the sum of 8 sub-competency scores for PC), one total score of MK (the sum of 2 sub-competency scores for MK), and one total score of the combined PC and MK competencies (the sum of 10 sub-competency scores for MK and PC). Therefore, 13 Milestones scores were collected for analysis. Finally, no significant correlation was found between Milestones scores and board certificate scores based on the Spearman rank correlation coefficients.

- (3) Regression analysis of sub-competency levels and board certification examination scores at fourth-year resident

To evaluate the criterion-related validity of the sub-competencies for PC and MK, we used the written and oral board examination scores as criteria for assessing the association between board examination scores and the 10 Milestones sub-competency scores (8 and 2 sub-competencies for PC and MK, respectively). Accordingly, our results disclosed no significant correlation between board examination scores and Milestones scores.

(4) Internal consistency analysis

The internal consistency among the 10 Milestones sub-competency scores was evaluated by calculating the Cronbach's alpha coefficient. Accordingly, our findings showed high internal consistency among all scores (Cronbach's alpha = 0.976).

3.1.2. Second stage of the Taiwan PMR milestones 2.0 project

Three webinars were held to achieve a consensus on the identified issues. First, revision of Taiwan PMR Milestones 2.0 Project was done according to the feedback gathered from the first pilot test and

suggestions from members of the TAPMR-MWG. Second, operational definitions of 'Not Yet Assessable' and 'Not Yet Completed Level 1' were discussed and defined. Third, the other four competencies (SBP, PBLI, PROF and ICS) were translated and finalised (version 20221113), with the initial drafters listed in [Supplementary Table 3](#). Forth, most of the assessment tools mentioned in the other four competencies of Milestones 2.0 used by the ACGME were included in the Taiwan PMR Milestones 2.0 Project (version 20221113). Similar to the previous version, a blank response item was also created to allow participants to fill in any other assessments not listed. After completing the second version of the Taiwan PMR Milestones 2.0 Project, the second pilot test was conducted in the previous 12 residency training hospitals from November 11 to December 16, 2022. Among the 129 Milestones reports collected during this period, 59 were self-assessments by first-to fourth-year residents, whereas 70

were matched reports from their clinical instructors or programme directors. Meanwhile, feedback was also collected based on which the TAPMR-MWG further revised the Taiwan PMR Milestones 2.0 Project and adjusted the implementation methods. Unlike the first pilot test, fourth-year residents had not yet taken their board certification examination, which will be held in June 2023. Thus, correlation analysis between competency levels and board certification scores among fourth-year resident could not be performed.

The initial analysis in the second pilot test is summarised as below.

(1) Residency sub-competency levels according to training year

For the second stage, the radar chart showed the residents' competencies progressed in the different training years ([Fig. 2](#)). The difference among various

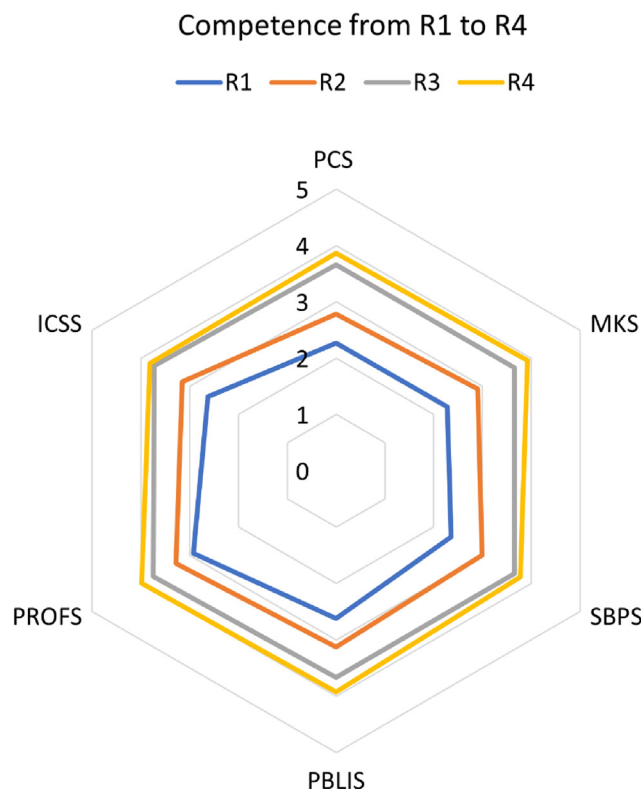


Fig. 2. Six competencies in different training year residents during the second stage of the Taiwan version of Milestones 2.0 Project for Physical Medicine and Rehabilitation Residents (Taiwan PMR Milestones 2.0 Project). Note: The value of each competence was the mean total score of each competency in certain training year residents. To convert the mean total score of each competency into a 5-point scale, the following formula was used: $5 * (\text{mean of total score of sub-competencies in certain training year resident}) / (\text{total score of sub-competencies in each competence})$. Abbreviation: ICS, Interpersonal and Communication; MK, Medical Knowledge; PC, Patient Care; PBLI, Practice-Based Learning and Improvement; PROF, Professionalism; R1, first year residents; R2, second-year residents; R3, third-year residents; R4, fourth-year residents; SBP, Systems-Based Practice.

training year residents was analysed using mixed model analysis. The total scores of each competency were used for analysis (i.e. PCS is the sum of PC1 to PC8; MKS is the sum of MK1 and MK2). If one or more the sub-competencies in a certain competency was rated as 'Not Yet Assessable', this competency was excluded from analysis. Accordingly, our analysis for the second stage showed that the levels of all six competencies in the first-year residents were significantly lower than those for training year residents.

(2) Internal consistency analysis

The internal consistency of the Taiwan PMR Milestones 2.0 Project scores was assessed by calculating the Cronbach's alpha coefficient. Notably, our findings showed high internal consistency among all Taiwan PMR Milestones 2.0 Project scores (Cronbach's alpha = 0.987).

(3) Assessment tool analysis

Our analysis of assessment tools used in Taiwan found that self-assessment for residents (30.98%), data regarding practice habits (22.90%), direct observation (13.87%) and charts (7.57%) were the most used assessment tools. The four least used tools were Objective Structured Clinical Examination (OSCE) (0.30%), simulation (0.31%), multisource

feedback (0.72%) and Quality improvement (QI) process (1.24%). The analysis of assessment tools is summarised in Fig. 3.

(4) Feedback from residents and clinical instructors

After the second pilot test, our residents and clinical instructors provided several qualitative suggestions. These suggestions were condensed into five domains: (1) context of assessment; (2) evaluation method; (3) time cost; (4) standard of competencies; and (5). teaching and learning plan. The consensus and action plan of the TAPMR-MWG are summarised in Table 3.

In the domain of context of assessment, several assessors stated that the tables contained too much data and were too long. However, given that the TAPMR-MWG considered detailed information for evaluation, most of the context were retained except for some examples of PROF1. Given that some situations did not occur in the clinical environment, the assessors had difficulty in rating the level. For further case-based discussions, an OSCE or simulation may be needed for comprehensive evaluation.

One concern raised was that the assessment tools were excessive and not clearly defined. After consensus discussions, some examples were added to the 'Written

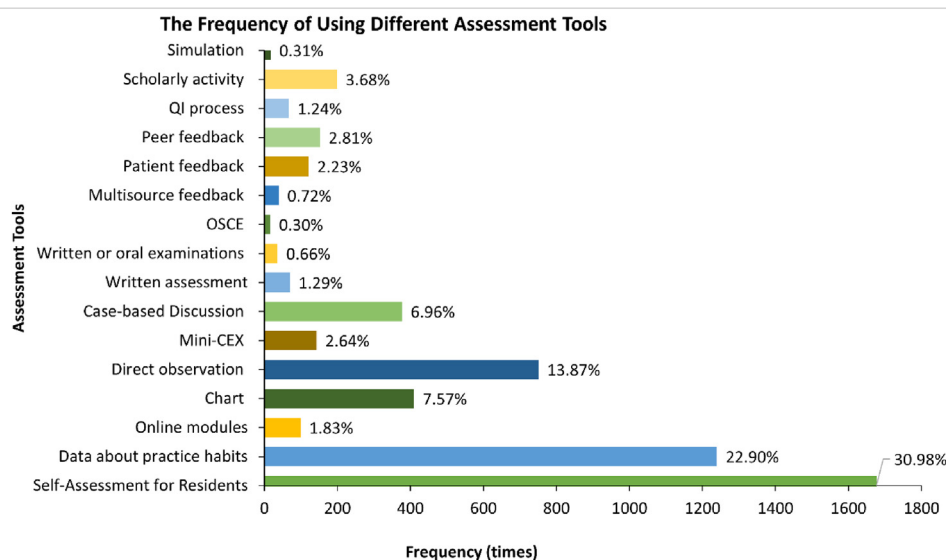


Fig. 3. Frequency at which different assessment tools were used during the second pilot test. The percentage values indicate the proportion of one assessment tool among all assessment tools. Abbreviation: Mini-CEX, Mini-clinical evaluation exercise; OSCE, Objective Structured Clinical Examination; QI, Quality improvement.

Table 3. Feedback from the residents and clinical instructors.

Domains	Contexts of feedback	Decisions of consensus meeting
Context of assessment	<ol style="list-style-type: none"> 1. 'There are too much context of the tables'. 2. 'Some examples of medical practice in PROF1 can be deleted'. 3. 'In the Milestones of level 3 in ICS1, I should evaluate the competence of managing challenging patients' encounters. However, this situation may not exist clinically. I can only rate at level 2. Therefore, may I only select other milestones for evaluation only, but not based on all three milestones?' 	<ol style="list-style-type: none"> 1. In order to explain the details of assessment, keep current context. 2. Delete some examples which rarely occurred in rehabilitation department in Taiwan. 3. Keep current methods of assessment. Discuss with the residents about these special situations in the meeting in the department and rate their levels based on their thinking process. 4. Use OSCE or stimulation to evaluate the residency competence depending on your department's consideration. 5. Keep follow-up this issue later.
Evaluation Method	<ol style="list-style-type: none"> 1. 'In the assessment tool '8-Written assessment', we can consider including the records of mentor, learning reflection, or portfolio'. 2. 'In the assessment tools, I don't know whether I can choose one or much more multiple tools'. 3. 'I don't realise the meaning of some of the assessment tools clearly'. 4. 'If there is an online system for evaluation and even automatic figuration, it will be more efficient when conducting consensus meetings'. 5. 'Hope the written form and online form can be integrated'. 	<ol style="list-style-type: none"> 1. Add some examples of documents in the assessment tool '8-Written assessment', such as the records of mentor, learning reflection, portfolio, awards and punishment, and meeting etc. 2. Add the words 'multiple choice' in the column of assessment tool in word file and google online form. 3. At present, keep use the google form before a new online system can be provided. 4. Keep both written and online form to meet different training hospital's needs. In the online google form, make hyperlinks to link to the written form and video of introduction. <p>The plan is the same as point 4 of in the evaluation method.</p>
Time cost	<ol style="list-style-type: none"> 1. 'The tables are too long. Although this project is well-intentioned but failed to consider the time cost of completion'. 2. 'The evaluation requires a word and a google form. I don't know why the same thing must be repeated twice. The process is not optimised for the time cost of committee members, administration staffs and evaluators'. 	
Standard of competencies	'The standard is extremely high, and it is difficult to show reality'.	None.
Teaching and learning plan	<ol style="list-style-type: none"> 1. 'Thank you for the careful planning of the society. The process of evaluating residents also provides attending physicians with a clear and complete direction for future teaching, and we will work together to create a teaching of holistic care'. 2. 'From the milestone reports, I can understand the core competencies that residents need to learn. This assessment also includes indicators of different levels. I can first understand which level I achieve currently, follow these traces and proceed step by step. I can also adjust the learning method and content, and move on to the next level'. 	None.

assessment'. Given that this project was just in its developmental period, it was too early to decide which assessment tools were needed or unnecessary. Thus, the TAPMR-MWG decided to retain all assessment tools.

The time consumption could be explained by the following reasons: (1) too many items needed to be evaluated and (2) assessors needed to complete both written and online forms. Meanwhile, several assessors suggested an integrated online evaluation system that provided an automatic outline to resolve this issue in the future. Before establishing a new online evaluation system, the TAPMR-MWG decided to integrate the assessment contents and introduction video into the online google form.

Some assessors stated that the framework of the Milestones report can be extended to other teaching fields, such as holistic care or learning plan for professions development.

4. Discussion

To the best of our knowledge, this has been the first study to clarify the national experience with regard to Milestones evaluation of PMR residency training in Taiwan. From the initial development of the Taiwan PMR Milestones 2.0 Project and the preliminary data of the two pilot tests, the current study found that the Milestones Project had high internal consistency. Notably, residents showed progressive improvements in Milestones levels during the second pilot test. Several issues and ongoing future planning for improvement are presented in the following discussions.

4.1. High internal consistency of Taiwan PMR milestones 2.0 project

The two pilot tests showed particularly high internal consistency. A high Cronbach's alpha value indicates that each resident's response values across the Taiwan PMR Milestones 2.0 Project were consistent. This suggests that when residents responded high on one of the items, they were likely to respond high on the other items as well, indicating that the Taiwan PMR Milestones 2.0 Project measurements are reliable and that the items likely measure the same characteristics. However, the influence of halo effects by raters should be also

considered given that the Taiwan PMR Milestones 2.0 Project measures the overall impression of competency level instead of direct observation of skills. In the future, inter-rater reliability of the Taiwan PMR Milestones 2.0 Project will be assessed among different observers, including the residents themselves, clinical instructors and programme directors.

4.2. Progression of milestones levels from junior to senior residents

We found progressive improvement in Milestones levels from junior to senior residents in the radar chart of two pilot tests and first year residents were significantly lower than other training year residents. It seemed that Milestones levels were time-dependent. This finding was inconsistent with those presented by Bockenek et al. in the US,³ who explained that these results were related to the various curricula of the residency training programme at different training hospitals.³ Bockenek et al. mentioned that some curricula arranged certain procedures (i.e. electrodiagnostic procedure) based on residency training years, whereas others clustered this procedure in one block.³ This promoted differences in Milestones levels among same training year residents from different hospitals.³ Although different hospitals across Taiwan also have varied curricula, the curriculum design and training programme do not differ quite widely given the need for TAPMR RRC accreditation. In addition, the TAPMR-MWG has established a clear consensus regarding the definition for 'Not applicable' and 'Has Not Achieved Level 1'. Accordingly, when resident who did not start the training course related to a certain sub-competence were characterised as 'Not applicable,' and their scores were not included in statistical analysis. In contrast, when resident started the training course related to certain sub-competence but could not achieve Level I performance, they were characterised as 'Has Not Achieved Level 1' and provided a score of zero, which was included for statistical analysis. Hence, despite the subtle variations in curricula among the different hospitals throughout Taiwan, Milestones level analysis excluded data before the related training course was

started. Thus, the results did not reflect this variation in curricula.

4.3. Correlation between milestones level and board examination score

A number of US researchers have attempted to determine the correlation between Milestones levels and board examination scores to identify residents at risk for not passing the board examination.¹⁰ They found that the MK Milestones level was significantly and positively associated with scores for Part I (i.e. written) of the American Board of Physical Medicine and Rehabilitation Examinations.¹⁰ They also found that a one-level difference in the MK Milestones rating can positively predict a 38- to 60-point difference for Part I scores.¹⁰

The qualification process for licensed physiatrists in Taiwan includes passing the board examination, which takes place during the fourth residency training year in each summer. In our first pilot test, no correlation was observed between Milestones levels and the written or oral examination. However, the competencies were limited to PC and MK only as the other four competencies had not yet been developed at that time. On the second pilot test, the board examination had not yet been conducted. In Taiwan, junior residents (first- to third-year) can also participate in a mock written examination conducted on the same day the fourth-year residents take the board examination. The scores of all residents were analysed by the TAPMR and were sent to the programme directors and their residents. However, the mock tests for 2020–2022 were cancelled due to the coronavirus disease-2019 pandemic. Thus, there was insufficient data to analyse the correlation between Milestones level and board examination scores in current pilot tests. Nonetheless, such analysis can be considered after the mock test is re-established for junior residents in 2023 or later.

4.4. Need for further implementation

The feedback from the second pilot test indicated that the assessment of the Milestones report was time-consuming. Thus, an integrated online assessment system with a

digital platform to integrate the results of different assessments is needed. To our knowledge, several specialty departments in Taiwan have used a digital platform in recent years. As mentioned before, the Joint Commission of Taiwan has determined the need for a digital platform based on the suggestions from 23 medical specialties in August 2022. In that meeting, we suggested that well-developed assessments (e.g., the RRC assessment form of the teaching hospital) can be the first to be integrated into digital form. Additionally, the modification of the Taiwan PMR Milestones 2.0 to better fulfil the local needs in Taiwan's PMR settings would improve assessment effectiveness and utility. Future planning regarding the online assessment system with the cultural adoption and mapping, as well as the residency training curriculum modification from the feedback of residents, evaluators, and other stakeholders will be the necessary next step. Finally, further study is required to evaluate whether this project could improve resident performance and patient outcomes after the refinement of our Taiwan PMR Milestones 2.0.

5. Conclusion

We were able to establish the initial version of the Taiwan PMR Milestones 2.0 Project in its first year. Accordingly, we found that the current Milestones Project had high internal consistency and that the progression of residency performance was time-dependent.

Conflict of interest

The authors declare that there are no conflicts of interest.

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Appendix.

Supplementary Table 1. Competencies and sub-competencies in the different versions of the US Physical Medicine and Rehabilitation Milestones Project.^a

Competency	Number of sub-competencies ¹	
	Milestones 1.0	Milestones 2.0
Patient Care (PC)	7	8
Medical Knowledge (MK)	1	2
Systems-Based Practice (SBP)	3	4
Practice-Based Learning and Improvement (PBLI)	3	2
Professionalism (PROF)	3	5
Interpersonal and Communication Skills (ICS)	2	3
Total	19	24

^aReferences:

1. Bockenek WL, Massagli TL, Swing SR, Fischer C. The development of the physical medicine and rehabilitation milestones. *J Grad Med Educ* 2014; 6:204–206.
2. Accreditation Council for Graduate Medical Education. Physical medicine and rehabilitation milestone. Available from: https://www.acgme.org/globalassets/pdfs/milestones/pmr_milestones.pdf. Accessed January 27, 2023.

Supplementary Table 2. Demonstration of the main framework of the Milestones worksheet.

Name	Competency: sub-competency					
Level	Has Not	Level 1	Level 2	Level 3	Level 4	Level 5
	Achieved					
	Level 1					
Milestone	Milestone 1	Milestone 3	Milestone 5	Milestone 7	Milestone 9	
	Milestone 2	Milestone 4	Milestone 6	Milestone 8	Milestone 10	
Rating	<input type="checkbox"/> Not Yet	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Completed					
	Level 1					
	<input type="checkbox"/> Not Yet					
	Assessable					

Supplementary Table 3. Competencies and sub-competencies of Taiwan version of the Milestones 2.0 Project for Physical Medicine and Rehabilitation Residents (Taiwan PMR Milestones 2.0 Project) and the initial drafter.

Competence	Code of sub-competences	Name of sub-competences	Initial drafter
Patient Care (PC)	PC1	Physiatric history, appropriate for age and impairment	Ming-Miau Tsai
	PC2	Physical examination	Nai-Hsin Meng
	PC3	Medical management	Yen-Nung Lin
	PC4	Procedural skills: injections for abnormalities of tone or movement	Yu-Chi Huang
	PC5	Procedural skills: joint and soft tissue injections	Hung-Chou Chen
	PC6	Procedural skills: electro-diagnostic procedures	Jan-Wei Chiu
	PC7	Assistive technologies	Huan-Jui Yeh
	PC8	Rehabilitation interventions	Kai-Hua Chen

(continued on next page)

Supplementary Table 3. (continued)

Competence	Code of sub-competences	Name of sub-competences	Initial drafter
Medial Knowledge (MK)	MK1	Foundational principles of physiatric practice	Shin-Liang Pan
	MK2	Clinical reasoning	Wen-Hsuan Hou
Systems-Based Practice SBP (SBP)	SBP1	Systems-based practice 1: patient safety	Nai-Hsin Meng
	SBP2	Systems-based practice 2: quality improvement	Nai-Hsin Meng
	SBP3	Systems-based practice 3: system navigation for patient-centered care	Huan-Jui Yeh
	SBP4	Systems-based practice 4: physician role in health care systems	Kai-Hua Chen
Practice-Based Learning and Improvement (PBLI)	PBLI1	Practice-based learning and improvement 1: evidence-based and informed practice	Shin-Liang Pan
	PBLI2	Practice-based learning and improvement 2: reflective practice and commitment to professional growth	Yu-Chi Huang
Professionalism (PROF)	PROF1	Professionalism 1: ethical practice	Shin-Liang Pan
	PROF2	Professionalism 2: professional behaviors	Yen-Nung Lin
	PROF3	Professionalism 3: accountability	Hung-Chou Chen
	PROF4	Professionalism 4: patient care etiquette with patients of all abilities	Jan-Wei Chiu
	PROF5	Professionalism 5: resident well-being and help-seeking	Jan-Wei Chiu
Interpersonal and Communication Skills (ICS)	ICS1	Interpersonal and communication skills 1: patient- and family-centered communication	Hung Yu Cheng
	ICS2	Interpersonal and communication skills 2: interprofessional and team communication	Wen-Hsuan Hou
	ICS3	Interpersonal and communication skills 3: communication within health care systems	Ming-Miau Tsai

Supplementary Table 4. The 12 volunteer residency teaching hospitals involved in the first year of Taiwan version of the Milestones 2.0 Project for Physical Medicine and Rehabilitation Residents (Taiwan PMR Milestones 2.0 Project).

Name of the teaching hospitals
Chang Gung Memorial Hospital, Chiayi
China Medical University Hospital
Hualien Tzu Chi Hospital, Buddhist Tzu Chi Medical Foundation
Kaohsiung Chang Gung Memorial Hospital
Lotung Poh Ai Hospital
National Taiwan University Hospital
Shuang Ho Hospital, Taipei Medical University
Taichung Hospital, Ministry of Health and Welfare
Taipei Medical University Hospital
Taipei Veterans General Hospital
Tao-Yuan General Hospital
Wan Fang Hospital, Taipei Medical University

References

- Andolsek KM, Jones Jr MD, Ibrahim H, Edgar L. Introduction to the Milestones 2.0: assessment, implementation, and clinical competency committees supplement. *J Grad Med Educ* 2021;13:1–4.
- Edgar L, Roberts S, Holmboe E. Milestones 2.0: a step forward. *J Grad Med Educ* 2018;10:367–9.
- Bockenek WL, Massagli TL, Swing SR, Fischer C. The development of the physical medicine and rehabilitation milestones. *J Grad Med Educ* 2014;6:204–6.
- The physical medicine and rehabilitation milestone project. *J Grad Med Educ* 2014;6:207–21.
- Accreditation Council for Graduate Medical Education. Physical medicine and rehabilitation milestone. Available from: https://www.acgme.org/globalassets/pdfs/milestones/pmr_milestones.pdf. Accessed January 27, 2023.
- Accreditation Council for Graduate Medical Education. Supplemental guide: physical medicine and

- rehabilitation. Available from: <https://www.acgme.org/globalassets/pdfs/milestones/physicalmedicineandrehabilitationsupplementalguide.pdf>. Accessed January 27, 2023.
7. Edgar L, McLean S, Hogan SO, Hamstra S, Holmboe ES. The milestones guidebook. Available from: <https://www.acgme.org/globalassets/milestonesguidebook.pdf>. Accessed January 27, 2023.
 8. Kuo KN. Competency-based residency training: from RRC's point of view. Available from: <http://www.fma.org.tw/2016/E-4.html>. Accessed February 4, 2023.
 9. Lin HJ, Wu JH, Chen CY. Competency-based medical education and Milestones assessment. *J Intern Med Taiwan* 2020;31:115–21 [In Chinese].
 10. Francisco GE, Yamazaki K, Raddatz M, et al. Do milestone ratings predict physical medicine and rehabilitation board certification examination scores? *Am J Phys Med Rehabil* 2021;100:S34–9.