Internal Consistency and Reliability of the Filipino Gross Motor Functional Classification System – Expanded and Revised

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ABSTRACT

Background and Objective. The Gross Motor Function Classification System – Expanded and Revised (GMFCS-E&R) is a valid tool commonly used by physicians, therapists, and potentially also by other healthcare workers even at the primary care and grassroots levels to facilitate immediate screening, appropriate referral, and management of children with disability needing mobility devices. As Filipinos comprise one of the largest diaspora populations, this study aimed to provide a Filipino version of the GMFCS-E&R and determine its internal consistency and inter- and intra-rater reliability.

Methods. A multidisciplinary group of rehabilitation professionals at Philippine General Hospital worked with linguists to translate the original English GMFCS-E&R to Filipino/Tagalog, the Philippines' official language. Several steps were done: authorization from the original tool developers (CanChild™); forward and backward translations; semantic analysis; content analysis; pilot testing; and submission of final version to CanChild™. Internal consistency and inter- and intra-rater reliability were determined.

Results. The Filipino GMFCS-E&R translation was formulated and underwent several modifications. The final version yielded high internal consistency (Cronbach's alpha: 0.96) and inter- and intra-rater reliability (interclass correlation coefficients: 0.895 and 0.928, respectively).

Conclusion. The Filipino GMFCS-E&R is a reliable tool for use among pediatric Filipino patients for communication, clinical decision-making, registries, and research.

Keywords: translation, children with disability, mobility, cerebral palsy, pediatric rehabilitation, psychometric properties

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INTRODUCTION

According to the United Nations Children's Fund (UNICEF) in 2022, 236.4 million (10.1%) children (aged ≤19 years) have moderate-to-severe disabilities.[1] In the Philippines alone, there are approximately 137,474 children with disability (CWD) in need of mobility devices.[2] Amid the growing need for rehabilitation services for CWD especially in resource-limited countries, identifying them early on and providing appropriate interventions can potentially address the alarming rates of disability in this population. The foremost step involves immediate and proper screening of children at the primary care and grassroots levels. To facilitate communication and standardize descriptions of children's motor abilities and limitations, relevant validated tools can be used.

In particular, the Gross Motor Function Classification System – Expanded and Revised (GMFCS-E&R) developed by CanChild™ is a valid 5-level scale that describes the gross motor function of children with disability (e.g., cerebral palsy) based on their voluntary mobility in four different age bands.[3] It can be applied to clinical practice, research (including, but not limited to, databases and registries), teaching, and administration. It is useful in facilitating proper communication between and among stakeholders (e.g., parents, healthcare providers, health insurance organizations, schools, researchers) working collaboratively and efficiently for the child's benefit. In the Philippines, it is used by PhilHealth, the national government organization ensuring health insurance coverage to Filipinos, as a basis for determining whether a child is eligible for the disabilities benefit package that includes financial risk protection, habilitation or rehabilitation, and access to appropriate and good-quality assistive technologies (e.g., prostheses, orthoses, wheelchairs).[2] However, the GMFCS-E&R is not available in any Filipino dialect, including Tagalog, which is the most common. Its original English version, however, has been validated and translated to several other languages.[4,5]

Even though the Philippines has a bilingual educational system and is ranked 27th among 100 countries in terms of English proficiency,[6] the original GMFCS-E&R may remain prone to misinterpretation, especially among healthcare workers including nurses, aides, assistive device technicians, midwives, and caregivers at the grassroots levels not experienced enough in identifying CWD. Translating the tool to Filipino, the standardized form of Tagalog and official language in the Philippines, may ensure that it accurately reflects what it is supposed to measure.[7,8] It will allow for a more collaborative and time- and resource-efficient effort in evaluating and managing disabilities among children. Hence, this study aimed to translate the English GMFCS-E&R to Filipino and determine the translated version's internal consistency and inter- and intra-rater reliability.

METHODS

Study Design and Period

This was a cross-sectional study conducted at the Philippine General Hospital, designated as the country's national university hospital located in Manila. This hospital is the largest tertiary hospital in the Philippines and serves nearly 800,000 patients a year, catering to mostly non-paying and underserved patients from all over the country.[9] Ethics approval for the study was obtained from the University of the Philippines Manila - Research Ethics Board. Permission to utilize the Filipino translation of the GMFCS-E&R was requested from CanChild™. The study was implemented in 2021 when physical distancing was still widely implemented due to COVID-19. Hence, convenience sampling was the technique used and the data collection was purely online (i.e., emails, Google Survey, and Zoom videoconferencing). That is, only those who were reached by the online data collection form through online dissemination and found themselves eligible in the study through the criteria enumerated in the accompanying informed consent form were sampled in this study. Voluntary informed consent was obtained from all study participants and all of them were properly oriented regarding the study procedure.

Study Procedure and Population

There were two main study phases: 1) translation of the GMFCS-E&R to Filipino; and 2) pilot test of the Filipino GMFCS-E&R. Phase 1 involved several steps and commenced after approval from CanChild™ (Figure 1):

1. Initial forward translations: Two senior physiatrists (not part of the study team) from the Department of Rehabilitation Medicine of the study site were designated as P1 and P2, and one local professional linguist fluent in Filipino was designated as L1. Initial independent translations of the GMFCS-E&R from English to Filipino were performed by P1 and L1. Afterwards, P1 and L1 compared their individual translations and wrote down the differences in their versions in terms of terminologies, colloquialisms, and idioms. To help reconcile the differences, P2 thoroughly reviewed the two translations and then met with P1 and L1 to arrive at a consensus, producing version 1 of the Filipino GMFCS-E&R.
2. Backward translation of version 1: Another set of two qualified linguists (L2 and L3) who were unfamiliar with the original version of the GMFCS-E&R independently translated Filipino version 1 back to English. A comparison between the two backward translations while referencing the original English version was then done by P1 and L2, initially independently and then later as a dyad to make necessary revisions to version 1 and come up with the second Filipino version of the tool.
3. Semantic analysis per item: Version 2 of the Filipino GMFCS-E&R was then subjected to semantic analysis to determine whether the wording of each statement in the tool was clear. Based on the Brazilian-Portuguese cross-cultural adaptation of the GMFCS by Hiratuka et al., sample size was computed to be eighteen.[10] The participants were recruited via purposive sampling from the Department of Rehabilitation Medicine of the study site as well and divided into two groups. Group 1 (believed to have a relatively greater experience in evaluating CWD) consisted of three physiatrists, three physical therapists, and three occupational therapists; while Group 2 (with relatively lesser experience) included three nurses, three nursing aides, two prosthetic and orthotic technicians, and one certified wheelchair assessor. Each participant was asked to rate all the items in version 2 (containing descriptions of levels or Filipino "lebel" I to V for each of the five age bands) using a dichotomous scale (clear or unclear) and indicate any suggestions on how

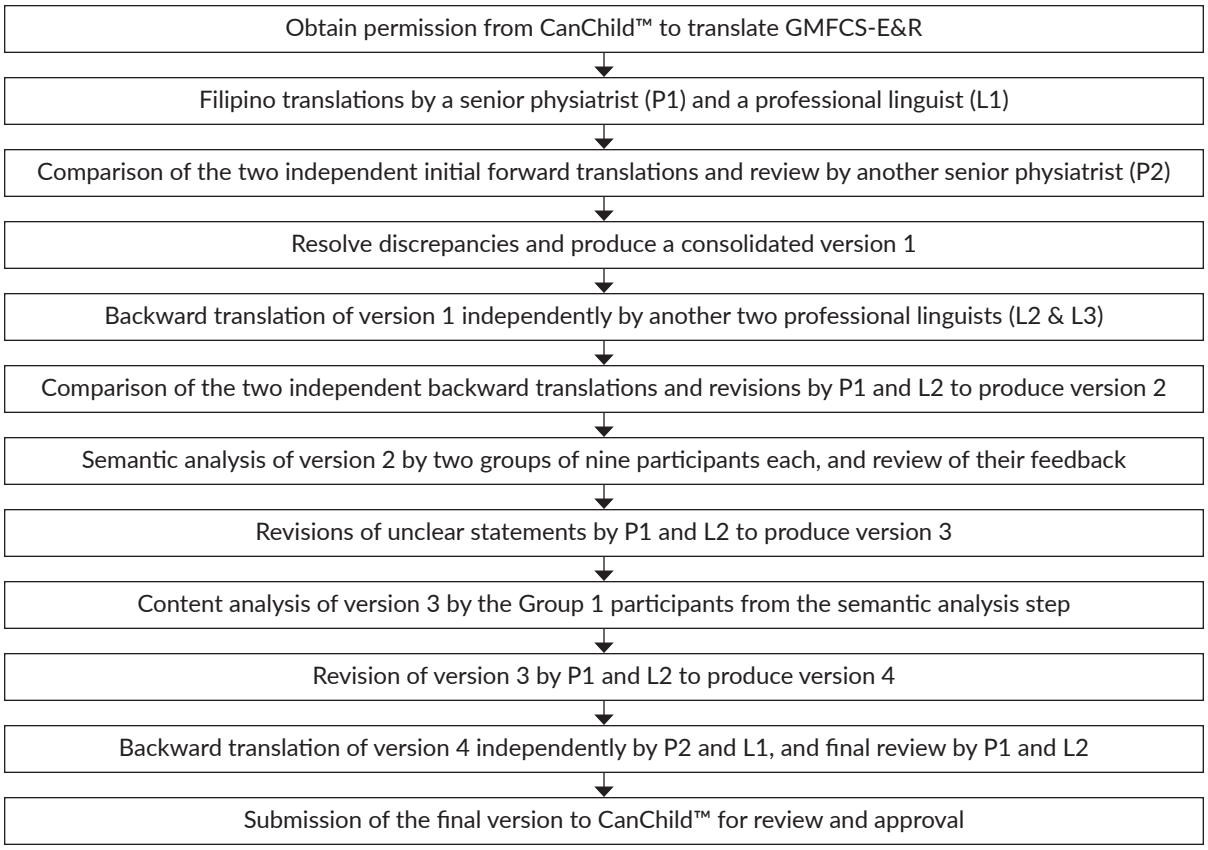

Figure 1. Process flow of the Filipino translation of GMFCS-E&R.

to improve the statement.[11] Any item deemed unclear by at least 20% of the participants was revisited by P1 and L2. All revisions were incorporated in version 3.

4. Content analysis: Version 3 was then subjected to content analysis by the participants in Group 1, who indicated whether they agreed or disagreed with each revised statement. If there were any items disagreed with by at least 20% of the participants, they would be discussed and revised again by P1 and L2, and consensus would be made to produce version 4.
5. Backward translations of version 4 and submission to the tool developers: The latest available version was individually back-translated into English by P2 and L1. The two backward translations were then reviewed and consolidated by P1 and L2. The study team then sent the latest forward and backward translations to CanChild™ for feedback and revisions were made accordingly. Upon obtaining approval from CanChild™, the latest forward translation was then considered the final Filipino version of GMFCS-E&R.

In the second phase of the study, the final Filipino version was pilot tested (figure 1). The pilot testing was conducted in July 2022, facilitated by three physiatrists with extensive experience in handling patients with cerebral palsy. Instead of engaging actual human participants as pilot sample, the physiatrists were asked to evaluate 20 videos of children with cerebral palsy and classify them according to the GMFCS-ER. They were again asked to repeat the evaluation after two weeks. The data from these evaluations were tested for reliability analysis. Furthermore, according to Ko et al., inter- and intra-rater reliability testing can be accurately conducted using video recordings.[12] In this study, therefore, four different videos of children with cerebral palsy for each of the following five GMFCS-E&R age bands were then selected from online sources to yield a total of 20 video clips: (1) <2 years old; (2) 2-4 years old; (3) 4-6 years old; (4) 6-12 years old; and (5) 12-18 years old. Each video was selected based on the following: (1) open-access (e.g., YouTube); (2) depicts an anonymized child with cerebral palsy exhibiting a mobility level different from other videos; (3) reviewed and approved by a senior physiatrist from the study department with expertise in pediatric rehabilitation and assistive technologies; and (4) within 1-2 minutes long. All short video clips were compiled into one montage to ensure the order in which they could be viewed by the pilot test participants. Copyright from the owners of each original video clip was retained.

Each child in the video was then independently evaluated using the final version of the Filipino GMFCS-

E&R by three junior physiatrists from the study department. The videos were presented chronologically by age band. The physiatrists were allowed to view the same clip repeatedly as needed. The physiatrists classified the 20 children with cerebral palsy presented on the videos using a classification of I-IV based on the GMFCS-ER criteria. Their evaluations were recorded on an online data collection form. After two weeks from submission of their initial responses, the same physiatrists were again asked to evaluate the same children using the Filipino GMFCS-E&R.

Data Analysis

All data were entered and analyzed using the Statistical Package for the Social Sciences Windows version 17 (SPSS Inc., Chicago, USA). The tool's internal consistency was computed using Cronbach's alpha, while its inter-rater and temporal intra-rater reliability were determined using the interclass correlation coefficient. The level of significance was set at 0.05 and a Cronbach's alpha of >0.80 is regarded as high internal consistency.

RESULTS

After permission to translate the GMFCS-E&R was granted by CanChild™, the first Filipino version was carefully drafted. Subsequently, there were several steps that resulted in modifications of the Filipino GMFCS-E&R. The final version was found to have high internal consistency and reliability.

All the statements in each of the following sections in the original English version of the tool were forward-translated accordingly: introduction and user instructions ("panimula at gabay sa gumagamit"); operational definitions ("pagpapakahulugan"); general headings for each level ("pangkalahatang paglalarawan sa bawat lebel"); distinctions between levels ("pagkakaiba ng bawat lebel"); before 2nd birthday ("bago ang ika-2 taong kaarawan"); between 2nd and 4th birthday ("sa pagitan ng ika-2 at ika-4 na taong kaarawan"); between 4th and 6th birthday ("sa pagitan ng ika-4 at ika-6 na kaarawan"); between 6th and 12th birthday ("sa pagitan ng ika-6 at ika-12 na kaarawan"); and between 12th and 18th birthday ("sa pagitan ng ika-12 at ika-18 na kaarawan"). Examples of differences between the initial translations of P1 and L1 resolved by P2 are shown in Table 1.

Most of these are related to the use of different synonyms resolved by choosing the more commonly spoken and colloquial terms. Some technical terms, such as premature, are retained in English as there is no specific direct Filipino translation for it. Similarly, the discrepancies in interpretations between the two professional linguists (L2 and L3) during the backward translation of version 1 were also found to be related to either using different synonyms or retaining the original English technical term to prevent confusion (Table 2).

The demographic profile of participants in Groups 1 and 2 who were involved in the semantic analysis is summarized in Table 3. Although with lesser years in formal training in the evaluation of CWD and not all with previous experience using the original GMFCS-E&R, Group 2 were much older and more experienced in dealing with children in general. Overall, both groups had comparable responses when asked about the clarity of each item in version 2 of the tool. Only two Filipino phrases in version 2 were deemed unclear by at least 20% of the participants (Table 4).

These were revisited by P1 and L2 to produce version 3. For instance, W-sitting initially translated as "pag-upong pasaklang" seemed to be a deep and uncommon Filipino phrase. The translators then agreed that "pag-upong nababanat nang paulit-ulit" was a more appropriate version. However, upon backward translation the meaning had changed drastically.

Table 1. Differences between the Initial Filipino Translations of One Senior Physiatrist (P1) and One Professional Linguist (L1), and Resolutions Made to Produce the Filipino GMFCS-E&R version 1 (V1)

Original English term/ phrase	P1	L1	V1
Level	Antas	Lebel	Lebel
Devices	Kasangkapan	Instrumentong	Instrumentong
Determining the level that most closely resembles	Pinakamalapit na kumakatawan sa pangkasalukuyang kakayahan ng kabataan	Magkakahawig na resulta	Magkakahawig na resulta
Early childhood	Maagang pagkabata	Murang gulang	Murang gulang
Premature	Maagang napanganak	Pagka-premature	Pagka-premature
Device with wheels	Kasangkapang may gulong	Instrumentong de-gulong	Instrumentong de-gulong
-nd / -th	Pang-	Ika-	Ika-
Adult assistance	Nakatatanda	Tagapag-alaga	Tagapag-alaga
"W-sitting" (sitting between flexed and internally rotated hips and knees)	Ang magkabilang paa ng bata ay nakatupi ang tuhod paharap at ang mga paa naman ay nasa likuran at gilid ng katawan na kawangis ng letrang "W"	Pag-upong nababanat nang paulit-ulit ang balakang at tuhod	Ang magkabilang paa ng bata ay nakatupi ang tuhod paharap at ang mga paa naman ay nasa likuran at gilid ng katawan na kawangis ng letrang "W"

Table 2. Differences between the Initial Backward Translations by Two Linguists (L2 and L3) and Resolutions Made to Produce the Filipino GMFCS-E&R version 2 (V2)

Filipino term/ phrase in the first forward translation	L2	L3	V2
Kumilos	Movement	Motion	Kumilos
Kabataan	Youth	Young people	Kabataan
Naitama na ang kanilang edad (corrected age)	Corrected (corrected age)	Age (corrected age)	Naitama na ang kanilang edad (corrected age)
Mga katawagan	Labels	Terms	Mga katawagan
Hawakan (railing)	Railings	Handle	Hawakan (railing)
Sanggol	Infant	Baby/ children	Sanggol
"W-sitting" (pag-upong nababanat nang paulit-ulit ang balakang at tuhod)	"W-sitting position" (sitting while repeatedly stretching its pelvis and knees)	"W-sitting" (sitting with the hip and knee repeatedly)	Pag-upong pasaklang
Karaniwang upuan	Usual chairs	Ordinary chairs	Karaniwang upuan
Isinasakay sa manual wheelchair	Placed on manual wheelchair	Transported on a manual wheelchair	Transported sa manual wheelchair

Table 3. Demographic Profile of Participants in the Semantic Analysis Step (N = 18)

Characteristic	Group 1 (with relatively greater experience in evaluating CWD), n = 9	Group 2 (with relatively lesser experience in evaluating CWD), n = 9
Age (years)	29.0 ± 3.5	41.0 ± 11.0
Sex, female	9 (100.0%)	8 (88.9%)
Total number of years of education	17.7 ± 4.2	13.7 ± 1.5
Total number of years of experience in evaluating CWD	4.9 ± 2.0	13.1 ± 10.4
With prior experience in using the original GMFCS-E&R	8 (88.9%)	2 (22.2%)

CWD: Children with disability, GMFCS-E&R: Gross Motor Function Classification System – Expanded and Revised

Table 4. Items Revised after Semantic Analysis of Version 2 (V2) to Produce Version 3 (V3)

Original English phrase	V2	Suggestions	V3
Crawl on hands and knees with a reciprocal pattern	Magkaiba ang direksyon ng paggalaw ng mga ito (reciprocal pattern)	Salitan ang direksyon ng paggalaw ng mga ito (reciprocal pattern)	Salitan ang direksyon ng paggalaw ng mga ito (reciprocal pattern)
"W-sitting" (sitting between flexed and internally rotated hips and knees)	Pag-upong pasaklang	Ang magkabilang paa ng bata ay nakatupi ang tuhod paharap at ang mga paa naman ay nasa likuran at gilid ng katawan na kawangis ng letrang "W"	Ang magkabilang paa ng bata ay nakatupi ang tuhod paharap at ang mga paa naman ay nasa likuran at gilid ng katawan na kawangis ng letrang "W"

Therefore, the translations were replaced with a clearer, albeit longer, description of how W-sitting actually looks like.

The resultant version 3 was then given to the participants of Group 1 for content analysis. After a thorough scrutinization, none of the statements in the latest version were unclear to more than 20% of the participants. Hence, no major revisions were done. Of note, however, a participant commented that it was tiring to read certain verbs due to repetitions of the first or second syllable, which is unique to the rules of Filipino grammar. For instance, the root word "upo" (Filipino verb for "sit") can take different forms depending on the tense, such as "nakaupo" (past tense as "sat" or past participle as "seated"), "nakakaupo" (present tense as "able to sit"), "uupo" (future tense as "will sit"), or "umuupo" (gerund or present participle as "sitting"). The translators concurred; hence, all tenses were revisited to make them in the present form, standard, and relatively easier to read, producing the Filipino GMFCS-E&R version 4.

Based on the pilot test, the latest Filipino GMFCS-E&R version yielded a high level of internal consistency (Cronbach's $\alpha = 0.96$). Re-test reliability was done at 14 days apart. The inter- and intra-rater reliability were 0.895 ($p \leq 0.05$) and 0.928 ($p \leq 0.05$), respectively.

DISCUSSION

This study was able to develop a Filipino translation of the valid and reliable original English version of the GMFCS-E&R and establish its internal consistency (Cronbach's alpha: 0.96) and inter- and temporal intra-rater reliability (interclass correlation coefficients: 0.895 and 0.928, respectively).[3] A Cronbach's alpha greater than 0.70 demonstrates that the

descriptions in each level across the different age bands are able to examine the same underlying construct (i.e., a child's gross motor function) and that the Filipino version of the GMFCS-E&R respects the original version.[10] Meanwhile, the closer the interclass correlation coefficient is to 1, the stronger the correlation (i.e., <0.40 is poor, 0.40 to 0.75 is moderate, >0.75 is excellent).[10] The present study was able to achieve an excellent inter- and temporal intra-rater reliability of the Filipino GMFCS-E&R based on our pilot test done using different video recordings of CWD, similar to previous studies that established the inter-rater reliability of GMFCS using structured video recordings as well.[12,13] The clinicians who participated in the study had a range of experience levels in evaluating CWD and their inputs were instrumental in achieving a clear and culturally appropriate translation of the tool. The GMFCS-E&R has been previously translated in different languages but to our knowledge, never in Filipino, prior to this study.

The Philippines' unique archipelagic landscape and overall lack of healthcare professionals and facilities, especially in geographically isolated and disadvantaged areas, are among the factors that make access to rehabilitation services challenging in the Philippines.[14] The World Health Organization recognizes the critical role of nurses and midwives in the healthcare system, whether it involves triage, patient care, or administration.[15] In the Philippines, nearly 60% of healthcare professionals are nurses, making them more accessible to the population than physicians and rehabilitation therapists.[16] Hence, if properly oriented, they can help in identifying and referring children in need of specialized services. Meanwhile, there are also a lot of nursing aides, midwives, and caregivers with more frequent interactions with potential patients in the community, and with adequate training they can also help streamline the process of CWD screening and referral. Lastly, prosthetic and orthotic technicians, and wheelchair assessors may also benefit from using the GMFCS-E&R as a standard way of communicating with other healthcare professionals regarding the individual needs of children referred to them. In general, healthcare workers even at the grassroots level can help identify children with mobility problems in the community and rural areas, and refer them to hospital- or urban-based specialists for further appropriate evaluation and management. Empowering local healthcare workers in using valid and reliable screening tools that are available in the native language can help mitigate the burgeoning disparity between the increasing rates of disability among children and the shortage of healthcare workers and resources for training, especially in countries with limited resources.[17]

The process of translating the GMFCS-E&R was adapted from Beaton et al. and Hiratuka et al.[10,18] Two separate forward translations were initially done and then compared with each other to identify and resolve discrepancies to improve the wording. As shown in our results, some words or phrases (e.g., translations for "level," "devices," "premature," "early childhood," or "W-sitting") were different between the two forward translators (Table 1). With the help of a third person, resolutions were made to minimize the ambiguity of the Filipino translation and ensure the vocabulary was appropriate for the target users.

The backward translation was then done to verify the validity of the tool and ensure that the translated version reflected the same content as the original.[10,18] The semantic analysis was then performed to ensure the clarity and understandability of the terms used in the translated version. It checked for the appropriateness of sentence construction and use of unique Filipino colloquialisms and idioms, making sure that the essence of the original English version was preserved.[11]

Regarding the semantic analysis, involving participants with lesser years of formal training in evaluating CWD and lesser to no experience in using the GMFCS-E&R was vital to ensure that the tool could potentially be easily understood and followed by their counterparts at the grassroots level. On the other hand, participants with more years of formal clinical training and expertise were instrumental in performing the content analysis of the Filipino GMFCS-E&R (i.e., ensuring the items in the translated version referred to the latent attribute -- gross motor function of children with disability like cerebral palsy).[10] The content validity of the Filipino translation was then verified by this "higher stratum" group, considered as "experts" in using the original English tool. As such, they were able to ascertain whether the details in the translation were correct or incorrect. The "lower stratum" group was no longer involved in our pilot test as Silva et al. ensured the reliability of GMFCS-E&R for use among clinicians across different strata or levels of education and experience.[19]

In line with telerehabilitation, a practical application of our study is the use of the Filipino GMFCS-E&R in developing a remote virtual screening tool to help healthcare workers at the grassroots level and geographically isolated areas to evaluate and refer CWD. In 2021, the Philippine Council for Health Research and Development has approved funding for the development of an original and customized mobile application, which intends to use our Filipino GMFCS-E&R, for early detection of children with mobility impairments from a distance.[20] Telerehabilitation can help address the geographic and economic barriers to healthcare access.[21] Despite its benefits, however, it has its several challenges. For instance, in the Philippines, there is a lack of a validated online Filipino data collection tool that can facilitate telehealth.[22] But now that there is a reliable Filipino GMFCS-E&R that can be integrated and eventually tested using the mobile application project, this can hopefully advance telerehabilitation specifically for the pediatric population in the Philippines. Furthermore, within or outside the Philippines, the Filipino GMFCS-E&R can be used to improve communication among stakeholders for clinical, research, and registry purposes. It can also allow

for collaborative and time- and resource-efficient efforts in evaluating and managing disabilities among children, especially in settings or communities wherein language may be a barrier between healthcare providers and Filipino patients wherever they are in the world.

The study authors believe that complete equivalence between the Filipino and English GMFCS-E&R may not be achieved as with any cross-cultural translations. Some items may remain prone to misinterpretation despite the rigorous steps that have already been undertaken. Further research is recommended to establish the inter-rater and intra-rater reliability of the tool among other populations, such as primary care physicians, nurses, midwives, and other healthcare workers at the grassroots level. Nonetheless, the study was able to establish the first Filipino version of the GMFCS-E&R, which was accepted by CanChild, and its psychometric properties were found to be at par with the validated original version and other translations of the tool.

CONCLUSION

The Filipino GMFCS-E&R is a reliable tool for use among pediatric Filipino patients for communication, clinical decision-making, registries, and research. The tool developed was determined to respect the original version with excellent inter- and temporal intra-rater reliability.

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Data Availability

The datasets generated from the study are not publicly available but may be obtained from the corresponding author upon reasonable request.

Statement of Authorship

All authors certified fulfillment of ICMJE authorship criteria.

Author Disclosure

All authors declared no conflicts of interest.

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