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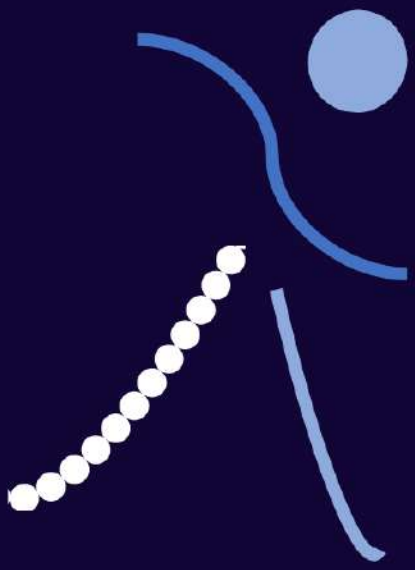

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Message from the President of the Malaysian Physiotherapy Association:

Assoc. Prof. Dr. Mohd Haidzir Abd Manaf

Dear Colleagues,

Experience is a very good tool for learning and becoming proficient in the physiotherapy and rehabilitation field. However, when it comes to the real evaluation of practices, strategies, and decisions, personal experience is far than adequate, as it can be very biased and misleading. Sometimes, unconsciously, we see things the way we wish to see them, and hence good evidence-based approach should be utilized to better assess our available knowledge.

Admittedly, it is not an easy task: meticulous planning, rigorous data collection, appropriate analysis, and knowledge dissemination. The evidence-based approach should be part of our professional life at all levels. At the public decision-making level, the evidence-based approach is even more crucial. We cannot afford to make decisions that will influence a whole population without proper justification and scientific evidence.

As a member of the Malaysian Physiotherapy Association (MPA) for many years, I have witnessed the Association's steady growth, thanks to the efforts of all its previous leaders and highly enthusiastic members. I would like to express my recognition for our predecessors' excellent work and tireless efforts.

I take this opportunity to express my sincere appreciation and congratulate the editorial board members of the Malaysian Physiotherapy Journal (MPJ) on the publication of the first issue of the MPJ. I believe that the MPJ will exemplify a globalized journal in the physiotherapy and rehabilitation field. A significant amount of time and effort was spent on the publication. MPA has selected renowned professionals for the editorial board, and they also have made efforts to call for and publish high-quality papers.

MPJ publication is the achievement of MPA by collaborating with academic and clinical organizations leading in the physiotherapy and rehabilitation field. The MPJ is aimed to spread knowledge and update the members with the latest physiotherapy research findings and practice that are available. We would like to encourage our members to contribute and share their experiences. Members will be able to publish their scientific work and have free access to the MPJ publications. Lastly, I would like to thank all MPJ editorial boards and reviewers who have contributed to the publication for their time and effort.

Thank you.

Mohd Haidzir Abd Manaf

EDITOR'S NOTE

Welcome Note by the Chief Editor: Assoc. Prof. Dr. Nor Azlin Mohd Nordin

Welcome to the first volume of the Malaysian Physiotherapy Journal (MPJ). Let me begin with congratulating the President of the Malaysian Physiotherapy Association and his dedicated team for taking this crucial step in establishing MPJ and bringing our physiotherapy profession to a higher level.

The main aim of MPJ is to serve as a platform for scientific communications among Malaysian physiotherapists and fellow friends from other regions of the world. MPJ is intended to publish high quality peer-reviewed research papers and critical viewpoints in the field of physiotherapy and rehabilitation. MPJ is published as an online journal so that it could reach wider audience with common interest in these two areas. To facilitate reading, the journal is structured to portray articles based on its category: in specified sections which start with 'Editor's Note' and ends with 'Special Issues'. MPJ also contains an 'Acknowledgement' section to express gratitude to everyone who are involved in the production of each volume/issue.

I would like to thank the Malaysian Physiotherapy Association for appointing me as the Chief Editor of MPJ for the period ending 2024. It is indeed my greatest honour and pleasure to have an opportunity to serve as the first Chief Editor for the long-waited MPJ. I am very proud to be working in tandem with an excellent team of Editors. The line-up of the Editorial Board consists of physiotherapy academia as well as practitioners who are experts in the key areas of physiotherapy including education technology. I trust the membership of the editorial board ensures a good balance for MPJ in getting the much-needed input and guidance through the milestones it has and will achieve. We have also identified reputable reviewers to provide constructive feedbacks to potential authors so that each submitted paper stands a chance of publication in the journal.

Producing this first volume of MPJ has been a challenging but rewarding 6-month journey. We started from scratch and upon receiving a good number of papers in hand, we strived to conduct a quality peer review based on rigorous evaluation criteria and make unbiased editorial decisions in timely manner. I sincerely thank all authors, reviewers and editors for their kind effort and contributions to this MPJ, 2022, 1(1). Special thanks to Dr. Choy Ker Woon, being an excellent Assistant Chief Editor who worked tirelessly in ensuring this first mission is successfully accomplished and its output well delivered. Our next step is to create an online system for a more efficient management of MPJ.

On a last note, I ask for everyone's continuous support for MPJ. Let us have this journal in mind whenever we intend to publish our next scientific work or critical viewpoints. I am confident that together, we can make MPJ grows as an internationally accepted and respected journal with an impact to implicate the practices of our beloved physiotherapy profession.

Best regards,

Nor Azlin Mohd Nordin

EDITOR'S NOTE

Sharing by the Assistant Chief Editor: Dr. Choy Ker Woon

The journey behind the establishment of Malaysian Physiotherapy Journal

Like the saying says, "Every success begins with a single step".

A journal plays an important role in the community by raising issues, discussing controversies, setting the scientific standards, and, of course, helping researchers to make their work public. The idea of establishing the Malaysian Physiotherapy Journal begins by our chief editor, Associate Professor Dr. Nor Azlin Mohd Nordin, who felt it is timely that Malaysian physiotherapists should have their own publication platform to share scientific works and clinical opinions. The existence of a home-grown physiotherapy journal will also provide student researchers in the country with a greater opportunity to get their study output published. With the support from the Malaysian Physiotherapy Association (MPA) whose current president being dynamic, the idea was translated into action by setting up a local and international editorial board for the journal. The identified members are among physiotherapy academia as well as practitioners who have extensive research experience and are experts in the key areas of physiotherapy.

Producing this first volume of MPJ is a journey of thousand miles. The first meeting was held immediately to discuss about the suitable name of the journal. Malaysian Physiotherapy Journal (MPJ) was chosen as the official name which is concise and reflect the scope of the journal. All the relevant documents needed for registering MPJ as a journal was identified. MPJ's publication scope, number of volume and journal guidelines were discussed in detailed among the editorial board members.

The design for MPJ's journal cover was done in a thorough manner. A dark blue colour was chosen as blue is regarded as the colour that represents physiotherapy profession worldwide, with dark blue seen as a sign of stability and reliability. A *songket* pattern, representing a cultural icon of Malaysia, was placed at the corner of the journal cover to reflect the origin country of MPJ. A sketch of a human was selected characterizing movement therapy as one of the core natures of physiotherapy. A few templates were designed, and the finalized design was chosen based on the total number of votes from members of MPA and editorial board.

A call for manuscript submission was made by MPA in October 2021 and thankfully, we received a welcoming number of submissions, nationally and internationally. A panel of reputable and experienced reviewers were elected to provide rigorous evaluation to the authors and make unbiased decision on the acceptance of the manuscript. Format, grammar, and the flow of all accepted manuscripts were proofread and edited thoroughly before the final publication. All these steps were necessary as we strive to publish high-quality papers with great scientific merit in MPJ.

After six months of hardship, we are proud that the first volume of MPJ is finally produced. This achievement could not be done without the major contribution from excellent editorial board members, experienced panel of reviewers, responsible editorial assistants as well as supportive MPA members and researchers. We hope that MPJ will achieve its aims and bring a greater impact to the evidence-based practice and quality of physiotherapy, nationally and internationally. This journey of thousand miles will hopefully bring MPJ to a greater height in the future.

Sincerely,
Choy Ker Woon

ORIGINAL ARTICLE

Physiotherapy Faculty Members and Students Readiness with Interprofessional Education

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ABSTRACT

Background: This study assessed readiness of faculty members and undergraduate physiotherapy students towards interprofessional education. **Methods:** A cross sectional survey with simple random purposive sampling was used for this study. The Readiness for Interprofessional Learning Scale (RIPLS) was administered to participating physiotherapy faculty members' and students. Data were analysed using descriptive statistics while the correlation based on the faculty members and students' gender, level of study and year of study were identified using inferential statistics. **Results:** This study enlisted 37 faculty members and 92 physiotherapy students, and the response rate was 100%. The p-value was > 0.05, indicating that there was a significant difference in faculty and physiotherapy students' readiness for interprofessional education. Faculty members reported lower readiness (M = 61.05, SD = 17.98) than students (M = 74.93, SD = 6.20). There was no correlation, significant between the student's gender, level of study, or year of study and their readiness for interprofessional education, as all the p-values were < 0.05. Diploma students were reported as being more ready than degree students, female students showed more readiness than male students and third year students reported more readiness than the other year students for interprofessional education. **Conclusion:** Malaysian physiotherapy students showed a higher interest in interprofessional education as compared to their faculty members. This, however, are merely a gauge of preparation prior to the start of a formal interprofessional academic session. To promote interprofessional activities, more research on physiotherapy personnel is encouraged. The findings of this study have offered a focal point for developing Interprofessional learning practices between the physiotherapy department and the university's other health departments.

Keywords: Interprofessional education, readiness, physiotherapy

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INTRODUCTION

Physiotherapists are trained to make decisions and act autonomously within a professional environment, and is responsible and accountable for those decisions and actions (Sedgley 2013). Explained professional autonomy or clinical reasoning in physiotherapy is defined as the thinking and decision-making processes related with clinical practice (Higgs, Refshauge & Ellis 2001). Clinical reasoning necessitates the ability to critically evaluate practice, learn from experience, and adapt what has been learned to new situations. It is the connection between a physiotherapist's knowledge, ability to gather, analyse, and synthesize pertinent data and personal awareness, self-monitoring, and reflecting processes (Smith, Ajiawi & Jones 2009).

Physiotherapists are educated to be self-sufficient, but when they enter the healthcare industry, they are compelled to work collaboratively in teams (Rose et al. 2009). Malaysian healthcare is delivered through multidisciplinary teams. Healthcare workers must be able to work as part of a multidisciplinary team in order to provide high-quality patient care. Despite the fact that Malaysian healthcare is multidisciplinary, healthcare students are underprepared (Tong et al. 2016).

Integrating teamwork and communication is critical for health care workers to provide excellent patient care (Boland et al. 2016). It is critical for newly graduated students to become proficient in their abilities and to deliver safe and effective care regardless of the increased obligations. Despite growing obligations, responsibilities, and problems, new graduates must master their professional abilities (Boland et al. 2016). The willingness of learners and academics was identified as a crucial aspect in interprofessional learning's acceptability and execution (Ernawati & Utami 2020). Health education serves as the foundation for the evolution of the healthcare profession in the industry, with health institutes bearing primary responsibility for the development of critical abilities such as collaboration (Interprofessional Education Collaborative Expert Panel 2011).

Recent advancements in healthcare have driven a strong push for the integration of multiple healthcare professionals in the delivery of patient care. The Malaysian government backed this up by enacting the Allied Health Act 2016, which formalizes the allied health profession so that healthcare practitioners' patient care can be properly supervised. Physiotherapy was added to the list of professions in the allied health legislation of 2016, which takes effect in 2020. Doctors, dentists, veterinarians, nurses, medical assistants, and pharmacists were previously the only professions governed by the Malaysian legislation. Physiotherapy's admission as an allied health profession outlined the importance of the profession's contribution to the healthcare industry and their importance in healthcare teams.

One of the challenges in bringing physiotherapy together with diverse healthcare professions is that professionals may have difficulty working together in an integrated manner unless they have been trained to do so (Jones et al. 2012). Other challenges include limited access to other healthcare disciplines, lack of adequate clinical training sites, poor administrative support, insufficient resources for faculty development, lack of standardized assessment instruments, and attitudinal differences and scheduling conflicts (Jones et al. 2012; Maniall & Rowe 2016). Working in a collaborative atmosphere necessitates clarity, particularly when it comes to border crossing (Horsburgh, Lamdin & Williamson 2001; Manilall & Rowe 2016). Miscommunication among healthcare providers has a negative impact on both healthcare delivery and patient care (Manilall & Rowe 2016). The World Health Organization (WHO) suggested interprofessional education as a solution to these challenges (WHO 2010; WHO 2013).

Interprofessional education is a collaborative strategy for educating healthcare students to work as effective future members of interprofessional teams (Buring et al. 2009; Olenick, Allen & Smego 2010). Interprofessional education is also encouraged by the Institute of Medicine (IOM), the Canadian Interprofessional Collaborative (CIHC), the European Interprofessional Education Network, The UK Center for Advancement of Interprofessional Education (CAIPE) and supported locally by the Malaysian, Ministry of Health (MOH) and Malaysian Qualifying Agency (MQA).

Despite the Malaysian government's efforts to promote collaboration in the healthcare industry, healthcare education is lacking interprofessional execution (Shoesmith et al. 2016; Tong et al. 2016). Collaborative education is often provided as an extra-curricular activity or an elective rather than as a core competency subject (Tong et al. 2016). Multidisciplinary education was also included in the Malaysian Qualifying Agency's (MQA) framework for initiation, guidance, evaluation, and accreditation. To date, no formal application has been filed in relation to multidisciplinary education. There has been little research on how therapy professionals see interprofessional collaboration because the majority of Interprofessional studies centred on doctors and nurses (De Vries et al. 2016).

There is, however, a lack of clarity about how health professions instructors may create and assess collaborative competency in undergraduate healthcare students. Healthcare education has not kept pace with the demands of struggling health systems, prompting calls for educational changes to create graduates with suitable professional capabilities. This is demonstrated by the fact that various professions do not effectively collaborate, probably because of poor core competency development in undergraduate education (WHO 2013).

It appears that the ability to interact effectively must be actively taught in undergraduate health professions curriculum if healthcare practitioners are to handle the increasingly complicated health requirements of their client populations. Furthermore, interprofessional education appears to be a suitable location within the curriculum to include the development of collaboration as a fundamental ability. However, there is little data on how this vital skill is fostered in students studying health professions (Horsburgh, Lamdin & Williamson 2001). The goal of this research was to see how students and professors in a physiotherapy department thought about the development of collaborative competency in the undergraduate curriculum.

In Malaysia, studies of healthcare programs and participants pertaining to multidisciplinary treatment indicated a dearth of physiotherapy participation. Although multidisciplinary education is recognized as collaborative education, in many cases the term interprofessional education is used. According to the World Health Organization (WHO), interprofessional education is an experience that “occurs when students from two or more professions learn about, from, and with each other” (WHO 2010). Till then the term interprofessional education had been popularly conceptualized.

Only a study by Ismail and colleagues that included physiotherapy as a participant was retrieved from the literature. They found that among the healthcare students surveyed on their readiness for interprofessional education, the physiotherapy students had the highest readiness (Ismail et al. 2018). There were no physiotherapy-related follow-up studies found. Most healthcare studies, focused on medical, nursing, and pharmacy students (Aziz, Teck & Yen 2011); dentistry, nursing, pharmacy and health sciences (Maharajan et al. 2017); pharmacy students (Tahir 2020); dentistry and medical students (Htay et al. 2019).

Two studies on interprofessional education were reported among faculty members. One looked at a government university (Chelliah, Efendie & Mohamad 2015), while the other one looked at private university faculty members (Thanikasalam 2017).

Faculty members, according to Chelliah and colleagues, have a high level of readiness for interprofessional education. However, it is unclear which faculty members were interested in interprofessional education based on

the findings of this study (Chelliah, Efendie & Mohamad 2015). In the meantime, Thanikasalam found that faculty members' readiness on interprofessional education varied. The study did not look into how physiotherapy faculty members interacted with interprofessional education (Thanikasalam 2017).

As a result, depending on different studies to back up research findings can be perplexing. By focusing entirely on physiotherapy students and faculty members, this study intends to clear up any uncertainty that has arisen. This will aid in determining physiotherapy professionals' readiness levels and initiating interprofessional efforts within the physiotherapy academic curriculum.

MATERIALS AND METHODS

Study design

The purpose of this research was to look into the relationship between physiotherapy students and faculty members with readiness for interprofessional education. The university's research committee granted permission for this study to be conducted. The university was considered as the university that met the research requisites proposed in previous studies (Marshall & Rossman 2006).

Upon approval, an ex post facto, non-experimental design was selected. An ex post facto research design was found to be suitable in measuring relationship variables (Newman & Benz 1998). A non-experimental design was chosen as the independent variables in this study cannot be manipulated (Newman et al. 2006).

For this study, a survey method was used. A survey method was considered since a standardized response was required to determine the participants' degrees of readiness response. The answer will be able to assist in the development of a framework for interprofessional implementation activities at the university. If a qualitative approach is taken, divergent viewpoints will serve to delay the interprofessional initiative because triangulating each participant's Interprofessional response necessitates careful interpretation.

Study samples & procedure

A simple random, purposive sample technique was used to select the faculty members and physiotherapy students for this study. The anticipated sample size was calculated using the population calculation developed by Krejcie and Morgan (1970).

All of the participants signed a written informed consent form and met the inclusion criteria. Full-time students entering the physiotherapy programme with no prior experience with interprofessional education and no academic papers other than physiotherapy were the inclusion criteria. In terms of lecturers, this study looked at full-time instructors as well as lecturers who only teach the physiotherapy programme.

A survey instrument was developed for this research. The instrument was made up of two sections. Section A contained the participants' socio-demographic information, such as gender, educational level, and level of study for the students. The Readiness of Interprofessional Education Scale (RIPLS) by Parsell et al. (1999) was included in Section B and applicable to the students and faculty members (permission for the use of this questionnaire was acquired beforehand). With an internal validity of 0.9 during the pilot study and a recommendation from Malaysian researchers, Aziz and colleagues, the RIPLS was well on its way to meeting this study objective (Aziz, Teck & Yen 2011).

The students and faculty members were given the questionnaire face-to-face. This was necessary because feedback from students and faculty members might be used to improve the university's Interprofessional efforts. The purpose of the study was explained to the participants. The participants were not compelled to take part in the study. Participants were advised that if they did not feel comfortable with the study, they could withdraw. The study was completed by all participants, and the response rate was 100%.

Data analysis

The data was analysed with descriptive and inferential statistics using the Statistical Package for Social Sciences (SPSS) (v.20). To test the relationships, descriptive, mean, and correlation statistical approaches were used.

RESULTS

Demography

In this study 37 faculty members and 92 physiotherapy students were recruited. Among the 92 physiotherapy students, male students account for 19 (20.7%), while female students account for 73 (79.3%). In the level of program, there were 36 (39.1%) diploma students and 56 (60.9%) degree students. In the category of year of study; 18 (19.6%) were first year; 24 (26.1%) were second year; 32 (34.8%) were third year; and 18 (19.6%) were fourth year students.

Statistical tests results

A T-Test was performed to see if the variable designation was significant using RIPLS and its subscales. The variable designation was found to be significant using the RIPLS and its subscales, as $p < 0.05$. Table I shows the overall RIPLS score and each of the RIPLS subscales for the faculty members and students. Overall, both faculty and students reported a differing readiness level. The faculty members reported a lower readiness ($M = 61.05$, $SD = 17.98$) than the students ($M = 74.93$, $SD = 6.20$) who reported a high readiness. Faculty members had also rated themselves low than students in terms of teamwork and collaboration, positive identity, and roles and responsibilities. Faculty members also expressed a higher level of negative identity than students.

Table I: Mean score for faculty members and students for RIPLS and its subscales

Readiness for Interprofessional Learning Scale (RIPLS)	Designation		*p-value*
	Faculty (mean ± SD)	Students (mean ± SD)	
Overall	61.05 (17.98)	74.93 (6.20)	0.00*
Teamwork and collaboration	28.32 (8.88)	38.33 (3.86)	0.00*
Negative identity	9.92 (3.03)	8.36 (1.28)	0.00*
Positive identity	12.78 (3.86)	17.30 (2.19)	0.00*
Roles and responsibility	10.03 (2.95)	10.95 (1.31)	0.00*

A T-Test was also utilized to determine whether the level of study had any bearing on the RIPLS and its subscales. According to the test, RIPLS and its subscales had no bearing on level of study, as the p-values were > 0.05. The diploma student had reported a higher readiness, teamwork and collaboration, negative identity, positive identity, and roles and responsibilities than the degree students (Table II). Overall, the diploma and degree students had reported a higher readiness towards Interprofessional Education.

Table II: Mean score for diploma and degree students for RIPLS and its subscales

Readiness for Interprofessional Learning Scale (RIPLS)	Level of Study		*p-value*
	Diploma (mean ± SD)	Degree (mean ± SD)	
Overall	76.89 (5.45)	73.68 (6.36)	0.79
Teamwork and collaboration	39.81 (3.47)	37.38 (3.82)	0.55
Negative identity	8.58 (1.29)	8.21 (1.27)	0.42
Positive identity	17.67 (2.01)	17.07 (2.29)	0.60
Roles and responsibility	10.83 (1.25)	11.02 (1.35)	0.69

The RIPLS and its subscales had no effect on gender, so a T-Test was selected to evaluate if it did. RIPLS and its subscales had no effect on gender, according to the test. All of the p values were > 0.05, indicating that the results were not significant. The diploma student had reported a higher readiness, teamwork and collaboration, negative identity while the degree students had reported a higher positive identity, and roles and responsibilities than the diploma students (Table III). Overall, both genders had reported a higher readiness towards interprofessional education.

An ANOVA test was used to investigate if the RIPLS and its subscales had any effect on the year of study.

Table III: Mean score for male and female students for RIPLS and its subscales

Readiness for Interprofessional Learning Scale (RIPLS)	Gender		*p-value*
	Male (mean ± SD)	Female (mean ± SD)	
Overall	73.74 (6.47)	75.25 (6.13)	0.53
Teamwork and collaboration	38.53 (3.99)	38.27 (3.85)	0.80
Negative identity	8.47 (1.12)	8.33 (1.33)	0.21
Positive identity	16.47 (2.34)	17.52 (2.12)	0.79
Roles and responsibility	10.26 (1.19)	11.12 (1.29)	0.79

The ANOVA test reported RIPLS and its subscales had no effect on the year of study. The p value was > 0.05 for the RIPLS and its subscales, indicating that the outcome was indeed not statistically significant. Mixed results were reported among the year or study (Table IV). The aggregate score indicated that the students were highly ready for interprofessional education.

The third year students reported the highest level of readiness for interprofessional education, while fourth year students reported the lowest level of readiness. Third year students also reported higher levels of teamwork and collaboration, whereas first year students reported the lowest levels. Second year students expressed a more negative identification toward interprofessional education, whereas fourth year students reported a lower negative identity. Students in their third year reported a stronger positive identity, while those in their fourth year reported the lowest positive identity. On the topic of roles and responsibilities, fourth year students scored lower than first year students, who scored higher.

DISCUSSION

The focus of this research was to determine the levels of readiness that physiotherapy faculty members and students had towards interprofessional education. The outcome showed mixed results. With interprofessional education, faculty members reported a low level of readiness, whereas students reported a higher level of readiness.

The faculty members' findings contradicted with the studies by Chelliah et al. (2015) and Thanikasalam (2017) who found that faculty members were highly ready for interprofessional education. In this study, the faculty members highlighted paperwork, time limits,

Table IV: Mean score for year of study for RIPLS and its subscales

Readiness for Interprofessional Learning Scale (RIPLS)	Year of Study				*p-value*
	1st Year (mean ± SD)	2nd Year (mean ± SD)	3rd Year (mean ± SD)	4th Year (mean ± SD)	
Overall	73.72 (7.17)	74.63 (3.3)	77.00 (5.61)	72.89 (8.21)	0.12
Teamwork and collaboration	37.17 (4.51)	37.21 (2.71)	39.72 (3.42)	38.50 (4.60)	0.13
Negative identity	7.83 (1.2)	9.08 (0.77)	8.69 (1.20)	7.33 (1.28)	0.46
Positive identity	17.56 (2.61)	17.04 (1.60)	17.72 (2.08)	16.67 (2.59)	0.39
Roles and responsibility	11.7 (1.29)	11.29 (1.12	10.88 (1.26)	10.39 (1.53)	0.10

and budgetary concerns as impediments to having interprofessional education readiness. Most of the lecturers in this study were foreigners, with some having prior interprofessional experience in their home and working country. They stated that while interprofessional education appears to be simple, it is not realistic to implement. The faculty members' situation was also found to be compatible with other research findings (Chelliah, Efendie & Mohamad 2015; Barr 2015).

This study's findings on the physiotherapy students were consistent with other studies which also reported that physiotherapy students were having high readiness for interprofessional education (Rose et al. 2009; Ismail et al. 2013; Meche et al. 2017). The results of the Malaysian study by Ismail et al. (2018) had contradicted with the studies by Hind et al. (2003) and Manilall and Rowe (2016) who found that physiotherapy students were having low readiness for interprofessional education. These studies attributed dominance from other health professions for their lack of interest with interprofessional education (Hind et al. 2003; Manilall & Rowe 2016). Meanwhile, the physiotherapy students in this study highlighted dorm sharing, cross teaching, and cooperative extracurricular activities as important influences with their high readiness for interprofessional education. This academic scenario had also increased their tolerance and desire to collaborate rather than dominate other professions during studies and practice.

When comparing diploma and degree students, diploma students indicated a better level of readiness for interprofessional education than degree students. Degree students acknowledged being less ready than diploma students since they were exposed to more significant clinical cases in the healthcare industry. Their readiness for interprofessional education had been influenced by this encounter.

Gender was not found to be a predictor of interprofessional education readiness in this study. This finding is supported by a study by Ahmad et al. (2013), who found that gender was also not a predicting factor for interprofessional education readiness. Female students were shown to be more ready for interprofessional education than male students in this study. The results of this study agree with other studies that found females healthcare students were more supportive of interprofessional education (Curran et al. 2008; Coster et al. 2008; Aziz, Teck & Yen 2011; Keshtkaran, Sharif & Rambod 2014; Talwakar et al. 2016). The findings of this study, however, contradict with a study by Htay et al. (2019) who claimed that females were less ready for interprofessional education.

There was no relationship between year of study and readiness in this study. This was also supported by studies by Ahmad et al. (2013) and Chua et al. (2015) which stated that year of study was not a determining element in interprofessional education. The findings of this study contradict studies by Al-Qahtani (2016) and Maharajan et al. (2017) who found that the year of study had an impact on interprofessional education. Despite the fact that the year of study had no effect on readiness in this study, the mean scores varied significantly as the year of study, progressed. The students reported moderate levels of readiness at the start of their studies, which increased as years moved on, but their readiness declined dramatically during their final year of study. This observation concurs with studies by Coster et al. (2008) and Maharajan et al. (2017). However, the findings of a study by Williams et al. (2013), who reported students' readiness progress as their study years progressed, were not supported by this study. The students stated that the reality of healthcare and collaboration work had made them less ready for interprofessional education. There was also a lot of interference, particularly from attending medical officers, which influenced their decision. Research findings by Manilall & Rowe (2016) also supported this claim. This was supported by another study by Dehat (2012) who added that student learning was linked to non-classroom interactions with teachers, the type of peer group relationships, and extracurricular activities. The advantages of social activities and outside-of-classroom engagement are a gateway to interprofessional success that should not be overlooked (Delnat 2012).

CONCLUSION

The study's goal of investigating physiotherapists' perspectives of interprofessional education was met. It also reveals a huge disparity in interprofessional readiness among the faculty members and students. The findings of the study reported that the Malaysian students showed higher interest on interprofessional education as compared to their faculty members. The findings of this study have offered a focal point for developing interprofessional learning practices between the physiotherapy department and the university's other health departments. The findings, however, are merely a gauge of preparation prior to the start of a formal interprofessional academic session. To promote interprofessional activities, more research on physiotherapy personnel is urged. With the acknowledgement of interprofessional education, it is vital to increase faculty commitment and awareness of interprofessional preparation.

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CONFLICT OF INTEREST

The author declares no conflict of interest.

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ORIGINAL ARTICLE

Clinical Profile and Predictors of Motor Function Improvement at Discharge following Inpatient Stroke Rehabilitation in a Public Rehabilitation Hospital

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ABSTRACT

Background and Objectives: Data on the outcomes following inpatient stroke rehabilitation (ISR) in developing countries, including Malaysia, are scarce. This study aimed to assess the motor function outcomes among stroke patients following ISR in a rehabilitation hospital and identify the predictors affecting their motor function improvement. **Methods:** This retrospective observational study analysed data on stroke patients admitted to a rehabilitation hospital for ISR from January 2014 to December 2015. All patients received 60 minutes of physiotherapy sessions five times a week. Purposive sampling was used in this study. The Motor Assessment Scale (MAS) score was the primary outcome measure and assessed during admission and discharge. Linear regression analyses identified the predictors of MAS score improvement from the subjects' demographics and clinical characteristics. **Results:** 124 subjects were analysed with a mean age of 53.9 (SD=13.6) years, predominantly male (n=93, 75.0%), and the majority had an ischemic stroke (n=99, 79.8%). The median length of stay (LOS) was 30 (19.0–41.8) days. The majority of subjects had stroke onset to ISR admission interval (OAI) of <90days (n=77, 62.1%). Overall, the subjects' achieved a median MAS score improvement of 9 points (p<0.001). An equation to predict the MAS score improvement following ISR was derived: MAS score improvement = 5.273 + 0.114(LOS)+ 4.269(OAI <90days). **Conclusion:** ISR was able to improve stroke patients' motor function in our setting. The above-identified predictors can help guide ISR duration for stroke patients and highlight the importance of early enrolment into ISR before the late subacute stroke recovery phase.

Keywords: Inpatient stroke rehabilitation, stroke, physiotherapy, motor function, motor assessment scale, Malaysia

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INTRODUCTION

Stroke is a significant global health problem. Stroke was ranked the third killer and top ten hospitalisation causes in Malaysia (Department of Statistics Malaysia 2020). The number of stroke survivors increases due to advancements in medical care that reduce mortality during acute stroke episodes (Mohd Nordin et al., 2016). The years-lived post-stroke in most stroke survivors is at least five years, with the majority of them having continuous neurological deficits and requiring continuous rehabilitation (Brønnum-Hansen et al. 2001).

Stroke rehabilitation services are commonly delivered in the sub-acute phase once the stroke survivor is medically stable (Lindsay et al. 2016). Stroke rehabilitation constitutes the primary mode of therapy to improve quality of life and function outcomes following stroke by aiming to help stroke survivors achieve the maximum physical, functional and psychological recovery (Langhorne et al. 2011; Ng et al. 2013). In stroke rehabilitation, relearning of skills as before the stroke will be facilitated. Additionally, stroke survivors and their family members are trained to adapt and compensate for post-stroke deficits (Langhorne et al. 2011).

Inpatient stroke rehabilitation (ISR) is an essential stroke service under the Global Stroke Guideline and Action Plan by World Stroke Organization (Lindsay et al. 2016). ISR provides hospital-level care to stroke survivors who require intensive and interdisciplinary rehabilitation care under a physiatrist or physician (Winstein et al. 2016). Several guidelines have recommended enrolment in ISR for post-acute care (Burris 2017; Lindsay et al. 2018; NICE 2013; Sall et al. 2019). ISR has been shown to reduce mortality, length of inpatient stay and improve activity daily living (ADL) independence among stroke survivors

(Kollen et al. 2006). Additionally, stroke survivors enrolled in ISR for post-acute care have been shown to achieve higher functional gains than other facilities such as skilled nursing facilities (Chan et al. 2013). Generally, ISR is recommended for stroke survivors who are (1) too disabled to return home, (2) able to participate in therapy with adequate cognition and fitness, (3) require continuous medical rehabilitation and education by interdisciplinary rehabilitation professionals, and (4) have sufficient social support to return to home (Department of Health and Human Services 2012).

The outcomes on motor function of stroke survivors following ISR can be highly variable. Predicting clinical outcomes of stroke survivors receiving ISR at the time of admission is crucial as it has been shown to improve the efficiency of rehabilitation and improve therapists' confidence (Stinear et al. 2019). Similarly, estimating stroke survivors' future discharge outcomes by utilising the baseline clinical information during early enrolment in ISR would help clinicians design better-targeted treatment strategies with more realistic rehabilitation goals and anticipate the patient's assistive needs and discharge care plan (Harari et al. 2020).

Developing countries such as Singapore and Thailand had reported the positive outcomes of ISR on functional gains in stroke survivors (V Kuptniratsaikul et al. 2009; Ng et al. 2013; Suksathien et al. 2015). However, data on ISR outcomes in Malaysia is lacking. The data from other countries cannot be generalised into our local setting given the difference in ISR setting, health policy, practices and outcome measures used. In addition, information on the effects of length of stay (LOS) during ISR is needed as Malaysia is a country with subsidised healthcare. Thus, this study aimed to assess the motor function outcomes among stroke patients following ISR in a rehabilitation hospital and identify the predictors affecting their motor function improvement.

MATERIALS AND METHODS

Study design, setting and population

This retrospective observational study was conducted from October 2016 to October 2017 at Hospital Rehabilitasi Cheras (HRC) Kuala Lumpur, the first rehabilitation hospital in Southeast Asia. HRC was officially operated in March 2013. In HRC, the multidisciplinary stroke rehabilitation team consists of an interdisciplinary team that includes a physician, physiotherapist, occupational therapist, speech therapist, audiologist, pharmacist, nurses and dietician. Stroke survivors admitted to HRC were commonly referred from the acute hospital setting. Before admission, all referred stroke survivors were assessed and screened by a rehabilitation physician in the clinic. Upon admission, stroke survivors were initiated on rehabilitation treatment/program within 24 hours. The duration of each physiotherapy session was 60 minutes per day, five times a week.

Ethics approval

This study was approved by the National Medical Ethics & Research Committee (MREC), Ministry of Health, Malaysia (NMRR–16–2296–33394). Informed consent was waived due to the retrospective nature of the study. This study conformed to the principles outlined in the Declaration of Helsinki.

Inclusion criteria

This study's inclusion criteria were: (1) stroke survivors admitted to HRC for ISR from 01 January 2014 and discharged by 31 December 2015; and (2) stroke survivors with the first ISR admission.

Exclusion criteria

This study excluded stroke survivors with: (1) unplanned discharged or discharged at their own risk; and (2) incomplete data.

Data collection

Purposive sampling was used in this study. The admission and discharge lists of stroke survivors were extracted from patients' admission and discharge records. Medical records of stroke patients were traced from the Record Unit of HRC and were screened and reviewed based on eligibility criteria. All encounter stroke patients who fulfilled the inclusion criteria were recruited. Data such as age, gender, ethnicity, actual stroke diagnosis, type of stroke, sites of motor deficits, date of stroke onset, date of HRC admission and discharge, comorbidities, Motor Assessment Scale (MAS) score during HRC admission and on discharge, completion of ISR, and LOS were retrieved from the patients' medical record. The stroke onset to ISR admission interval (OAI) was categorised into <90 days (acute & early subacute), 90 – 180 days (late subacute) and >180 days (chronic) based on phases of stroke recovery (Bernhardt et al. 2017).

Assessment tool

The Motor Assessment Scale (MAS) is a standard assessment tool used in Malaysian public health facilities for stroke survivors. In this study, MAS was used to assess the stroke survivors' motor function in eight areas: rolling, lie to sit, balanced sitting, sit to stand, walking, upper arm function, hand movements, and advanced hand activities. All areas were assessed using a 7-scoring ranging from 0 to 6. The maximum score of 6 indicates the optimal motor function (Carr et al. 1985). All stroke survivors performed each task three times with the best performance recorded for final analyses. All item scores were summed to provide the final overall score. In acute stroke survivors, the MAS has excellent concurrent validity with the Fugl-Meyer Assessment (FMA) for all items, except sitting balance ($r = 0.96$, excluding tonus item) (Malouin et al., 1994). In addition, MAS has excellent inter-rater reliability (mean correlation $r = 0.95$) for both acute and chronic stroke survivors (Carr et al. 1985).

Statistical analysis

Data analysis was performed using the statistical package for social sciences (SPSS) for Windows version 26.0 (IBM Corp., Armonk, N.Y., USA). Descriptive analysis used to describe continuous data was expressed as mean and standard deviations (SD) or median and interquartile range (IQR) depending on

normality distribution, whereas categorical data were reported as counts and percentages. The linear regression models included subjects' demographics and clinical characteristics in determining predictors affecting the motor function progression (improvement of MAS score) among the stroke patients who received intensive ISR in HRC. We included variables with a p-value < 0.25 from the simple regression analysis in the multiple regression model to assess the independent predictors for MAS improvement. Results of regression models were presented as odds ratios with a 95% confidence interval. All statistical tests with a p-value of < 0.05 denote statistical significance.

RESULTS

Subjects' demographics and clinical profile

A total of 238 stroke survivors were discharged from the Physiotherapy Unit of HRC from January 2014 to December 2015. After screening, a total of 124 subjects were included in the final analyses (Figure 1).

The majority of the subjects were male (n = 93, 75.0%), Malay (n = 85, 68.5%) with a mean age of 53.9 (SD = 13.6) years. More than half of the subjects had an ischemic stroke (n=99, 79.8%) and motor deficit at the right side (n = 66, 53.2%). Also, most stroke patients admitted to HRC had stroke onset to admission interval of below 90 days (n = 77, 62.1%).

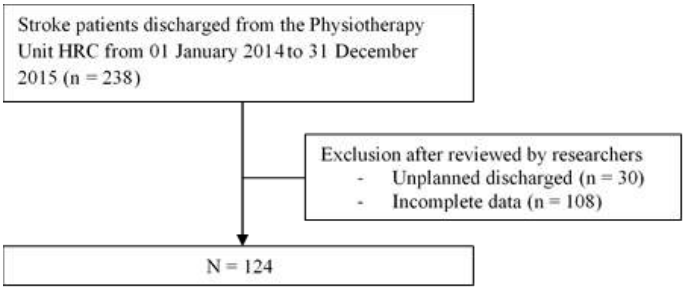

Figure 1: Study recruitment profile

MAS score changes at discharge

The median improvement of the MAS score achieved was 30 (19.0 – 41.8) (Table I). Overall, ISR in HRC significantly improved the motor function of stroke patients upon discharge (p < 0.001) (Table II).

Predictors of MAS score improvement

An equation to predict the improvement of MAS score for stroke patients who received intensive ISR: MAS score improvement = 5.273 + 0.114 (LOS) + 4.269 (OAI < 90 days), was derived from the multiple linear regression model (Table II). There were significant positive relationships between (1) LOS and MAS score improvement and (2) OAI < 90 days and MAS score improvement. When there was an increase in LOS by ten days, the MAS score improved by 1 point. Similarly, if stroke patients were admitted for intensive ISR within 90 days from the stroke onset, their MAS score improved by 4 points (Table III).

Table I: Subjects' demographics and clinical characteristics (n=124)

Variables	Frequency, n (%), mean (SD), or median (IQR)
Age, in years (mean (SD))	53.9 ± 13.6
Gender, n (%)	
Male	93 (75.0)
Female	31 (25.0)
Races, n (%)	
Malay	85 (68.5)
Chinese	24 (19.4)
Indian	12 (9.7)
Others	3 (2.4)
Motor deficit, n (%)	
Right	66 (53.2)
Left	46 (37.1)
Both sides	11 (8.9)
None	1 (0.8)
Stroke type, n (%)	
Ischemic	99 (79.8)
Haemorrhagic	20 (16.1)
Mixed	5 (4.0)
Chronic comorbidities, n (%)	
Hypertension	97 (78.2)
Diabetes mellitus	54 (43.5)
Ischemic heart disease	12 (9.7)
Dyslipidaemia	28 (22.6)
Recurrent stroke	5 (4.0)
Atrial fibrillation	3 (2.4)
Chronic kidney disease	4 (3.2)
Malignancy	4 (3.2)
Number of Chronic Comorbidities, n (%)	
0	15 (12.1)
1	27 (21.8)
2	41 (33.1)
3	30 (24.2)
4	9 (7.3)
5	2 (1.6)
Length of stay, days	
Median (IQR)	30 (19.0 – 41.8)
Range	5 – 89

Table II: Change of MAS score upon completion of intensive ISR among stroke patients

MAS score on admission Median (IQR)	MAS score upon discharge Median (IQR)	Z statistics	p-value[a]
17 (8 – 28)	26 (17 – 33)	-9.313	<0.001

[a] Wilcoxon signed-rank test

Table III: Simple and multiple linear regression analyses of the possible predictor for the improvement in MAS score

Predictor variables	MAS score Improvement					
	Simple linear regression			Multiple linear regression		
	b (95% CI)	t	P-value	b (95% CI)	t	P-value
Age	-0.018 ([-]0.092 – 0.056)	-0.480	0.632			
Male gender	0.376 ([-]1.951 – 2.703)	0.320	0.749			
Ischemic stroke	-0.319 ([-]2.831 – 2.193)	-0.023	0.802			
Hemorrhagic stroke	-0.519 ([-]3.258 – 2.220)	-0.375	0.708			
Mixed CVA	3.141 ([-]1.952 – 8.235)	1.221	0.224			
LOS	0.107 (0.047 – 0.167)	3.547	0.001	0.114 (0.059 – 0.169)	4.605	<0.001
Number of chronic comorbidities	-0.026 ([-]0.885 – 0.833)	-0.060	0.952			
OAI <90 days	4.068 (2.122 – 6.013)	4.139	<0.001	4.269 (2.434 – 6.104)	4.070	<0.001
OAI 90 - 180	-2.487 ([-]5.191 – 0.218)	-1.820	0.071			
OAI > 180 days	-3.646 ([-]6.000 – [-]1.293)	-3.067	0.003			

b = adjusted regression coefficient
Stepwise multiple linear regression method applied. Model assumptions are fulfilled.
No interaction and multicollinearity were detected.
Coefficient of determination, $r^2 = 0.216$

DISCUSSION

To our knowledge, this is the first study in Malaysia to assess the ISR outcomes in a rehabilitation hospital. This study provides an insight into the clinical profile and motor outcomes of stroke patients enrolled in ISR of a rehabilitation hospital. Also, this is the first Asian study reporting the predictors of MAS improvement among stroke patients enrolled in ISR. Our study findings suggested that ISR is beneficial to stroke patients, with early enrolment and a longer LOS improved stroke patients' MAS score better.

The mean age of stroke patients in this study is far younger than 62.5 years reported by the Malaysia National Stroke Registry (Abdul Aziz et al. 2017). Also, their mean age is younger than stroke patients reported in most Asian countries such as Indonesia, India, Thailand, Singapore and Japan (Abdul Aziz et al. 2017; Ling et al. 2020; Toyoda et al. 2019). Younger stroke survivors in our population is a concern as they might have greater social and economic consequences, such as returning to work (Crichton et al. 2012). Besides, the predominantly male stroke survivors in this study were consistent with the Malaysia National Stroke Registry (Abdul Aziz et al. 2017). Male gender is a known risk factor for stroke up to 75 years old (Rosamond et al. 2007). Various general and sex-specific risk factors such as pre-existing comorbidities, tobacco usage, alcohol consumptions, changes in testosterone level and others play a role in the higher incidence of stroke in males (Girijala et al. 2017).

Ischemic stroke was the commonest stroke type in this study, consistent with the Malaysia National Stroke Registry (Abdul Aziz et al. 2017). Additionally, this study found hypertension, diabetes, and hyperlipidaemia as the top three comorbidities among stroke survivors; all are modifiable risk factors for stroke (Boehme et al. 2017). It is crucial to note that hypertension is the most important modifiable risk factor for stroke, as there was a strong, direct, linear, and continuous relationship between blood pressure and stroke risk (Boehme et al. 2017). Similarly, diabetes mellitus increases the risk of stroke by two-fold, and stroke accounts for about 20% of deaths in diabetic patients (Boehme et al. 2017). The prevalence of hypertension, diabetes and hyperlipidaemia among Malaysians were high, with 8.1% (1.7 million) and 16.2% (3.4 million) of adults having three and two of these risk factors, respectively (Institute for Public Health 2020). Thus, the health authorities and individuals must prevent and control these non-communicable diseases to reduce the incidence of stroke.

Multiple studies and a network meta-analysis had shown the benefits of ISR where stroke patients who received organised inpatient care are more likely to be alive, living at home, independent in looking after themselves 1-year post-stroke, achieved optimal functional ability, and improved psychological status and quality of life (Vilai Kuptniratsaikul et al. 2009; Langhorne et al. 2020). Consistent with the literature, our study also found the positive finding that ISR in our rehabilitation hospital can effectively improve motor function among stroke survivors.

The mean LOS for ISR in this study was longer than 18 to 28 days reported in Singapore, Thailand and Australia, probably due to newly established settings and lack of guidelines on the optimum duration of ISR (Vilai Kuptniratsaikul et al. 2009; Ng et al. 2013; The Stroke Foundation 2020). The previous studies have found variable outcomes for the effect of LOS on functional outcomes. A study in Thailand has shown that stroke patients who had longer ISR LOS had a lower functional score (Barthel Index) at 1-year (Vilai Kuptniratsaikul et al. 2013). In another study, a longer ISR LOS was significantly associated with lower total and motor Functional Independence Measure (FIM) scores at discharge in moderate stroke patients. However, in severe stroke patients, a longer LOS is associated significantly with higher total FIM scores and more likely

to be discharged home (Horn et al. 2005). Our study has found a positive correlation where stroke patients with a longer ISR LOS predict a better motor function improvement at discharge. However, a longer LOS for stroke patients can increase the healthcare burden as Malaysia is a country that provides subsidised healthcare to its citizens. Thus, an optimal LOS needs to be identified to ensure a cost-effective rehabilitation therapy for stroke patients.

Time since stroke may affect how the brain re-organises itself due to its association to the remaining levels of neural plasticity (Cramer 2008). Following the central nervous system reorganisation, the resulting neurophysiological processes, for example, cortical excitability and interhemispheric inhibition during task-oriented interventions, may affect motor function improvement (Cramer 2008; Takechi et al. 2014). Previous studies utilising an unstandardised duration of OAI (short OAI of < 20 days, medium OAI of 20 – 40 days, and long OAI of >40 days) had shown variable outcomes of ISR (Gagnon et al. 2006; Paolucci et al. 2000). Our study utilised a more recent definition of stroke recovery phases by where OAI of < 90 days include stroke patients with both acute and early subacute phases (Bernhardt et al. 2017). The positive predictive value of stroke patients with OAI < 90 days in this study was consistent with other studies (Gagnon et al. 2006; Horn et al. 2005; Vilai Kuptniratsaikul et al. 2013). On the contrary, one study found that only stroke patients with OAI < 20 days had significantly greater functional improvement, whereas stroke patients who joined ISR later were associated with poor functional improvement (Paolucci et al. 2000). Our study suggests that stroke patients should be referred early to receive ISR to achieve a better motor function improvement.

Increasing age is often associated with additional comorbidities and disabilities, impacting rehabilitation outcomes in stroke patients (Ween et al. 1996). However, the impact of age on stroke recovery remains inconclusive as there is conflicting evidence on the impact of age on functional outcomes, LOS, discharge destination, and mortality post-stroke (Teasell & Hussein 2018). In this study, age is not a predictor of MAS score improvement. Nevertheless, older stroke patients showed comparable improvements following rehabilitation and should be given equivalent priority in ISR (Luk et al. 2006).

A systematic review reported that females generally have worse functional outcomes than males in the long term after stroke, probably due to the differences in demographic, social, and medical histories (Gall et al. 2012). However, gender is not a predictor of motor function improvement following ISR in our study, in agreement with a more recent study where there was no significant difference between gender in achieving good functional outcomes (motor-FIM) (Scrutinio et al. 2020).

Brain injury and recovery mechanisms are different between ischemic and haemorrhagic stroke. The mechanisms of brain injury in ischemic stroke involve ischemia, inflammation and mass effect secondary to cerebral oedema (Deb et al. 2010). On the other hand, haemorrhagic stroke has additional toxic effects of lysed blood on the brain parenchyma and vasculature and the mass effect from the hematoma (Benowitz & Carmichael 2010). The data on the effect of ischemic and haemorrhagic stroke types on motor function improvement and functional outcomes during ISR is scarce. Although the available evidence was inconclusive, haemorrhagic stroke survivors were generally perceived to have better neurological and functional prognoses than ischemic stroke survivors (Perna & Temple 2015). One study had found that although there were no differences in discharge FIM or FIM improvement between stroke types, haemorrhagic stroke patients showed faster functional motor improvement and had shorter LOS (Chae et al. 1996). Similarly, our study found that stroke type did not predict motor function improvement during ISR.

The presence of comorbidities in stroke patients can considerably impact their frailty and functional impairment through organ-level impairments and pathophysiological changes (Fried & Guralnik 1997). Several studies have demonstrated the negative association between the numbers of comorbidities and functional outcomes post-stroke (Berlowitz et al. 2008; Jiang et al. 2020; Simić-Panić et al. 2018). However, there was no previous study that reported the impact of the number of comorbidities on MAS score. Our study found that the number of comorbidities in stroke patients did not affect their MAS score changes during ISR. However, different underlying comorbidities may impact the rehabilitation outcomes differently. For example, patients who were physically and/or cognitively frail pre-stroke due to their pre-existing comorbidities often have poorer cardiovascular and neuromuscular reserve due to lower pre-stroke physical activity and worse hemodynamic and collateralisation that impedes post-stroke functional recovery (Stroud et al. 2009). Some pre-existing comorbidities, such as dementia or previous stroke, can increase the risk of post-stroke cognitive decline that hinders neuropsychological adaption (Appelros et al. 2002). Due to the limited sample size, all comorbidities were not individually analysed and included in the multiple regression analysis in this study.

We acknowledged several limitations in this study. First, this study's retrospective observational nature may affect the data quality as the study primarily relies on the accuracy of documentation. Secondly, all subjects received ISR in a rehabilitation hospital. The outcomes of this study may not apply to other health facilities due to differences in settings and multidisciplinary involvement. Thirdly, there was unstandardized documentation in the medical records during the early establishment of the rehabilitation hospital. The lack of information on stroke severity and reperfusion intervention may affect the study outcomes. Furthermore, the individualised amount or intensity of mobility training received during ISR based on stroke patients' ability, tolerability, and endurance may affect their motor function outcomes. Lastly, this study involved

only subjects from one rehabilitation hospital in the urban capital city of Malaysia. Thus, the prevalence results obtained in this study may not represent all hospitals in Malaysia.

Nevertheless, this study's findings added knowledge on the motor function improvement in stroke patients who received ISR in a rehabilitation hospital. The identified predictors provide hints on the effects of ISR duration and early enrolment to ISR post-stroke. Future studies should include a larger sample size from multicentre of different regions that provide ISR and more outcomes measures.

CONCLUSION

ISR was able to improve stroke patients' motor function in our setting. The improvement of MAS score following ISR can be predicted by LOS and OAI. The identified predictors can help guide ISR duration for stroke patients and highlight the importance of early enrolment into ISR before the late subacute stroke recovery phase.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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ORIGINAL ARTICLE

Association of Home Environment and Physical Activity among Pre-Schoolers in Malaysia: A Cross-sectional Study

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ABSTRACT

Background and Objective: Home environment is important in supporting children's physical activity level as young children spend more time at home. The aim of the study was to determine the association of home environment and physical activity levels among pre-schoolers. **Methods:** A cross-sectional study that involved a total of 107 subjects (male=61, female=46) aged between 4 to 6 years old was conducted. Data on socio-demographic factors (age, gender, ethnicity, height, and weight of the children) were collected. Home Opportunities for Physical Activity Check-Up (HOP-Up) questionnaire was utilised to evaluate the availability of physical activity equipment and the space inside and outside of the homes as well as in the neighbourhoods. Early Years Physical Activity Questionnaire (EY-PAQ) was used to measure the levels of physical activity. **Results and Conclusions:** Prevalence of overweight and obesity among the pre-schoolers were 13.1% and 11.2% respectively. The body mass index of the subjects was higher among males compared to females. More than half of the pre-schoolers (56.1%) were reported to have low physical activity level. The variables associated with physical activity levels were ethnicity and attending after school childcare. A significant association was found between body mass index and physical activity level ($p = 0.002$). Home environment has a significant positive correlation with physical activity level ($p = 0.011$). Parent-teacher education program is suggested to be implemented for home-based and school-based interventions to improve physical activity and to prevent further complications in child's life.

Keywords: Home environment, obesity, overweight, physical activity, pre-schoolers, Malaysia

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INTRODUCTION

Obesity is a result of unnecessary or abnormal accumulation of fats caused by an imbalance between energy intake and energy expenditure. Previous studies reported that obesity is the major cause of many serious health diseases among Asians. The prevalence of childhood obesity is increasing rapidly in Malaysia in tandem with increasing global prevalence (Nor, Ghozali & Ismail 2019). The rising numbers of pre-schoolers having childhood obesity will further lead to rising health issues among the children. Obese children will have the risk of having many health problems such as cardiovascular disorder, metabolic disorder as well as sleeping disorder. Thus, action should be taken for obesity prevention (Sahoo et al. 2015). In addition, children aged between 3 and 7 years old will undergo a second rise in adiposity or body mass index (BMI). This phenomenon can be defined as adiposity rebound (Cole 2004). Fatness in adolescence and adulthood can be predicted by the period of adiposity rebound (3 to 7 years old). Hence, if the children are obese during the adiposity rebound period, the children will have a high risk to be obese in later life. Meanwhile, Guo et al. (2002) reported that childhood obesity usually will persist to adulthood.

Therefore, it is important to know the prevalence of obesity among pre-schoolers since the adiposity rebound period is the critical period of growth; it will never be too late to teach and change the obese children's lifestyle to reduce their weight. However, most of the studies on physical activity (PA) were targeting children aged above 6, and only a few studies targeted preschool-aged children as their study population, especially in Malaysia. Hence, there is a lack of knowledge regarding PA among pre-schoolers in Malaysia. The physical activity among young children is sporadic and intermittent in nature. The pre-school children are known as the most active population but the PA of the young children are mostly consisting of short burst of moderate-to-vigorous physical activity (MVPA) accompanied with resting or activities with low intensity like walking (Cliff, Reilly & Okely 2009). Young children aged 3 to 5 years rarely involve in PA in a continuous period. According to Australian Government

Department of Health (2019) healthy young children have to perform at least 180 minutes (3 hours) daily or accumulation of 60 minutes (1 hour) of MVPA to maintain adequate PA level. Otherwise, the children will be considered having low levels of PA. Majority of preschool-aged children tend to be sedentary and inactive (Barros, Lopes & Barros 2012). Hence, healthy behaviour like PA is usually entrenched during early childhood since there is an evident state that behaviours will track into their later life. Thus, early childhood should be targeted as a significant time to foster PA among the children.

A good body of studies established the role of social, environmental factors and neighbourhood level and built environment affecting the PA level, but the home physical environment has been neglected (Ding et al. 2011). Young children spend a proportion of time at home; therefore, the home environment is very important in supporting children's PA level. Home environments like space of the house, yard directly outside of the house, and nearby playgrounds might also be elements that affect the children's PA level. Since the interaction of behaviours like PA and environment occur simultaneously and reciprocally, varying the home environment could increase or decline the PA level. It is very important to understand the correlates of the home physical environment and PA because children have less autonomy in their behaviour. Thus, this is an important issue to be focused to improve young children's PA level and prevent obesity. Therefore, the main purpose of this study was to investigate the association of home environment and PA level among pre-schoolers in Malaysia.

MATERIALS AND METHODS

Study design and sample selection

A cross-sectional study was conducted to determine the PA level and obesity among pre-schoolers in Kajang, Malaysia. The study focused on the association of the home environment to the level of PA among pre-schoolers. This study was conducted at eight pre-schools in Kajang. The target population in this study was pre-schoolers aged between 4 and 6 years. Since this is a proxy-reported study, the parents of the subjects completed the questionnaire. Sample size was calculated using G-Power. Convenient sampling method was used in this study.

Procedure

The questionnaires were distributed among the parents of pre-schoolers. A short briefing on the data protection and background of the study was carried out. This questionnaire took approximately three to five minutes to complete. This questionnaire consisted of three sections: socio-demographic data, Early Years Physical Activity Questionnaire (EY-PAQ), and Home Opportunities for Physical Activity Check-Up (HOP-Up).

Demographic data

The socio-demographic factors included the age, gender, and ethnicity of the children. The height and weight of the children was also included in this section and the BMI was calculated based on this information by dividing the body weight in kg by square of height in meters. Then the BMI was compared with the CDC growth chart. The child was considered as overweight if the BMI is in the range of 85th percentile to less than the 95th percentile based on the CDC growth charts. If the BMI is equal to or greater than 95th percentile based on CDC growth charts, the child was considered obese (Center for Disease Control and Prevention 2021).

Instruments

Early Years Physical Activity Questionnaire (EY-PAQ)

Early Years Physical Activity Questionnaire (EY-PAQ) is a proxy-reported questionnaire used to measure the levels of moderate-to-vigorous physical activity (MVPA) and sedentary time (ST) in young children (Bingham et al. 2016). The frequency and duration of different MVPA activities engaged by the child in the last seven days were reported by parents through the questionnaire. This questionnaire consists of 16 items. The items calculating the MVPA were: (1) playing actively in the house; (2) playing actively in the garden; (3) walking from place to place; (4) engaging in active play causing sweating and increased breathing; (5) playing in the park or playground, and (6) playing at indoor play facilities. Pre-schoolers should perform at least 60 minutes (1 hour) of MVPA per day. Thus, if the daily minutes of MVPA are equal to or more than 60 minutes, PA level was considered high. While if the daily minutes of MVPA was lesser than 60 minutes, the PA level of pre-schoolers was considered low.

Home Opportunities for Physical Activity Check-Up (HOP-Up)

HOP-Up (Home Opportunities for Physical Activity Check-Up) questionnaire was utilised to evaluate the availability of PA equipment and the space inside and outside of the homes as well as in the neighbourhoods. The frequency of equipment and space accessed also been asked in the questionnaire. This questionnaire consists of five scales: Scale A is Indoor Home Space & Supports for Physical Activity, Scale B is Outdoor/Yard Space & Supports for Physical Activity, Scale C is Outdoor Space & Supports for Physical Activity, Scale D is Neighbourhood Environment Safety and Scale E is Frequency of Active Play Outdoors. The minimum total score is 15 while maximum score is 90. Higher scores indicate higher availability of space, higher availability of PA supports, high positive parent policies toward physical activity, easier to access to physical activity, higher sense of safety for physical activity, and higher frequency of PA. Intra-class correlations (ICCs) examining HOP-Up item agreement between researcher and parents revealed slight to substantial agreement (range 0.22 to 0.81) for all items (Cheng et al. 2016).

Table I: Demographic data of subjects

Variable	n (%)
Age	
4 years old	27 (25.2)
5 years old	41 (38.3)
6 years old	39 (36.4)
Gender	
Male	61 (57.0)
Female	46 (43.0)
Ethnicity	
Malay	8 (7.5)
Chinese	82 (76.6)
Indian	16 (15.0)
Others	1 (0.9)
Attending after school child care	
Yes	35 (32.7)
No	72 (67.3)
Numbers of children in the family	
Only 1	17 (15.9)
2 to 3	79 (73.8)
4 to 5	10 (9.3)
More than 5	1 (0.9)
Both parents are working	
Yes	81 (75.7)
No	26 (24.3)

Data analyses

Data analyses were performed using IBM Statistical Package for the Social Sciences-version 24. The level of significant difference was set at ($p<0.05$). Descriptive analysis and correlation analysis such as chi-square test and Spearman correlation were used in this study.

Ethical consideration

Ethical approval was obtained for this study from the Scientific and Ethical Review Committee (SERC) of Universiti Tunku Abdul Rahman (UTAR). Informed consent was obtained from the participants. Moreover, the participants were notified of the confidentiality of the information given by them and the right to withdraw from the study at any given moment.

RESULTS

A total of 107 subjects' parents completed the questionnaire. The responses of the questionnaire were collected by paper form through face to face survey. The age range of the subjects is 4 to 6 years. Out of 107 subjects, 27 (25.2%) were 4 years old, 41 (38.3%) were 5 years old, 39 and (36.4%) were 6 years old. Among 107 subjects, there were 61 males (57.0%) and 46 females (43.0%). Most of the subjects were Chinese (n = 82, 76.6%), followed by Indians (n = 16, 15.0%), Malays (n = 8, 7.5%) and another ethnicity (n = 1, 0.9%). Most of the subjects did not attend after school child care (n = 72, 67.3%). Only 35 (32.7%) subjects were attending after school child care. 79(73.8%) subjects live in a family with 2 to 3 children (including subject), 17 (15.9%) subjects have no siblings since the subjects were the only one child in the family, 10 (9.3%) subjects live in a family with 4 to 5 children and 1 (0.9%) subject live in a family with more than 5 children (Table I). Height, weight, BMI and classification of BMI of subjects are shown in Table II.

Table II: Height, weight, BMI and classification of BMI of subjects

Variable	n (%)	Mean (SD)
Height (cm)		108.78 (11.34)
Weight		18.62 (4.72)
BMI (kg/m^2)		15.67 (2.98)
Classification of BMI		
Underweight	22 (20.6)	
Healthy weight	59 (55.1)	
Overweight	14 (13.1)	
Obesity	12 (11.2)	

Table III: Total duration of different activities (mins/wk), total duration of MVPA (mins/wk) and daily minutes of MVPA

Variable	Mean (SD)
Total duration of different activities (mins/wk)	
Playing actively inside the house	151.64 (171.80)
Playing actively in the garden/yard	54.86 (61.46)
Engaging in physical activity/active play that makes them sweat or breathe harder	53.78 (57.77)
Walking	112.64 (162.42)
Playing at the park/playground	43.39 (43.45)
Playing at Indoor play facilities	30.30 (50.32)
Total duration of MVPA (mins/wk)	446.61 (303.17)
Daily minutes of MVPA (mins/day)	63.80 (43.31)

Table V: Association between attending after school childcare and PA level

Attending after school childcare	Physical activity level		χ^2	df	*p-value*
	Low n (%)	High n (%)			
Yes	25 (71.4)	10 (28.6)	4.978*	1	0.026
No	35 (48.6)	37 (51.4)			

*Chi-Square test was performed, df = degree of freedom, Level of significance at $p < 0.05$

The association between gender and classification of BMI was calculated. Female subjects have higher prevalence of healthy weight (n = 27, 58.7%) compared to male subjects (n = 32, 52.5%). Female subjects also have higher prevalence of underweight (n= 13, 28.3%) compared to male subjects (n= 9, 14.8%). In contrast, the prevalence of overweight (n = 10, 16.4%) and obesity (n = 10, 16.4%) among the male subjects were higher than prevalence of overweight (n = 4, 8.7%) and obesity (n = 2, 4.3%) among the female subjects. The difference of the prevalence of classification of BMI among different gender was not statically significant since p = 0.069 which was greater than 0.05. Hence, there was no association between gender and classification of BMI. A total of 60 (56.1%) subjects were having low PA level (<60 minutes MVPA) while there were 47 (43.9%) of subjects having high PA level (>60 minutes MVPA). Table III shows the mean of total duration of different activities per week. The association between age and PA level was calculated.

Table IV: Association between ethnicity and PA level

Ethnicity	Physical activity level		χ^2	df	*p-value*
	Low n (%)	High n (%)			
Malay	4 (50.0)	4 (50.0)	9.463*	3	0.024
Chinese	52 (63.4)	30 (36.6)			
Indian	4 (25.0)	12 (75.0)			
Others	0 (0.0)	1 (100.0)			

*Chi-square test was performed, df = degree of freedom, Level of significance at $p < 0.05$.

The prevalence of low physical activity level among 6 years old (n = 26, 66.7%) subjects was the highest, followed by 4 years old (n =12, 44.4%), then 5 years old subjects (n = 19, 46.3%). There was no association between age and PA level. The association between gender and physical activity level was also calculated.

Table VII: Correlation between daily minutes of MVPA and frequency of active play outdoors

	Mean (SD)	N	r_s	*p-value*
Daily minutes of MVPA	63.80 (43.31)	107	0.201*	0.038
Frequency of active play outdoors **	4.26 (1.20)			

*Spearman correlation analysis was performed, r_s is the correlation coefficient, level of significance at $p < 0.05$.
**The maximum of the score was 10, while the minimum score was 2. The higher the total score, the more frequency of active play outdoors.

There was no association between age and physical activity level (p-value = 0.207). The association between ethnicity and physical activity level was calculated by chi-square test (Table IV). The prevalence of low PA level among Chinese (n = 52, 63.4%) was the highest, followed by Malay (n = 4, 50.0%) and Indian (n = 4, 25.0%). The difference of the prevalence of low PA level and high PA among different ethnicities was statically significant since $p = 0.024$ which was lesser than 0.05. Hence, there was an association between ethnicity and PA level. The association between attending after school childcare and PA level was calculated. (Table V). The difference of the prevalence of low PA level and high PA among different groups of subjects who were attending or not attending after school childcare was statically significant (p = 0.026). Hence, there was an association between attending after school childcare and PA level. The association between number of children in the family and PA level was calculated. There was no statistically significant association between number of children in the family and PA level (p = 0.289). There was no association between number of parents working and PA level (p= 0.241).

Association between PA level and classification of BMI

As shown in Table VI, the prevalence of obesity and overweight were higher among subjects with low PA level, 91.7% (n = 11) and 78.6% (n = 11) respectively compared to prevalence of obesity (n = 1, 8.3%) and overweight (n = 3, 21.4%) among subjects with high PA level. Besides, the prevalence of underweight among subjects with high PA level were 68.2% (n = 15) which was higher than prevalence of underweight among subjects with low PA level 31.8% (n = 7). Meanwhile, the prevalence of healthy weight among high PA level was 47.5% (n = 28), lower than the prevalence of healthy weight among the subjects with low PA level 52.5% (n = 31). The association between PA level and classification of BMI of subjects was statically significant (p = 0.002).

Table VIII: Correlation between daily minutes of MVPA and home environments

	Mean (SD)	N	r_s	*p-value*
Daily minutes of MVPA	63.80 (43.31)	107	0.245*	0.011
Home environments **	56.67 (8.38)			

*Spearman correlation analysis was performed, r_s is the correlation coefficient, level of significance at $p < 0.05$.
**The maximum of the score was 10, while the minimum score was 2. The higher the total score, the more frequency of active play outdoors.

Association between home environment and PA level in daily minutes of moderate to vigorous physical activity

The mean scores of indoor home space and supports for PA was 18.53 (4.58). There was a positive correlation between indoor home space and supports for physical activity and daily minute of MVPA as r_s was 0.375. The strength of the positive relationship was fair. Therefore, there was an association between indoor home space

Table VI: Association between PA level and BMI

Physical activity level	Classification of BMI				χ^2	df	*p-value*
	Under-weight n (%)	Healthy weight n (%)	Overweight n (%)	Obesity n (%)			
Low	7 (31.8)	31 (52.5)	11 (78.6)	11 (91.7)	14.603*	2	0.002
High	15 (68.2)	28 (47.5)	3 (21.4)	1 (8.3)			

*Chi-Square test was performed, df = degree of freedom, Level of significance at $p < 0.05$

and supports for PA and daily minutes of MVPA ($p < 0.001$). There was no association between daily minutes of MVPA and outdoor or yard space and supports for PA ($p = 0.062$). There was no association between daily minutes of MVPA and outdoor space and supports for physical activity ($p = 0.192$). There was no association between daily minutes of MVPA and neighbourhood environment safety ($p = 0.168$).

As shown in Table VII, the mean score of frequency of active play outdoors was 4.26 (1.20). There was a positive correlation between daily minutes of MVPA and frequency of active play outdoors as r_s was 0.201. The strength of the positive relationship was relatively weak. The correlation was statistically significant ($p = 0.038$). Table VIII presents the mean score of home environments was 56.67 (8.38). There was a positive correlation between daily minutes of MVPA and home environment as r_s was 0.245. The strength of the negative relationship was fair. The correlation was statistically significant ($p = 0.011$).

DISCUSSION

The results of the study show that the prevalence of overweight among the pre-schoolers is 13.1% and the prevalence of obesity is 11.2%. The prevalence of obesity among the pre-schoolers is almost similar to the findings of a previous study conducted among pre-schoolers in the United States which was 13.9% (Hales et al. 2017). However, according to another study the prevalence of overweight and obesity among adults in Malaysia are 30.0% and 17.7% respectively which is different with the results of this study (Institute for Public Health Malaysia 2015). Meanwhile, the prevalence of overweight (16.4%) and obesity (16.4%) among the males are higher than prevalence of overweight (8.7%) and obesity (4.3%) among females. However, it is found that there is no statistically significant association between gender and overweight and obesity. This finding is supported by a study conducted in Malaysia that stated the prevalence of obesity was not statistically significant with gender (Zainuddin 2016). In addition, the results of this study revealed that the prevalence of overweight and obesity in Malaysia is high. One of the factors that cause obesity among pre-schoolers is the high screen time among children. According to a previous study, at least two-thirds of children have high screen time which exceeded two hours per day (Atkin et al. 2014). A laboratory-based experimental study suggested that exposure to media screen would increase food intake without increased appetite sensation (Chaput et al. 2011). Therefore, it can be concluded that the high screen times among pre-schoolers will lead to increase in energy consumption and further leads to overweight and obesity among pre-schoolers. Interventions that may change behaviour and/or body composition direct participants to substitute activities, such as active gaming for sedentary gaming, or to earn TV time by participating in PA. However, the acceptability of these changes in the home is debatable, with the need for space, boredom and disruption of other family members.

Another factor that causes obesity among pre-schoolers is dietary intake. A previous study showed that infants with high energy density dietary patterns such as sweet desserts and French fries from 9 months, will have a higher chance to be overweight at 6 years old (Rose, Birch & Savage 2017). Thus, parents should offer healthy food like fruits and vegetables for children. Furthermore, a cross-sectional study conducted in Japan reported that there is an association between the lifestyle behaviour of the pre-schoolers and overweight (Watanabe et al. 2016). In July 2019, a news report from Malaysia reported that a 12-year-old boy with right leg infection passed away due to the complications. that arose by obesity (Bernama 2019). This news report highlighted the severity and fatality of obesity among children. Therefore, parents should play their roles in monitoring children's BMI since young and foster good lifestyle behaviors among children. In a nutshell, the prevalence of obesity and overweight is high among the pre-schoolers in this study. Furthermore, gender is not associated with overweight and obesity in this study. As the lifestyle patterns adopted in childhood are likely to continue in adulthood, analysis of diet or dietary patterns is also among the approaches that can be performed.

The findings of this study revealed that 56.1% of subjects are having low physical activity level, that is having less than 60 minutes of moderate to vigorous physical activity (MVPA) daily. These results show more than half of the subjects did not meet the physical activity guideline that the pre-schoolers should achieve i.e., at least 60 minutes of MVPA daily. This finding is in accordance with a previous study that reported 65.3% (95% CI: 9.4-70.8) of pre-schoolers are having a low level of PA which was less than 60 minutes of outdoor PA daily. Conversely, another study reported that the PA level of pre-schoolers aged between 2 to 6 years old was adequate (Schmutz et al. 2018). One of the possible reasons for the difference in findings is due to the recommended guideline of the previous study used was at least 180 minutes per day of PA while this study is based on the recommendation guideline from the Australian Government Department of Health which is at least 60 minutes of MVPA. Furthermore, the study was conducted in Switzerland. Switzerland has different cultures, seasons and weather compared to Malaysia. Meanwhile, a few studies conducted in Malaysia on the PA level among children reported low PA levels (Sharif et al. 2016; Wafa et al. 2014). It was found that the prevalence of low PA level among 6-year-old children is the highest (n = 26, 66.7%) compared to 4 and 5-year-old children. However, there was no statistically significant association between age and PA level. In addition, high PA level was reported among male subjects (49.2%) than female children (37.0%). However, there is no association between gender and PA level. Meanwhile, the results of this study show that ethnicity is associated with the PA level ($p =$

0.024). The prevalence of low PA among Chinese is the highest, followed by Malays and Indians. Previous studies reported the association between ethnicity and PA which supports the findings in this study (Lee et al. 2017; Ying et al. 2015). The study reported that the prevalence of physical inactivity among Chinese (47%) was the highest. Moreover, the results of this study revealed that there is an association between attending after school childcare and PA level. The results showed low PA levels among subjects attending after school childcare (71.4%) which is much higher than subjects not attending after school childcare (48.6%). This finding was supported by a similar study that reported pre-schoolers had a significantly low PA during childcare hours (Hinkley et al. 2016). This finding may be explained by parents' belief that their children perform enough physical activity in childcare centres and not prioritise PA after childcare hours. Hence, parents should pay more attention to PA in children even if they are attending the after school childcare centres. The findings of this study showed that the prevalence of low PA levels in families with 4 to 5 children is the highest. However, no statistically significant difference is found between the number of children. The results of this study revealed the importance of PA since the low PA level is associated with overweight and obesity. This is in line with another study which reported that MVPA was significantly associated with adiposity among children (Marques et al. 2015). Moreover, a study on parenting practices on affecting the adiposity and physical activity has revealed that parental influences play important roles in children's BMI and lifestyle such as having high physical activity levels (Lloyd et al. 2014). Obesity or high BMI is due to uneven intake and expenditure of energy. Since physical activity is one of the methods for energy expenditures by promoting fat oxidation, parents should foster physical activity behaviour among children since young for obesity prevention.

The main finding of this study was that home environment attributes were significantly associated with children's physical activity level. The finding revealed a significant positive correlation between the home environment and the pre-schoolers' physical activity level (p=0.011). This finding is supported by a cross-sectional study that used direct observation methods in the home environment which had more reliability compared to other studies (Nicola et al. 2008). Besides, a study on the relationship between home environment and children's after school PA reported that the home environment is associated with boys' PA level (Lau et al. 2015). Another previous study also supports that home environment such as home spaces were associated with PA level (Sirard et al. 2010). The home environment is an important influence on the sedentary behaviour and physical activity of children, who have limited independent mobility and spend much of their time at home.

The present study utilized HOP-Up questionnaire to access the home physical environment. This questionnaire includes different subscales such as indoor home space and supports, outdoor or yard space and supports for physical activity, outdoor space and supports for physical activity, and neighbourhood environment safety. The correlation of each subscale is analysed independently with the PA level of the subjects to obtain more specific and detailed results. There is a significant positive correlation between indoor home space and supports for physical activity and PA level ($p < 0.001$). The finding shows that the larger home spaces and the more physical support in the house, the higher the PA level among pre-schoolers. In terms of physical activity supports, current findings are aligning with several previous studies that suggest the availability of home physical activity resources are positively associated with PA levels among children and adolescents (Lau et al. 2015; Sirard et al. 2010). This is because the availability of home physical supports will improve the children's motivation in engaging in physical activity with physical support equipment such as toys and active video games.

A previous study on active video games suggested that active video games are able to promote light to moderate PA among children (Biddiss & Irwin 2010). Thus, parents could consider providing active video games at home as an appealing option to motivate children involving PA in leisure time. Meanwhile, no significant correlation is found between outdoor or yard space and supports for physical activity and PA level among pre-schoolers ($p = 0.062$). In this subscale, the outdoor space is representing space that is immediately outside the house or yard. In addition, both outdoor space and supports for physical activity and neighbourhood environment safety were not significantly correlated to the PA levels among pre-schoolers. A previous study suggested that parents of the subjects, who perceived a high crime rate in the neighbourhood, allowed the subjects to play more in the yard instead of the outdoor (Veitch, Salmon & Ball 2010). Thus, the children's PA level still remains constant no matter the children were playing in the neighbourhood or in the house yard. However, the present study showed that the frequency of active play outdoors is positively correlated with children's physical activity level, but the strength of the relationship is relatively weak. Thus, the explanation is still acceptable since it is not mandatory to let children be physically active outdoor instead of indoors. In summary, this study found a statistically significant association between home environment and physical activity levels among pre-schoolers.

Limitation and recommendations

This study provides preliminary evidence on the link between home environment and PA behaviours of pre-schoolers in Malaysia. However, the results of the current study should be interpreted with caution because of its cross-sectional study design, which limits the ability to make causal inferences. In addition, both the home environment characteristics were proxy-reported and, as such, may have been vulnerable to bias. Therefore, the correlation of the home and neighbourhood environment with children's PA needs to be studied further with increased specificity and improved measures to improve

the quality of evidence. Future research should explore the relationships between parental behaviour, family rules, equipment, and arrangement of the home space, to better understand how physical activity is influenced by the home environment.

CONCLUSION

This study concluded that the prevalence of overweight and obesity are high among pre-schoolers. However, no statistically significant association was found between gender and obesity. Furthermore, the prevalence of PA among pre-schoolers is relatively low. There are no associations found between age, numbers of siblings and numbers of working parents with physical activity levels among pre-schoolers. Meanwhile, the prevalence of low PA level among subjects attending after school childcare is higher than subjects who are not attending after school childcare. A significant positive correlation is found between the home environment and PA level among pre-schoolers. Parents should encourage outdoor activities of children and take steps to decrease screen time of pre-schoolers. More research is needed on correlations between the home environment and PA in Malaysia, particularly using objective measures of the built environment and longitudinal cohort studies to better guide effective health promotion interventions and policies.

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CONFLICT OF INTEREST

The authors declare no conflicts of interest.

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ORIGINAL ARTICLE

Comparison Between Different Eccentric Exercises and Static Stretching Exercise on Hamstring Flexibility: A Randomized Controlled Trial

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ABSTRACT

Background and Objective: Hamstring strain is one of the most common sports injuries contributed by lack of hamstring flexibility as one of the injury risks factors. Eccentric training could serve to reduce the risk of hamstring strain by improving hamstring flexibility. However, the effectiveness of different eccentric hamstring exercise in improving hamstring flexibility is still understudied**.** The aim of this study is to compare the effectiveness of eccentric exercises and static stretching exercise on hamstring flexibility of recreational athletes. **Methods:** A randomized controlled trial was carried out to examine the effects of Nordic Hamstring Exercise (NHE) and Sliding Leg Curls (SLC) on hamstring flexibility of recreational athlete for four weeks. Participants with hamstring tightness were classified as sit and reach test score for less than 30cm for males and 33cm for females. Participants were randomly assigned using sequentially numbered, opaque, and sealed envelopes to three equal groups (n = 15 for each group): NHE, SLC and Static Stretching (SS). Assessor was blinded from participants' group assignment. **Results:** A total of 45 recreational athletes (28 male and 17 female), mean age 20.36 ± 1.25 years participated in the study. There was no difference between eccentric hamstring (NHE and SLC) and static stretching exercise in improving hamstring flexibility (p = 0.82). NHE and SLC exercises are equally effective in increasing hamstring flexibility [NHE: $p < 0.0001$, ES = 0.90, 95% CI (4.36, 6.77); SLC: $p < 0.0001$, ES = 0.70, 95% CI (4.26, 6.09)], as to static stretching [SS: $p < 0.0001$, ES = 0.62, 95% CI (3.18, 4.71)]. **Conclusion:** Eccentric hamstring exercises are equally effective as static stretching in improving hamstring muscle flexibility.

Keywords: Nordic hamstring exercise, sliding leg curls, static stretching, hamstring flexibility

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INTRODUCTION

Hamstring strains are common injuries incurred during sporting activities at high school, collegiate, and professional levels and further accentuated by the high injury recurrence rate (Elliott et al. 2011; Kaux et al. 2015; Kay et al. 2017; Mohd Jamali et al. 2021). Majority of hamstring muscle strain occurs in sports that require sprinting and kicking, namely football, basketball, soccer, rugby, and track and field (Liu et al. 2012). While the exact time of the occurrence remains debatable, it is believed that hamstring strains may occur when the hamstring is in eccentric contraction, and elongated position (Liu et al. 2012).

Despite the high incidence of hamstring strains in several popular sports, there are inconsistence findings on the causation, rehabilitation, and prevention of hamstring strains. The ability to design effective rehabilitation and injury prevention programs are hampered by inadequate understanding of the injury causes. Literature reveals complex intrinsic and extrinsic risk factors of hamstring strains, including poor hamstring flexibility, previous history of a hamstring injury, age, muscle fatigue and insufficient warm-up (Ernlund & Vieira 2017; Liu et al. 2012). However, the evidence of hamstring flexibility as a risk of hamstring strains are inconsistent (Mendiguchia et al. 2012; Thacker et al. 2004). The accepted notion is that athletes with poor hamstring flexibility may have shorter optimum hamstring muscle length and are at a greater risk of hamstring strain injury than athletes with normal hamstring flexibility (Liu et al. 2012).

Stretching exercises including static, dynamic, ballistic and proprioceptive neuromuscular facilitation are widely prescribed to increase hamstring flexibility. Among these exercises, static stretching is commonly practiced as it is effective to increase muscle flexibility, safe and easy to perform. However, recent studies have found that static stretching, if not performed properly, may hamper athletic performance (Simic et al. 2013; Winchester et al. 2008). Therefore, other

effective alternatives, without the risk of reducing athletic performance, are needed.

A study has suggested eccentric exercise to increase muscle flexibility as it is equally effective to stretching in improving hamstring flexibility (Nelson & Bandy 2004), while increasing eccentric strength. Eccentric strength will allow the muscle to withstand the increase of tension during the late swing phase of sprinting owing to eccentric loading and lengthening of the hamstrings (Van Der Horst et al. 2015). Eccentric hamstring strengthening exercises such as the Nordic Hamstring Exercise (NHE), Sliding Leg Curl (SLC), Romanian deadlift, and hip extension exercise become popular in preventing and rehabilitating hamstring strain. NHE is considered to be one of the most effective eccentric hamstrings strengthening exercises (Arnason et al. 2008; Ernlund & Vieira 2017). However, due to the load transmitted to the knee structure in a kneeling position while performing the exercise, it may be unsuitable for an individual with knee pathology or in the early rehabilitation phase. Unfortunately, the effectiveness of the other hamstring exercises with minimal weight bearing such as SLC is limited.

Although previous studies have reported that eccentric hamstring training increases hamstring flexibility, to the best of our knowledge, no studies have been performed to compare the effects of different eccentric hamstring exercises. Thus, the aim of this study is to compare different eccentric exercises and static stretching exercises on hamstring flexibility. This information is crucial to provide athletes, health care and medical professionals with management options to increase hamstring flexibility in various stages of rehabilitation and hamstring injury prevention programs.

MATERIALS AND METHODS

Study design

This study used a single-blinded, randomized-controlled trial design with pre-test and post-test measurements. Participants were randomly assigned to one of the three groups, which were the intervention groups [Nordic Hamstring Exercise (NHE) or Sliding Leg Curl (SLC)], or the control group static stretching (SS). This study was approved by the institution's ethical review committee (UTAR)(U/SERC/144/2018).

Study setting and duration

Data collection was conducted at Physiotherapy Centre, Universiti Tunku Abdul Rahman, Selangor between October to December 2019.

Participants

The sample size was determined using G*Power 3.1 software, where the power was set at 0.80, alpha at 0.05, effect size at 0.25, and additional of 10% to compensate for drop-out rate, which required a total of 45 participants. The ratio of the group allocation is 1:1:1, therefore, 15 participants were allocated for each group. Inclusion criteria were individuals aged between 18 to 25 years old, who have hamstring tightness, and undertake sports at least once a week for leisure (Rosenbloom 2012). Hamstring tightness was defined as receiving a score less than 30cm in males and 33cm in females in sit-and-reach test (Ayala et al. 2012). To ensure reliability of the results, participants with history of back and lower limbs injury in the previous year were excluded. Participants were informed of the benefits and risks of the investigation prior to signing an approved informed consent document to participate in the study. All participants were subjected to a randomization to one of the three groups. Participants were randomly assigned by an investigator using sequentially numbered, opaque, and sealed envelopes. Each envelope contained a carbon paper and paper with one of the three group code labels. No differences in size or weight could be detected among the envelopes. Participant information was written on the envelopes prior to opening. An audit trail was observed with the transfer of information onto the assignment paper using the carbon paper. Subsequently, the coded sealed opaque envelope was opened.

Outcomes

Hamstring flexibility was assessed using the sit and reach test device (ICC = 0.92) (Ayala et al. 2012). The height, length, and width of this box are 12 inches (30.5 cm) and the length on the top of this box is 20 inches (51.4 cm). Participants sat with legs extended and feet flat against the sit and reach device. Participants stretched forward as far as possible with one hand over the other and fingertips in line and held the end point for two seconds. This process was repeated three times and the average score was used for analysis.

Procedures

Pre-test and post-test measurement of hamstring flexibility were performed using the same procedures by the same assessor. The posttest measurement was conducted two to three days after the final day of the intervention session. The same assessor was blinded from participants' group assignment. For the interventions, the investigator (SYC) delivered the interventions to all the participants.

Interventions

Nordic Hamstring Exercise (NHE)

Participants started in a kneeling position on the mat with their arms in front of their chests and upper bodies straightened. Examiner stabilized the participants' ankles. Participants lowered their bodies down slowly as possible by keeping them straight and fell on their arms, and their chests touched the mat when they could not resist the movement and pushed up immediately with their upper limbs (Mjølsnes et al. 2004). Participants performed three sets of four repetitions of NHE for three non-consecutive days. One-minute rest interval was given between sets. The repetitions were increased by two each week for four weeks.

Sliding Leg Curl (SLC)

Participants started by lying on their backs with one knee bent. Participants lifted their pelvic off the floor and slowly slid the bent knee until it was fully extended.

Participants returned to the starting position and repeated the movement. Participants switched sides (Orishimo & McHugh 2015). Participants performed three sets of four repetitions of SLC for three non-consecutive days. One-minute rest interval was given between sets. The repetitions were increased by two each week for four weeks.

Static Stretching (SS)

Participants stood erect with the left foot planted on the floor and the toes pointing forward. The heel of the foot to be stretched was placed on a knee-high stool with the toes directed toward the ceiling (Nelson & Bandy, 2004). Participants leaned their bodies forward as far as possible until a gentle stretch was felt in the posterior thigh, and this position was maintained for 30 seconds while keeping the knee fully extended. Participants performed five repetitions for each leg for two sets with a one-minute rest interval given between sets. Participants performed three times per week for four weeks.

Data analysis

Descriptive statistics were performed on demographic data including age, height, body weight, and body mass

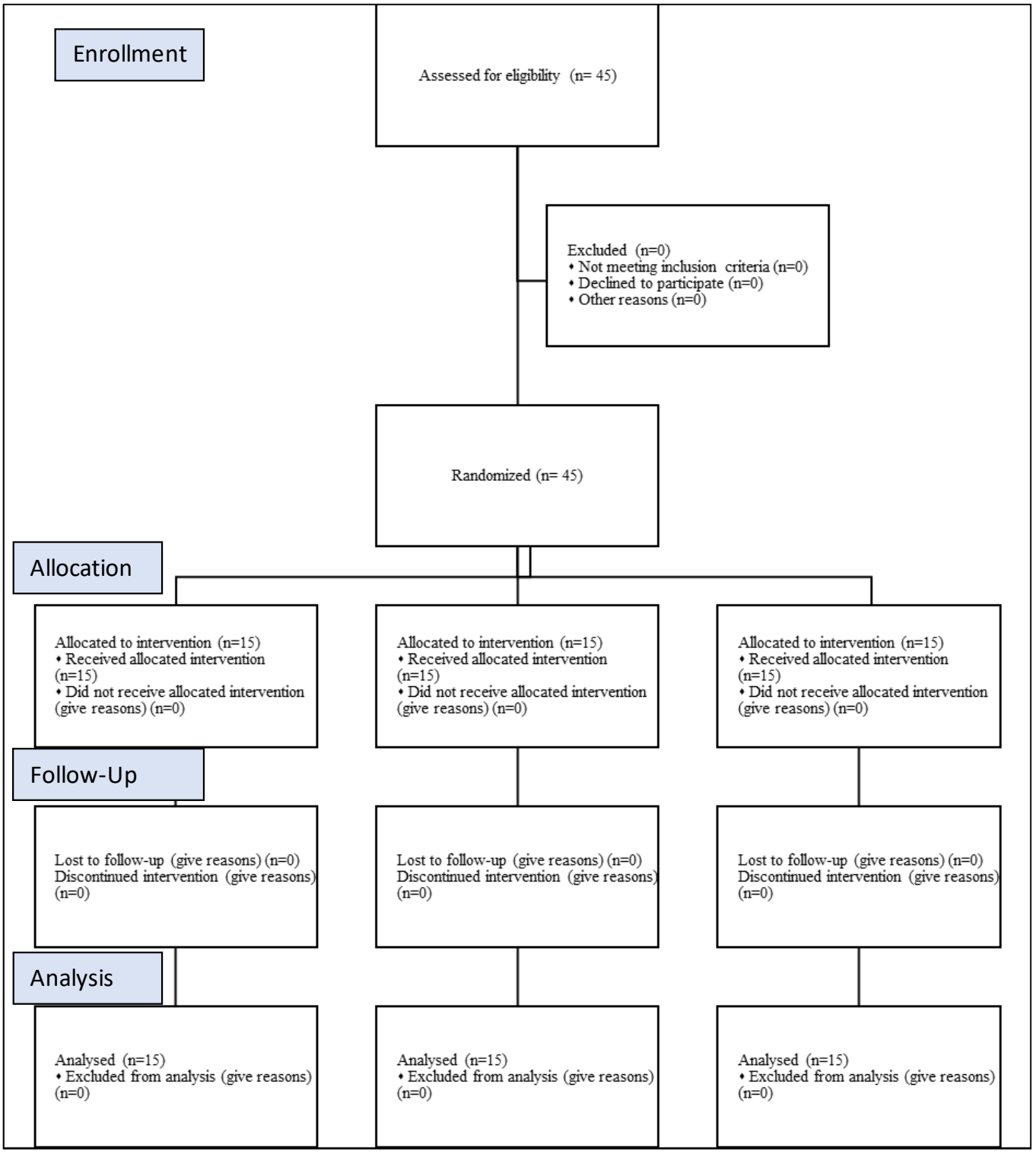

Figure 1: Flow of patients throughout the course of the study

index, and were reported as means (M) and standard deviations (SD). All variables were tested for normality of distribution and met the assumption for the analysis of the variance analyses (one-way and mixed between–within). A one-way analysis of the variance was used to determine the baseline demographic differences and pretest measurements for all variables between the groups. Mixed model analysis of the variance was used to compare the means of the groups to determine whether a significant difference existed. Cohen's d was calculated for pairs with significant differences. Data were analysed using SPSS version 23 (SPSS Inc., Chicago, IL, USA) and the level of significant differences was set at $p < 0.05$.

RESULTS

A total of 45 participants were recruited and included in the analysis (Figure 1). No drop out and important harm occurred. The characteristics are shown in Table I. No group difference between characteristics measures was observed except for age ($p < 0.05$). Majority of the participants were males (n = 28, 62.2%) compared to females (n = 17, 37.8%).

Table I: Participants' anthropometrics measures

Characteristics (n = 45)	NHE (n = 15) M ± SD	SLC (n = 15) M ± SD	SS (n = 15) M ± SD
Age (years)	19.73 ± 1.16	19.93 ± 1.22	21.4 ± 0.51
Height (m)	1.67 ± 0.09	1.68 ± 0.09	1.67 ± 0.08
Weight (kg)	63.53 ± 10.99	70.81 ± 19.96	61.92 ± 15.08
BMI (kg/m^2)	22.72 ± 3.26	24.62 ± 5.39	21.91 ± 3.55

The means (SD) of the hamstring flexibility are shown in Table II and Figure 2. Interaction effect between group and time was observed ($F_{2.42} = 3.43$, $p = 0.042$, partial eta squared = 0.14). Time effect was observed ($F_{1.42} = 345.41$, $p < 0.001$, partial eta squared = 0.89) and indicates significant increase in hamstring flexibility following interventions. No significant group difference was observed in hamstring flexibility pre-intervention ($F_{2.42} = 0.075$, $p = 0.93$, partial eta squared = 0.004) and indicates all groups are equally effective in increasing hamstring flexibility. For all groups, differences were observed in hamstring flexibility following interventions [NHE: $p < 0.0001$, ES = 0.90, 95% CI (4.36, 6.77); SLC: $p < 0.0001$, ES = 0.70, 95% CI (4.26, 6.09); SS: $p < 0.0001$, ES = 0.62, 95% CI (3.18, 4.71)].

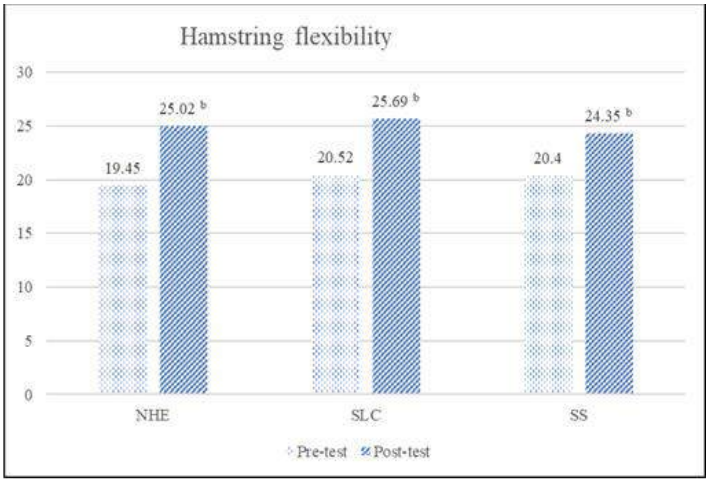

Figure 2: Pre- and post- hamstring flexibility between three groups

DISCUSSION

The aim of this study is to compare the effectiveness of eccentric exercises and static stretching exercise on hamstring flexibility of recreational athletes. After four weeks of intervention, significant improvement in hamstring flexibility was observed in NHE, SLC, and SS with no difference between the three groups. Importantly, this study is the first to report the comparison of different eccentric exercises and static stretching exercise on hamstring flexibility.

Different eccentric hamstring exercises, namely NHE and SLC, effectively increase hamstring flexibility among recreational athletes. The mechanism for the increased hamstring flexibility following NHE and SLC is unclear, however, it could be due to increase in fascicle length contributed by the addition of serial sarcomeres in the muscle fibres (Vogt & Hoppeler 2014), which was observed following other hamstring eccentric exercise i.e. prone hamstring curl (Potier et al. 2009). These changes increase muscle contraction velocity and extensibility, thus allowing more powerful force production at longer muscle lengths, which potentially protect against muscle damage (Vogt & Hoppeler 2014). Increased hamstring flexibility could reduce the risk of hamstring strains especially during sporting activities that imposed high risk of injury to the hamstring such as sprinting (Wan et al. 2017) and kicking (García-Pinillos et al. 2015). On the other hand, fascicle length increases are dependent on the range of lengths used during the intervention (Seymore et al. 2017). The differences in range of motion could lead to a difference in magnitude of architectural changes (Potier et al. 2009).

Table II: Pre and post hamstring flexibility between three groups

Hamstring flexibility (cm)	NHE (n = 15) M ± SD	SLC (n = 15) M ± SD	SS (n = 15) M ± SD	Time effect	Group effect
Pre	19.45 ± 5.91	20.52 ± 7.65	20.40 ± 6.66	< 0.001	0.93
Post	25.02 ± 6.46	25.69 ± 7.17[b]	24.35 ± 6.15		
Difference	5.57 ± 2.17	5.17 ± 1.66	3.95 ± 1.38		
ES	0.90	0.70	0.62		

NHE tends to train on larger knee and hip joint angles, while the SLC tends to train on smaller knee and hip joint angles. However, these effects are not seen in this study.

Significant improvement in hamstring flexibility was also observed in SS, similar to a previous study that found 30 seconds of static stretching, where a slow static stretch facilitates the Golgi tendon organ and produces autogenic inhibition (Davis et al. 2005). With regard to SS chronic effect, a routine program decreases muscle- tendon unit stiffness, but not tendon stiffness, suggesting that SS does not affect the elasticity of tendon structures but affects that of connective tissues in parallel with muscle fibres such as the endomysium, perimysium, and epimysium (Ichihashi et al. 2014). Additionally, a routine SS increases pain thresholds as it modifies the stretch tolerance and inhibits signals from nociceptive fibres by the afferent input from muscles and joints, thus increasing flexibility.

The current study found that eccentric hamstring exercise is equally effective in increasing hamstring flexibility, similar to a previous study by Nelson & Bandy (2004). Although NHE and SLC achieve the same flexibility gains as static stretching, eccentric training offers a more functional option for flexibility training. The multifactorial nature of the hamstrings strain injuries suggests that it is not the sole existence of a single risk factor that leads to injury. NHE and SLC offer both strengthening and flexibility effects. It is believed that after NHE and SLC training, the muscle can generate a greater torque at more extended joint positions, where most damage to the hamstring occurs, further preventing muscle fibre tears that leads to a protection against hamstring strain (Brockett et al. 2001).

When considering the above findings, a few limitations should be taken into account. Firstly, only recreational athlete from 18 to 24 years old were recruited, thus, the findings cannot be generalized to sport-specific athletes of other skill levels, sex or ages. Next, the effects of the eccentric exercises are only limited to four weeks. Further study is needed to determine the effects of different hamstring exercises among sport-specific athletes of other skill levels, gender or ages. Future study should also consider a more extended intervention period.

CONCLUSION

In general, different eccentric exercises such as Nordic Hamstring Exercise and Sliding Leg Curl, and hamstring static stretching effectively improve hamstring muscle flexibility among recreational athletes. The findings provide coaches, athletes, health care and medical professionals with options to effectively increase hamstring flexibility in various stages of rehabilitation and hamstring injury prevention programs.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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ORIGINAL ARTICLE

The Impact of Diabetes Mellitus on Functional Disability among the Patients with and without Diabetic Polyneuropathy: A Comparative Study

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ABSTRACT

Background and Objective: Diabetes mellitus (DM) is a global epidemic associated with increased health expenditure and low quality of life. The complications of diabetes such as diabetic polyneuropathy (DPN) is associated with an increased risk of physical disability, and later may result in early death. The objective of this study was to evaluate the functional disability in patients with and without DPN. **Methods:** A total of 260 subjects were recruited and divided into three groups, DM with DPN (G1), isolated DM (G2), and controls (G3) with 65, 65 and 130 subjects respectively. They were assessed for functional disability with WHO Disability Assessment Schedule 2.0 (WHODAS 2.0) questionnaire. A simple mean and standard deviation were used to analyse the Demographic variables, whereas one-way ANOVA and Tukey test for multiple comparison were used to analyse the data. **Results:** The overall WHODAS scores of the three groups were 48.97 ± 8.87, 38.38 ± 2.83 and 36.26 ± 0.84 respectively. There was a significant statistical difference in WHODAS in G1, G2 and G3 ($p = 0.000$). **Conclusion:** The functional disability is more in patients with DM with and without DPN when compared to controls.

Keywords: Diabetes mellitus, diabetic polyneuropathy, functional disability, WHODAS

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INTRODUCTION

Diabetes mellitus (DM) is a group of metabolic disorders marked by hyperglycaemia known to interfere with insulin production, insulin action or both. DM caused by a number of different pathophysiological mechanisms; these could range from autoimmune death of pancreatic beta cells, resulting in insulin deficiency, to defects that lead to insulin resistance (Edwards et al. 2008). The increasing incidence of DM poses a serious challenge for the medical profession all over the world. Annual worldwide healthcare costs for diabetes treatment and complications prevention are calculated at 727 billion USD in year 2017 and it is estimated as 776 billion USD in the year 2045 (Muc, Saracen & Grabska-Liberek 2018).

DM and its complications are often associated with increasing risk of physical disability (Officer & Groce 2009). Diabetic polyneuropathy (DPN) is present in up to 50% of all chronic diabetic patients and is a major cause of morbidity and mortality (UK Prospective Diabetes Study 1991). In the United States alone, the total costs associated with DPN are USD 10.9 billion a year. Up to 25% of the diabetic patients develop painful neuropathy, characterized by pain, paraesthesia, and sensory loss. Sensory loss can lead to the development of pressure ulcers, balance impairments, an altered gait with potentially increased risk of falling and impaired levels of physical activity. Reduced mobility can lead to restrictions in daily and social activities, dependency on others, depression and as a result decreased quality of life (QoL) (Edwards et al. 2008).

Functional disability is frequently defined as difficulty in performing tasks which are essential for independent living. (Godino et al. 2017; Boyle et al. 2010; Gregg, Beckles & Williamson 2000) such tasks include dressing, lifting or carrying objects, managing money and walking up several flights of stairs. Persons with diabetes are more likely to develop functional disability in tasks of everyday living compared to those without diabetes which in turn, is related to increased expenditures, hospitalizations, and mortality (Hardy et al. 2011; Kalyani et al. 2010; Kalyani et al. 2017). Consequently, functional disability among persons with diabetes represents a significant public health and economic burden. The reasons for this higher prevalence of disability among persons with DM remain unclear but may relate to the presence of comorbidities such as cardiovascular diseases (CVD) and obesity. Socio demographic factors, health status, and lifestyle behaviours may contribute to heterogeneity in the development and progression of functional disability over time (Chen et al. 2016; Boyd et al. 2008).

The World Health Organization Disability Assessment Schedule 2.0 (WHODAS 2.0) is a practical, generic assessment instrument that can measure health and disability at population level or in clinical practice. WHODAS 2.0 quantifies the patient's functioning through analysis of various domains such as cognition, mobility, self-care, good relationship with people, life activities and participation. It consists of 36 questions covering six domains: cognition (6 items); mobility (5 items); self-care (4 items); good relationship with people (5 items); life activities (8 items); and participation (8 items). Each question has five alternatives as possible answers; the first answer represents "No struggle" and the fifth answer "Extreme struggle or unable to perform". The sum of the answers constitutes a 0-100 score in which the higher the number, the worse the functioning level (Chi et al. 2014).

The aim of this study is to find out the impact of DM on functional disability among the patients with and without DPN using WHODAS 2.0 questionnaire, and their functional disability is also compared with the age matched controls (healthy individuals).

MATERIALS AND METHODS

This study was approved by the Institutional Ethical Committee, Voluntary Health Services Hospital, Chennai, KG Hospital, and Post Graduate Institute, Coimbatore. A Power Analysis was used in this study to estimate the minimum sample size required for an experiment, given a desired significance level, effect size, and statistical power. With Power Analysis, 260 samples were needed. This study was conducted over a period of six months which started on March 2019 till August 2019. A total of 130 subjects were identified who met the inclusion criteria and recruited. 65 subjects who were clinician-diagnosed Type 2 DM with DPN were assigned as Group1 (G1 = DM with DPN) (Figure 1). 65 subjects who were clinician-diagnosed Type 2 DM without DPN were assigned as Group2 (G2 = isolated DM). 130 subjects without any metabolic disorders including DM and without any types of associated neuropathy who consented to take part in the study were assigned as Group3 (G3 = controls). Cluster randomization was used to categorize the subjects into respective groups. Written consent was obtained from the individuals. A simple mean and standard deviation were used to analyse the demographic variables; one-way ANOVA and Tukey test for multiple comparison were used to analyse the data. The one-way ANOVA was used to determine whether there are any statistically significant differences between the means of three groups. Tukey test uses pair wise post-hoc testing to determine whether there is a difference between the mean of all possible pairs using a studentized range distribution. This method tests every possible pair of all groups.

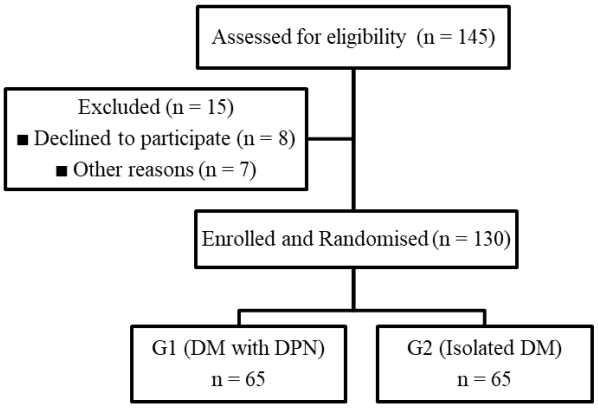

Figure 1: Flow of patients throughout the course of the study

RESULTS

Table I describes the demographic variables which include the age, gender, years of formal education, marital status, and co morbidities. Table II shows the means and standard deviations of WHODAS in G1 was 48.97 ± 8.87, in G2 was 38.38 ± 2.83 and in G3 was 36.26 ± 0.84. The results of one-way ANOVA were statistically significant in WHODAS in G1, G2 and G3 (p = 0.000), along with F-ratio = 164.496. Table III shows the multiple comparisons of WHODAS scores among the groups. The Tukey honestly significant difference (HSD) test was

Table I: Demographic Variables

S. N.	Characteristics		G1 (DM with DPN) n = 65	G2 (Isolated DM) n = 65	G3 (Controls) n = 130
1	Age		60.52 ± 12.86	67.85 ± 7.77	65.46 ± 9.45
2	Gender	Female	30 (46.2%)	32 (49.2%)	66 (50.8%)
		Male	35 (53.8%)	33 (50.8%)	64 (49.2%)
3	Years of formal education		8.69±4.39	8.34±4.37	9.11±3.16
4	Marital status	Never married	3 (4.6%)	5 (7.7%)	0 (0%)
		Currently married	27 (41.5%)	34 (52.3%)	102 (78.5%)
		Separated	3 (4.6%)	4 (6.2%)	0 (0%)
		Widowed	32 (49.2%)	22 (33.8%)	28 (21.5%)
5	Comorbidities	Present	64 (98.5%)	56 (86.2%)	116 (89.2%)
		Absent	1 (1.5%)	9 (13.8%)	14 (10.8%)

Table II: ANOVA between the groups G1, G2 and G3

	G1 (DM with DPN) n = 65	G2 (Isolated DM) n = 65	G3 (Controls) n = 130	F-ratio	p-value
WHODAS	48.97 ± 8.87	38.38 ± 2.83	36.26 ± 0.84	164.496	0.000*

*significant at p < 0.05

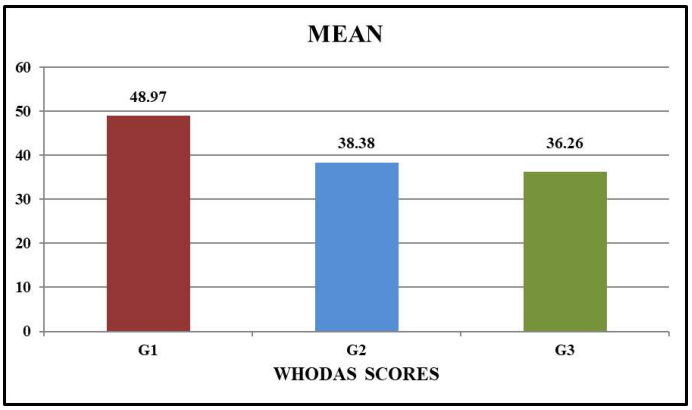

Figure 2: WHODAS scores in each group

Table III: Multiple Comparisons of WHODAS scores between G1, G2 and G3

Dependent variable	(I) Group	(J) Group	Mean Differences (I-J)	Std Error	Sig.	95% confidence	
						Lower bound	Upper bound
WHODAS	G3	G2	-2.123*	0.711	0.009*	-3.80	-0.45
		G1	-12.708*	0.711	0.000*	-14.38	-11.03
	G2	G3	2.123*	0.711	0.009*	0.45	3.80
		G1	-10.585*	0.821	0.000*	-12.52	-8.65
	G1	G3	12.708*	0.711	0.000*	11.03	14.38
		G2	10.585*	0.821	0.000*	8.65	12.52

*significant at $p < 0.05$

performed under the significant result of ANOVA. Multiple comparison results presented statistical differences between groups G1 & G2, G2 & G3 and G1 & G3 ($p = 0.000$).

DISCUSSION

In this study, functional disability among the patients with diabetes mellitus (DM) with and without diabetic polyneuropathy (DPN) when compared to controls assessed with WHODAS 2.0, showed a significant change in all the domains. The WHODAS scores were higher in groups G1 (DM with DPN) 48.97 ± 8.87, G2 (isolated DM) 38.38 ± 2.83 than in group G3 (controls) 36.26 ± 0.84. We also found the presence of functional disability in G3 group, who are controlled subjects without DM and without any types of associated polyneuropathy. This could be due to the process of aging and age-related co-morbidities such as hypertension, cervical spondylitis, osteoarthritis, rheumatoid arthritis, etc.

Individuals with diabetes had at least twofold higher rates of coexisting chronic conditions than those without diabetes (Werfalli et al. 2018). This study showed that diabetes was associated with poor functional disability when considering their age, gender, socio-economic status (low education), being in a low wealth quintile, having a poor employment history, marital status (not being in a partnership) and co-morbid conditions.

The relationship between diabetes and functional disability was seen in all four functional domains, with activities of daily living having the most diabetes-related burden, followed by instrumental activities of daily living, lower extremity mobility, and general physical activities. Chronic hyperglycaemia can trigger inflammatory pathways in the body, leading to a loss of muscle mass, strength, and quality, especially in the lower limbs. This might lead to a decrease in physical activity and involvement in daily activities, worsening the onset of functional impairment. Further, comorbidities commonly associated with longer duration of diabetes, such as coronary heart disease, peripheral arterial disease, and stroke, can all lead to functional disability (Schwartz et al. 2008).

Declining cognitive functioning in patients with diabetes might affect adherence to treatment and drug regimens (McGuire, Ford & Ajani 2006; Sinclair, Grilling & Bayer 2000; Coker & Shumaker 2003). Patients with diabetes with low cognitive functioning were less likely to engage in diabetes monitoring and treatment, resulting in more hospitalizations, restrictions of activity daily living, and the need for more personal assistance, leading to increased functional disability and mortality. Abnormalities in cognitive functioning tests can promptly and effectively reveal changes in neuropsychological functioning and act as a warning indicator for hypoglycaemia (Park et al. 2007; Wong et al. 2013; Bardenheier et al. 2014). This can possibly be a predictor of future functional disability.

CONCLUSION

The functional disability scores are severely higher in patients with DM and DPN, moderately higher in patients with isolated DM and mildly higher in age matched controls (healthy individuals without DM and without any types of associated polyneuropathy). The results directly reflect the level of disability are getting worse when the patients have DPN with involvement of sensory and motor decline as well as autonomic dysfunction. It is recommended to monitor the level of diabetics' functional activities and independence in daily life, so that their health status can be improved and early detection can help in plan of care in order to avoid complications.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

FUNDING

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ORIGINAL ARTICLE

Comparison of Technology Enhanced-Learning and Traditional-Based Learning on Academic Performance among Undergraduate Physiotherapy Students

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ABSTRACT

Background: Learning is the act of acquiring knowledge or skills through instruction, attention and repeated experiences. Educators must arrange an appropriate learning environment to elicit the correct response. In physiotherapy education, there is a need for a continuous development that forces the educators to plan and implement new kinds of strategies in order to help the students to prepare for their future and to gain optimal learning. **Objective:** This study compared the technology-enhanced learning versus traditional-based learning on academic performance among undergraduate physiotherapy students. **Methods:** Quasi experimental study design was used. 30 students were selected by convenient sampling and were randomly divided into experimental group (A) and control group (B). They underwent a class on role of physiotherapy in congenital heart diseases for four hours in a week for about four weeks. The student's academic performance was evaluated by asking few questions regarding the class which was conducted in Kahoot! for Group A and multiple-choice questionnaires (MCQs) for group B. **Results:** The comparison of post-test mean score between Group A and Group B showed the calculated t value = 9.63 with the p value < 0.00001. The result was significant at $p<0.05$. **Conclusion:** Technology enhanced-learning is more effective than traditional method of learning among undergraduate physiotherapy students which indicates that students are actively participating in technology-enhanced learning which increases the academic performance of students.

Keywords: Traditional learning, technology-enhanced learning, physiotherapy students, MCQs, Kahoot!

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INTRODUCTION

In this modern technological era, students have the mind set of swiping and pinching the smart aids than flipping the pages in the books. It is hard to make the learners to be engaged in learning through a passive traditional method (Weeks & Horan 2013). In traditional learning, a teacher's basic instructional tools are chalkboards, multipurpose boards, pegboards, bulletin boards and flip charts. Recently the use of electronic presentations has become common and Microsoft PowerPoint (PPT) is the most popular instructional aid now. A traditional classroom is replaced by digital ones and teachers ensure individual attention to augment the learning capabilities of the child (Raunak 2017). Various studies have been conducted to assess the effectiveness of lectures using. PPT or other such media in comparison to lectures using chalkboard. When technology-enhanced learning is used instead of traditional method of learning, it can enhance learner's cognition and interest in a broader perspective. Several studies reported that educational computer games could enhance student's learning interest and motivation. Active game-based or technology enhanced learning have great potential for improving the learning achievements of students.

Combining games with educational objectives could not only trigger students' learning motivation, but also provide them with interactive learning opportunities. It is well known that playing games is one of the most natural forms of learning.

One of the emerging game-based learning platforms used in education institutions is Kahoot! which is freely available (Plump & LaRosa 2017). It allows teachers to create game-based quizzes, surveys, etc. in which the participants compete against each other. Top responders for each question are revealed and the overall winner(s) will be displayed at the end of the Kahoot! session (Johns 2015). The scoreboard at the end of the game will display the winners. The good thing about Kahoot! is, the results including their descriptive analysis data can be exported and saved by the teachers for future reference.

Multiple choice questions (MCQs) are a well-established, reliable method of assessing knowledge and are used widely among medical students. Well-constructed MCQs

have a greater ability to test knowledge and factual recall but they are less powerful in assessing the problem-solving skills of the students. Generally, MCQs stimulate students to make a superficial and exam-oriented study.

In this study, we used Kahoot! and MCQs to assess for the technology-enhanced learning over the traditional-based learning on academic performance among the undergraduate physiotherapy students.

METHODS

KG Institutional ethical committee approval and individual consent was obtained as per ethical guidelines. A quasi experimental design that use a control group but no pre-test, post-test only design was adopted for this study. By convenient sampling technique, 30 undergraduate third year physiotherapy students from KG College of Physiotherapy were selected and randomly divided into experimental group (A) and control group (B). The 'role of physiotherapy in congenital heart diseases' as a topic was designed for both the groups. The classes were scheduled four hours per week for four weeks, for both groups. The classes for Group A (technology-enhanced learning group) were taken through power point and video presentations. For Group B (traditional-based learning group) the classes were delivered sing chalkboard and charts.

The groups were evaluated by Kahoot! and MCQs respectively. 30 questions were created as questions in Kahoot! game-based tool, and the same questions were asked in paper-and-pencil test as MCQs. In Kahoot!, students answered the questions by choosing one of the different shapes within particular time using their mobile phones with the given code; in MCQs test, students marked the correct answers on paper. Duration of the test session was 30 minutes. Each question carries 1 mark, with the total 30 marks. After the Kahoot! session each student's score was displayed on their screen immediately after answering; in MCQs, the researcher evaluated the answers and the score was given back to the students.

RESULTS

Table I and II describes demographic variables and the mean scores of Group A (technology-enhanced learning) and Group B (traditional-based learning), which were analysed by student independent t –test respectively. The mean score of Group A (25.80) was higher than the Group B (20.27). This result indicated that Kahoot! was a fun and effective method to give feedback thus better than the MCQs test. There was a significant difference on academic performance between Group A and Group B ($p<0.05$).

Table I: Demographic variables

S.N.	Characteristics	Numbers	Total
	Age		
1	20	14	30
	21	16	
	Gender		
2	Male	9	30
	Female	21	

Table II: Comparison of technology-enhanced learning and traditional-based learning on academic performance among undergraduate physiotherapy students

Group	Variable	Posttest Mean	Independent T-Test	*p-value*
Experimental Group (A)	Kahoot	25.80	9.63*	0.00001*
Control Group (B)	MCQ	20.27		

*significant at $p \leq 0.05$

DISCUSSION

The present study revealed that there was a significant difference on academic performance between technology-enhanced learning and traditional-based learning among physiotherapy students. The comparison of mean score between Group A and Group B showed that the calculated t-value = 9.63 with the p-value < 0.00001. The result was significant at $p < 0.05$. This result is consistent with the study conducted by Douglas et al. (2017), which stated that contemporary instruction group performed significantly better on the posttest questionnaire and scored 8.94 ($p = 0.001$) when compared to traditional instruction post mean score of 7.30. The contemporary instruction format improved the students' learning of the topic as assessed by test scores (Flavio et al. 2018).

The rise of technology-enhanced learning has occurred primarily due to the ease of internet access enabling the retrieval and sharing of information in an instant. The better scores could be due the engagement of students that improve the experiential nature of active, intentional learning. Educational games and game-based student response systems both increase student motivation and engagement, especially in circumstances where conventional lecture style or 'chalk-and-talk' teaching is resented by students and induce boredom (Cugelman 2013; Douglas et al. 2017; Leaning 2015; Barrio, Muñoz-Organero & Soriano 2016).

In Malone's theory of intrinsic motivation, by challenging students with difficult problem-solving tasks in an audio-visually stimulating environment, the fantasy 'game-show' environment further increases their absorption during problem-solving. Kahoot! has a greater impact on interpersonal interactions than other tool (e.g., Socrative), by allowing competition and discussion to occur between an entire class rather than in small groups (Wang & Lieberoth 2016; Graham 2015; Roehl, Reddy & Shannon 2013). Kahoot! also improves classroom dynamics as the system provides students with real- time feedback of their performance, and to some extent adapt teaching activities based on students' responses to quizzes (Méndez & Slisko 2013; Plump & LaRosa 2017).

CONCLUSION

Education is not just about memorizing facts and vocabulary words; it is about solving complex problems

and being able to collaborate with others in the workforce. Subjects that students deem challenging or boring can become more interesting with technology. Kahoot! is an innovative formative assessment tool which reflect on what the students have learned. The present study concluded that technology-enhanced learning is more effective than the traditional-based learning among undergraduate physiotherapy students.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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ORIGINAL ARTICLE

Relationship between Level of Gross Motor Function Classification System and Quality of Life in Children with Cerebral Palsy

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ABSTRACT

Background and Objective: Quality of life (QoL) evaluation is an important aspect in management of children with cerebral palsy (CP) as it helps provide robust information of the children's health status, from the physical, emotional and social context. QoL assessment findings also assist healthcare professionals to make decisions regarding their intervention. Previous studies showed that the QoL of children with CP is lower than that of their normal peers. However, its associated factors were under-reported. This study aims to determine the association between Gross Motor Function Classification System (GMFCS) levels and the QoL of children with CP. **Methods:** This cross-sectional study included 71 children (46 males and 25 females), aged from 7 to 18 years old. The Malay version of Paediatric Quality of Life (PedsQL) 4.0 Generic Core Scale were given to the parents to report their child's QoL. **Results:** Higher QoL score was reported in the psychosocial than physical domains regardless the GMFCS category. Spearman correlation test results shows a significant, strong correlation between GMFCS level and all QoL domains score, with $r > 0.7$, $p < 0.05$ among the children. **Conclusion:** Management of children with CP should include assessment and intervention related to not just physical aspects, but emotional and social aspects such as communication and social skills.

Keywords: Quality of life, children, cerebral palsy, GMFCS

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INTRODUCTION

Cerebral Palsy (CP) is defined as a group of permanent disorders of movement and posture causing limitation in activity. It is a non-progressive disturbance that is developed from foetal or infant brain, but symptoms become worse if intervention does not take place early (Rosenbaum et al. 2007). The presentation and prognosis of children with CP are different from one child to another as it is influenced by factors such as therapies received, education, family, and social context (Pizzighello et al. 2019). According to the report by the Department of Statistics Malaysia in 2020, there are approximately 20,300 children with disabilities including those with CP (Department of Statistics Malaysia Official Portal). Based on the estimated prevalence of 1 to 4 CP children per 1000 live births among 9.3 million children among the Malaysian population, the actual number of CP children in Malaysia may be significantly higher.

In terms of functional ability, children with CP were classified into five levels using the Gross Motor Functional Classification System (GMFCS). GMFCS represent the gross motor function of CP and it is widely used among clinicians, for example, orthopaedic surgeons, physiotherapists and occupational therapists. In addition, GMFCS determines the functional levels of children with CP and their participation in social activities (Pizzighello et al. 2019). Other than the aspect of gross motor, quality of life (QoL) is an important domain that need to be considered in managing children with CP as stated in the International Classification of Functioning, Disability and Health (WHO 2018).

QoL is an aspect which determines a person's degree of satisfaction in life and with subjectively assessed self-fulfilment possibilities of future development (Kołtuniuk et al. 2019). It is defined as "an individual's perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards, and concerns" (Jiang et al. 2016). Identifying factors that influence participation and QoL help in the evaluation and treatment to improve QoL in children with CP (Omura, Fuentes & Bjornson et al. 2018). QoL can be determined by using a generic questionnaire or a specific measure. Examples of generic questionnaires are KIDSCREEN (Ravens-Sieberer et al. 2007) and Pediatric Quality of Life Inventory (PedsQL) (Varni et al. 2006).

Previous studies of children with CP have investigated the relationship between functional abilities and QoL. These studies have demonstrated that although functioning is correlated with physical domains of QoL, there was a non-significant or weak relationship between functioning and the psychosocial domains of QoL. For example, Shelly et al. (2008) demonstrated that GMFCS was not significantly related to social well-being. Similarly, a study by Tarsuslu and Livanelioglu (2010) found that GMFCS was not related to QOL measured by Nottingham Health Profile. In contrast, Omura et al. (2018) reported significant relationship between the GMFCS and QoL in children with CP GMFCS levels I–III. It remains unknown whether a relationship would exist when QoL represent not just physical domains but including psychosocial such as social and emotional status given the conflicting results reported from previous studies. Additionally, the life expectations of children with CP undergo changes similar to healthy individuals (Blair et al. 2019). So far data regarding relationship between GMFCS and QoL in children with CP in Malaysia are scarce. Therefore, this study aims to explore the relationship between GMFCS levels and QoL among children with CP. Specifically, associations were examined between different QoL domains and GMFCS. Based on previous studies, it was hypothesized that domains focused on physical well-being (feelings about functioning, participation, and physical health) would be more strongly associated with functioning than domains that focus on psychosocial well-being (emotional and social domains).

MATERIALS AND METHODS

Study design and participants

This is a cross-sectional study with purposive sampling. It was conducted among children with CP within the ages of 7–18 years old with mean (SD) of 11.07 ± 3.61. The inclusion criteria of this study are: (1) children diagnosed with CP GMFCS levels I–V, (2) aged from 7–18 years old (schooling age), and (3) parents who understand the Malay language. The exclusion criterion was children with CP at ages of more than 18 years old and below 7 years old and parents who do not understand the Malay language. This study has obtained UKM ethics approval (code JEP-2020-435).

The description of GMFCS levels is according to Palisano et al. (1997). GMFCS level I is characterized by children who can perform gross motor skills such as running and jumping and can engage with the community, such as in school but their walking speed, balance, and coordination are limited. GMFCS level II is a condition where children might face difficulty in walking long distance or balancing on uneven surfaces. These children have only minimal ability to perform gross motor skills. Meanwhile, GMFCS level III is a condition where children need to use a hand-held mobility device in indoor settings. They also might need wheeled mobility to travel long distances. GMFCS level IV is where children need assistance or powered mobility in most settings as they might walk for short distances with physical assistance or body support walker. In outdoor settings, they need a transport such as a manual wheelchair or a powered mobility device. Lastly, GMFCS level V is a condition where children need a transport such as a manual wheelchair in all settings as they do not have the ability to maintain antigravity for their head and trunk posture.

Instruments

The Malay version of the Pediatric Quality of Life (PedsQL) 4.0 Generic Core Scale was used to explore the QoL in children with CP. This questionnaire has been reported to have Cronbach's α value ranging between 0.7 and 0.98 which showed good reliability (Ainuddin et al. 2015). This questionnaire consists of four domains which are the physical, psychosocial, social and school functions. Physical function explains the levels of physical health and activity of children with CP. The psychological function describes the emotional status of the participant based on the parents' observation while the social function explains the children's relationships or activities with their peers. The school function interprets the children's performance and attendance within the school environment. This questionnaire consists of four domains which are the physical (8 items), psychosocial (5 items), social functions (5 items) and school functions (5 items). Each item has a 5-point Likert scale label for instance: 0 = never a problem, 1 = almost never a problem, 2 = sometimes a problem, 3 = often a problem and 4 = almost always a problem. The physical function domain is computed as Physical Health Summary (PHS). The Mean Emotional Functional Score (MEFS), Mean Social Functional Score (MSFS), and Mean School Functional Score (MScFS) are computed as Psychosocial Summary Score (PSS). All the domains are then summed up as Total Score (TS).

The online questionnaire form was given to the parents or caregivers of children with CP to indicate their children's QoL. PedsQL has been reported to be valid and reliable of parent proxy-report for children with and without chronic illnesses (Varni et al. 2007).

Procedure

This study had recruited participants from *Hospital Pakar Kanak-kanak* UKM, Physiotherapy Clinic UKM, and Community-based Rehabilitation (CBR) around Klang Valley. Participants who met the inclusion and exclusion criteria were contacted through email, WhatsApp, and phone calls. Then, patient information sheets were given to the parents or caregivers of children with CP regarding the study. Once they agreed to participate and signed the consent form, they were given the questionnaire to fill in.

Statistical analysis

All the data were transferred into an Excel spreadsheet. Then, the data is processed and analysed using the Statistical Products and Service Solution (SPSS) software version 25. Demographic data was analysed using descriptive analysis such as frequencies, means and standard deviations. The correlation between the

GMFCS levels and each domain of PedsQL were determined using the Spearman Correlation as the data was found to be not normally distributed. The r value was set as follows: r < 0.3 is regarded as low, r = 0.3-0.5 is regarded as fair, r = 0.5-0.7 is regarded as good and r > 0.7 is high (Portney & Watkins 2009). The statistical significance was set at p < 0.05.

RESULTS

A total of 71 children with CP were included in this study with 46 males (64.8%) and 25 females (32.2%). The mean (SD) age was 11.07 ± 3.61 and the mean (SD) for BMI was 19.58 ± 2.29. The demographic data of participants who participated in this study is shown in Table I.

Table I: Demographic data of children with CP reported by the parents or caregivers and status of children with CP

Demographic data	Frequency (n)	Percentage (%)
Gender		
Male	46	64.8
Female	25	35.2
Ethnicity		
Malay	45	63.4
Chinese	15	21.1
Indian	10	14.1
Other (Sikh)	1	1.4
Gross Motor Functional Classification System		
1	13	18.3
2	12	16.9
3	17	23.9
4	15	21.1
5	14	19.7
Type of CP		
Spastic	60	84.5
Dyskinetic	11	15.5
Type of walking aids used		
None	26	36.6
Crutches	9	12.7
Rollator	18	25.4
Wheelchair	18	25.4

The mean of the total raw scores, standard deviations for the domains and total score of the PedsQL are described in Table II. For the PedsQL domains and total scores, more severe GMFCS levels were associated with lower QoL (p < 0.05).

Table II: Descriptive statistics: PedsQL scores for children with CP stratified by GMFCS

	I (n=13)	II (n=12)	III (n=17)	IV (n=15)	V (n=14)
PHS	86.780 (5.898)	76.707 (7.463)	53.311 (10.251)	28.543 (10.758)	10.716 (5.630)
MEFS	93.846 (9.638)	89.091 (7.925)	68.529 (11.976)	51.667 (14.220)	42.143 (14.846)
MSFS	88.462 (9.484)	78.636 (10.021)	58.235 (9.693)	35.333 (13.350)	22.857 (20.241)
MScFS	85.000 (8.771)	75.909 (9.959)	58.824 (10.918)	44.169 (16.926)	53.424 (18.643)
PSS	89.103 (5.942)	81.211 (5.275)	61.863 (8.724)	43.334 (12.472)	31.071 (11.445)
TS	88.295 (4.330)	79.645 (5.407)	58.888 (7.579)	38.020 (9.643)	22.201 (6.971)

Values are mean (SD). PHS = Physical Health Summary, MEFS = Mean Emotional Functional Score, MSFS = Mean Social Functional Score, MScFS = Mean School Functional Score, PSS = Psychosocial Summary Score, TS = Total Score

Table III shows the correlation between the GMFCS level and QoL in all domains such as PHS, MEFS, MSFS, MScFS, PSS, and TS. It shows a significant strong relationship with (r = > 0.7, p < 0.05) between GMFCS and QoL across all domains.

Table III: Relationship between GMFCS and PedsQL domains

Domain PedsQL	n	r	P
PHS	71	0.955	.000
MEFS	71	0.858	.000
MSFS	71	0.885	.000
MScFS	71	0.717	.000
PSS	71	0.922	.000
TS	71	0.952	.000

PHS = Physical Health Summary, MEFS = Mean Emotional Functional Score, MSFS = Mean Social Functional Score, MScFS = Mean School Functional Score, PSS = Psychosocial Summary Score, TS = Total Score

DISCUSSION

To our knowledge, this is the first study in Malaysia investigating the relationship between function and QoL of children with CP. The results of this study provide information about the importance of measuring both function and QoL in the field of paediatric physiotherapy.

In this study, psychosocial QoL (i.e., emotional and social domains) of children with CP was higher than physical QoL. Our results were consistent with the trend reported by Ko et al. (2011), who investigated the QoL of 155 children with CP and concluded that GMFCS is associated with functional status and well-being of school-aged children with CP. When stratified by function levels (i.e., GMFCS), those with GMFCS levels of I–III were associated with higher emotional and social scores compared to those with GMFCS levels of IV–V. A study by Kaartina et al. (2015) reported that the mean (SD) scores for physical and emotional function were 62.59 (26.47) and 71.24 (20.09), respectively. The results showed that the participants in this study had higher QoL scores compared to Kaartina et al. that had recruited 379 participants with CP. The difference may be due to the fact that the previous study focused on adolescents, but our study included both children and adolescents.

In this present study, GMFCS showed a strong relationship with QoL among the children in all domains of PedsQL. This study also shows that the physical health domain has the strongest relationship with GMFCS of children with CP with r = .95, p < .001 compared to other domains. The result of this current study is supported by a previous study (Arnaud et al. 2008), which also found a positive result of the relationship between the GMFCS and physical dimension involving 818 children with CP with mean age of 10.4 years old. Similarly, a previous study by Keawutan et al. (2018) which used the parent-reported questionnaire known as CP-QoL reported that GMFCS level significantly impacts the dimension of their

functions, involving participation and physical well-being. In addition, the study by Keawutan et al. (2018) also reported similar results with this present study where children with CP with GMFCS levels II and III had lower QoL compared to children with CP with GMFCS level 1 in the domains of physical well-being and psychosocial which embody both emotional and social functions. For the current study, the school function dimension is strongly impaired with the increase in the GMFCS level. The study by Badia et al. (2016) shows that GMFCS level and type of schooling also affect the parent-reported QoL of their children. It is important to determine the type of schools attended by the children as Arnaud et al. (2008) mentioned that children with severely impaired gross motor function have reduced risk of having poor QoL. The results of our study support the need to incorporate holistic intervention that are not only focused on function but also include the QoL when assessing the overall status of children with CP.

Thus, QoL is essential and relevant as it can provide indication of the condition of children with CP regarding physical health, social and emotional status. It will also help in clinical decision-making for the intervention as it gives a clear picture regarding the overall impact of the condition of children with CP in all domains. In this study, we focus the assessment of QoL from the perspective of the parents or the caregivers of children with CP. Future studies may consider the QoL report from both parents and children' themselves.

CONCLUSION

In conclusion, this study found a strong relationship between GMFCS level and QoL across all domains of PedsQL. Our findings show the importance to incorporate QoL when evaluating and treating children with CP. This can include not just emphasizing on their physical aspects, but more importantly their psychosocial well-being when managing this population.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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ORIGINAL ARTICLE

Awareness and Practices of Injury Prevention Strategies Among Ultimate Frisbee Players in Selangor, Malaysia

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ABSTRACT

Introduction: Among all club sports, Ultimate frisbee has one of the highest numbers of reported injuries. To reduce the overall burden of injury, developing and implementing effective, sport-specific injury prevention strategies should be a top priority. This study aimed to investigate the awareness on injury prevention strategies as well as commonly used injury prevention strategies among Ultimate frisbee players in Selangor, Malaysia. **Methods:** A cross-sectional study was conducted using an online self-administered questionnaire. Participants were recruited through various Ultimate frisbee clubs from social media via purposive sampling. **Results:** 211 eligible responses were obtained and over 72% of the players consider using proper technique in the game is important for preventing injuries. Over 50% of the participants were aware of factors such as proper technique (72.5%), stretching during warm-up (65.4%), warm-up (62.6%) and strength training as extremely important. Majority of participants practices injury prevention strategies such as stretching (82.9%), pre match general warm up (79.6%), fluid consumption following match (75.8%) and training session (73.9%). **Conclusion:** Hence, education for Ultimate frisbee players is recommended to promote the importance and benefits of different sports related injury prevention strategies to reduce the likelihood of injuries thus, enhancing sports performance.

Keywords: Ultimate frisbee, injuries, awareness, prevention

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INTRODUCTION

The sport of Ultimate frisbee is gaining popularity, yet little is known about it in medical literature (Krustrup & Mohr 2015). Ultimate frisbee is a minimal contact, fast paced, mixed team sport played with a flying disc. Ultimate frisbee includes aspects of soccer, football, and basketball, with players having to run, cut, guard, jump, throw, catch, and sometimes layout (dive laterally with an outstretched arm) for the disc. It is played on a field that is 100 meters by 37 meters big, where two teams comprised of seven players compete with the intention of scoring goals, which is accomplished when a player catches the disc in the end zone, which is 18 meters in depth. Only by being tossed through the air is the disc advanced as players are not allowed to run with it such as in netball (Reynolds & Halsmer 2006).

Although frisbee player is still a growing sport in Malaysia, its popularity has been increasing steadily over the years (Jo-Lyn, 2017). In order to advance the disc and score a goal, players have to run, cut, guard, jump, throw, catch, and dive in a fully outstretched position. Some possible risk factors for injury in frisbee players include constant cutting, physical contact, and jumping among other players. Risk for overuse injury is high as players can run up and down the field without any restrictions to play. Incidental contact and various impact forces predisposes the players to vast amounts of biomechanical stresses and therefore the players are at a considerable risk for injury (Akinbola et al., 2015).

Previous study by Akinbola et al. (2015), showed that the majority of injuries in Ultimate frisbee were to the lower extremities. Several studies have shown that techniques such as bracing, taping and neuromuscular exercises were beneficial in preventing injuries inteam sports. However, regardless of the evidence showing these benefits, there is lack of evidence pointing towards whether these techniques are regularly or even used at all among Ultimate frisbee players. Players with a high compliance rate towards preventive measures had a significantly lower injury risk than players with lower compliance rate (Soligard et al. 2010). Therefore, it is important to identify the practices

of injury prevention techniques such as protective equipment, nutrition intake, sleep, stretching during warm-up and cool-down, flexibility training used in Ultimate frisbee players.

As a result, future injury prevention plans should concentrate more on improving players' compliance with evidence-based injury prevention strategies. To the author's best knowledge, there is no previous study reported on the Ultimate frisbee player's strategies in injury prevention. Thus, through this study we are able to identify the awareness and practices of injury prevention in Ultimate frisbee players in Selangor, Malaysia and understand the need to increase both awareness and promote practice of injury prevention strategies among Ultimate frisbee players.

METHODS

Study design and duration

This is a quantitative cross-sectional study conducted from January 2021 till April 2021, for three months period.

Sampling design and strategy

The main sampling technique used is purposive sampling, as the questionnaire was sent via direct messages to the social media pages (Instagram and Facebook) of several Ultimate clubs based in Selangor, namely City Gliders, Gl Ultimate, Impact Ultimate, Sate Ultimate, Serdang Stingers, Silverback Ultimate, Tintreach Ultimate, Badgers Ultimate, Monash Ultimate, Taylors Ultimate, MCKL Ultimate, Sunway Ultimate, and Ultimate Malaysia.

Sample size calculation

The required number of participants based on Cochran's formula for smaller population was 322. Population size of 2000 was based of the estimated amount of Ultimate frisbee players in Malaysia (Jo-Lyn, 2017). The response rate was 72.36%, however, 22 of them were excluded as they did not meet the inclusion criteria.

Inclusion and exclusion criteria

The inclusion criteria of the players include (1) Ultimate frisbee players from Selangor state, (2) aged between 18 to 45 years, (3) played at least one tournament at any level. Participants were excluded (1) if they do not understand English and (2) participated in other competitive sports.

Online self-administered questionnaire

This study used online self-administered questionnaire adapted from previous study by Hawkins and Fuller (1998) which requires only 10 to 15 minutes to complete.

Questionnaire subsection

Questionnaire consists of four sections namely: information sheet and informed consent, demographics information (three items), awareness of injury prevention (11 items) strategies, and practices of injury prevention strategies (13 items).

Scoring responses

Awareness of injury prevention were rated based on 5-point Likert scale ranging from extremely important to not important while 11 items on practices of injury prevention strategies were rated based on 5-point Likert scale ranging from always to never. Only two items were given the multiple-choice options.

Scoring interpretation

Interpretation is based on the percentage of responses on each item in the Likert scale. Higher percentage indicates higher awareness and practices of injury prevention strategies similar to the study by Bakhtiar et al. (2021).

Ethical clearance

Participants were informed about the study purpose, researcher's contact information, procedure and the anonymity of responses. Informed consent was obtained and participants was informed that they had the freedom to withdraw from the study at any point in time. The questionnaire was validated by two lecturers from Faculty of Health Sciences from a private university with sound research background. The ethical clearance was obtained from Research and Ethics Committee of INTI International University with ethical registration number, INTI- IU/FHLS-RC/BPHTI/7NY12020/018.

Data analysis

Data were analysed using the SPSS version 20.0. Descriptive statistics were used to analyse the awareness and practice of injury prevention strategies among Ultimate frisbee player and results were reported as frequency and percentage.

RESULTS

Table I: Sociodemographic and training characteristics of the Ultimate frisbee player

	Frequency (n = 211)	Percentage (%)
Age (years)		
18 – 30	205	97.2
31 – 43	6	2.8
Injury players		
Yes	207	98.1
No	4	1.9
Training characteristics		**Mean ± SD**
Number of tournaments		11 ± 6
Number of injuries		5 ± 3
Flexibility training per week		3.4 ± 2.3
Strength training per week		3.5 ± 2.3
Technique training per week		4 ± 2
Sleep (hours) per night		6.6 ± 1.1

A total of 233 participants filled out the questionnaire but 22 of them were excluded as they were below 18 years old or played competitive sports. Table I represents the sociodemographic information of the participants. From 211 eligible participants, majority (97.2%) are aged between 18-30 years with 98.1% of participants presented with history of injury during their training and competition. Table II reports the level of awareness of participants on injury prevention strategies. More than 50% of the participants reports factors such as proper technique (72.5%), stretching during warm-up (65.4%), warm-up (62.6%) and strength training to be extremely important. However, few participants considered usage of protective equipment (28%), nutrition intake (12.3%), sleep (4.3%), stretching during warm-up and cool-down (3.8%), flexibility training (3.3%) to be not important.

Table II: Awareness of injury prevention strategies among Ultimate frisbee player

	Awareness	Frequency (n)	Percentage (%)
Protective equipment	Extremely important	27	12.8
	Very important	16	7.6
	Important	5	2.4
	Somewhat important	104	49.3
	Not important	59	28.0
Nutrition intake	Extremely important	48	22.7
	Very important	52	24.6
	Important	25	11.8
	Somewhat important	60	28.4
	Not important	26	12.3
Hydration	Extremely important	117	55.5
	Very important	52	24.6
	Important	17	8.1
	Somewhat important	25	11.8
	Not important	0	0.0
Warm-up	Extremely important	132	62.6
	Very important	36	17.1
	Important	43	20.4
	Somewhat important	0	0.0
	Not important	0	0.0
Cool-down	Extremely important	75	35.5
	Very important	60	28.4
	Important	51	24.2
	Somewhat important	25	11.8
	Not important	0	0.0
Stretching during warm-up	Extremely important	138	65.4
	Very important	34	16.1
	Important	23	10.9
	Somewhat important	8	3.8
	Not important	8	3.8
Stretching during cool-down	Extremely important	85	40.3
	Very important	53	25.1
	Important	51	24.2
	Somewhat important	14	6.6
	Not important	8	3.8
Flexibility training	Extremely important	75	35.5
	Very important	52	24.6
	Important	33	15.6
	Somewhat important	44	20.9
	Not important	7	3.3
Strength training	Extremely important	107	50.7
	Very important	60	28.4
	Important	36	17.1
	Somewhat important	8	3.8
	Not important	0	0.0
Proper training technique	Extremely important	153	72.5
	Very important	33	15.6
	Important	16	7.6
	Somewhat important	9	4.3
	Not important	0	0.0
Sleep duration	Extremely important	77	36.5
	Very important	75	35.5
	Important	34	16.1
	Somewhat important	16	7.6
	Not important	9	4.3

Table III: Practices of injury prevention strategies among Ultimate frisbee player

	Practice	Frequency (n)	Percentage (%)
Wear protective equipment during training	Always (100% of the time)	8	3.8
	Very often (75% of the time)	11	5.2
	Often (50% of the time)	9	4.3
	Sometimes (25% of the time)	76	36.0
	Never (0% of the time)	107	50.7
Wear protective equipment during matches	Always (100% of the time)	8	3.8
	Very often (75% of the time)	19	9.0
	Often (50% of the time)	17	8.1
	Sometimes (25% of the time)	88	41.7
	Never (0% of the time)	79	37.4
Consume pre-training carbohydrates	Always (100% of the time)	69	32.1
	Very often (75% of the time)	50	23.7
	Often (50% of the time)	49	23.2
	Sometimes (25% of the time)	25	11.8
	Never (0% of the time)	18	8.5
Consume post-training carbohydrates	Always (100% of the time)	95	45.0
	Very often (75% of the time)	68	32.2
	Often (50% of the time)	25	11.8
	Sometimes (25% of the time)	9	4.3
	Never (0% of the time)	14	6.6
Pre-training fluids consumption	Always (100% of the time)	120	56.9
	Very often (75% of the time)	35	16.6
	Often (50% of the time)	38	18.0
	Sometimes (25% of the time)	8	3.8
	Never (0% of the time)	10	4.7
Post-training fluids consumption	Always (100% of the time)	156	73.9
	Very often (75% of the time)	24	11.4
	Often (50% of the time)	15	7.1
	Sometimes (25% of the time)	8	3.8
	Never (0% of the time)	8	3.8
Perform warm-up before training	Always (100% of the time)	133	63.0
	Very often (75% of the time)	69	32.7
	Often (50% of the time)	9	4.3
	Sometimes (25% of the time)	0	0.0
	Never (0% of the time)	0	0.0
Perform cool-down after training	Always (100% of the time)	63	29.9
	Very often (75% of the time)	33	15.6
	Often (50% of the time)	34	16.1
	Sometimes (25% of the time)	81	38.4
	Never (0% of the time)	0	0.0
Perform cool-down after matches	Always (100% of the time)	98	46.4
	Very often (75% of the time)	48	22.7
	Often (50% of the time)	48	22.7
	Sometimes (25% of the time)	17	8.1
	Never (0% of the time)	0	0.0
Stretch as warm-up pre-training	Always (100% of the time)	145	68.7
	Very often (75% of the time)	25	11.8
	Often (50% of the time)	32	15.2
	Sometimes (25% of the time)	0	0
	Never (0% of the time)	9	4.3
Stretch as warm-up pre-match	Always (100% of the time)	175	82.9
	Very often (75% of the time)	15	7.1
	Often (50% of the time)	11	5.2
	Sometimes (25% of the time)	0	0.0
	Never (0% of the time)	10	4.7
Stretch as cool-down post-training	Always (100% of the time)	54	25.6
	Very often (75% of the time)	39	18.5
	Often (50% of the time)	43	20.4
	Sometimes (25% of the time)	64	30.3
	Never (0% of the time)	11	5.2
Stretch as cool-down post-match	Always (100% of the time)	116	55.0
	Very often (75% of the time)	26	12.3
	Often (50% of the time)	31	14.7
	Sometimes (25% of the time)	27	12.8
	Never (0% of the time)	11	5.2

Also, over 50% of participants reported other than extremely important or not important for nutrition intake (65.8%), flexibility (61.1%), protective equipment, sleeping (59.3%), followed by stretching during cool-down (55.9%).

Based on Table III, participants practice stretching as warm up (82.9%), general warm up (79.6%) before the match. Similarly, the percentage of participants consuming fluid after the match and training session are (75.8%) and (73.9%) respectively. Our study results also show that proportion of participants were not using protective equipment during training (50.7%) and match (37.4%) respectively.

DISCUSSION

The objective of current study is to determine the awareness and practices of injury prevention strategies among Ultimate frisbee players in Malaysia. Current study showed 207 out of 211 Ultimate athletes experienced injury from training or competitive matches at least once over their lifetime, with a lifetime prevalence of injury as high as 98.1%. There is similar to a systematic review by Pulido and Lystad (2020) which reported the lifetime prevalence of injury among this population to be 100%. Ultimate athletes experience biomechanical strain and highly exposed to risk of injury due to unintentional contact and diverse impact forces (Akinbola et al. 2015).

Injury prevention strategies in current study is classified into protective equipment, nutrition, hydration, warm up, cool down, stretching during warm up and cool down, flexibility and strength training, proper technique, and sleep. Most respondents showed high awareness of proper technique (72.5%) as one of the injury prevention strategy similar to a study by Rahbek and Nielsen (2016) which concludes that players may predispose themselves to injury without proper technical guidance.

Stretching during warm up as a form of flexibility training is also regarded as key injury prevention strategy with almost 66% respondent classifying it as extremely important even though approximately 4% of respondents classified it as not important. This is similar to the previous studies (Patil et al., 2017) that stretching can effectively reduce injury risks among athletes. Stretching programs can alter the viscosity of the tendon and make it more compliant, which is vital for injury prevention when a sport requires high-intensity stretch-shortening cycles (Witvrouw et al. 2004).

No studies however had evaluated the awareness of warm up as a sports related injury prevention strategy. Practice of stretching as warm up (82.9%) and general warm up (79.6%) before the match is also high in current study. A study by Nair et al. (2018) on soccer players showed practices of warm-up prior to training, warm-up prior to matches, cool-down after training sand cool-down after matches were 85%, 89%, 79% and 51% respectively. This demonstrates that warm-up and cool-down are less common among Ultimate players in current studies compared to soccer players.

Nair and co researchers (2018) also concluded football athletes manifested lack of awareness in the importance of resistance training in preventing sports-related harm to the athletes as only 51% regarded strength training as an essential component in sports-related injury prevention. General strength training may be beneficial for increasing body mass, reducing the risk of soft-tissue injuries, and strengthening core stability (Young, 2006). Frisbee players requires strength training as an essential tournament preparation. This game involves movements like jumping, running, cutting and pivoting, hence the strength of lower limb muscles is essential to generating power in sprinting and jumping. A recent study by Pang et al. (2021) reported high prevalence of lower limb injuries (61.6%), hence emphasized the importance of strength training. Similarly, current study recorded only 50.7% of respondents acknowledging strength training as an extremely important component for injury prevention among athletes.

Protective equipment is reported as not important by 28% of respondents with only 12.8% reported it as extremely important. The practice of protective equipment is also relatively low as current study reported proportion of respondents not using protective equipment during training (50.7%) and match (37.4%). To the best of our knowledge, no study examined the awareness and practices towards use of protective equipment among Ultimate athletes. Thus, it is suggested wearing protective equipment like ankle brace, knee guard, compression, taping and gloves are important in preventing injuries and the habit of wearing protective equipment has to be strongly recommended.

Current study reported almost 88% of Ultimate players perceived nutrition as an essential component to prevent injuries with practice of carbohydrate consumption pre (32.1%) and post training (45%), pre (33.6%) and post (57.8%) competitive matches as relatively moderate. Carbohydrate intake is almost entirely responsible for muscle glycogen storage. Because the body's ability to store muscle glycogen is limited, and muscle glycogen is the primary source of energy during moderate to high-intensity exercise, the nutritional focus should be on carbohydrate consumption. The pattern of glycogen depletion and replenishment after the match and during recovery was linked to myofibrillar injury healing (Schlabach, 1994). Sharma et al. (2016) reported 74% of female teen football players assumed carbohydrate plays a significant role in sports nutrition. This demonstrates that players are well aware of the importance of nutrition as a strategy for avoiding sports-related issues. It can be summarized that Ultimate athletes are well aware of and practice optimal nutrition intake as a means of avoiding injury.

According to a study conducted by Ashadi et al. (2018), 100% of adolescent soccer participants are aware of the importance of hydration in sports. Similar to current study which reported 100% of Ultimate players deemed proper hydration as a crucial component in preventing injuries. This demonstrates that maintaining sufficient hydration is an extremely effective method for preventing injuries in Ultimate athletes. Hence, current study deduced Ultimate players are very aware of the importance of proper hydration in order to avoid injury. Dehydration leads to heat related injuries hence it can be prevented through pre- and post-match rehydration. Physiologically, it maintains fluid balance which prevents the deterioration of the performance (Shirreffs et al. 2006). Athletes should consume the beverages slowly at least four hours pre training in the estimation of five to seven milliliters per kilogram of body weight (Sawka et al. 2007). Noakes and et al. (2003) in their guidelines emphasized that the optimal rates of fluid consumption during exercise varies on individual and environmental factors, hence it is not advised to provide a blanket recommendation for all athletes during training.

Ultimate athletes slept an average of 6.6 hours per night, according to current study. Another study discovered that elite athletes sleep for an average of 6.55 hours per night (Leeder et al., 2012). This could be related to elite athletes' high training volume, which could negatively impact their sleep quality (Hausswirth et al. 2014). According to the National Sleep Foundation, an adult should sleep for 7-9 hours per night on average (Hirshkowitz et al. 2015). As a result, it is clear that Ultimate athletes do not get enough sleep per night to accomplish maximum recovery and avoid sport injuries.

Small sample size and lower response rate due to online distribution of questionnaire were a few of the limitation of current study. Besides, majority of participants were of younger age group hence it affects the generalizability of the study finding. This could be due to the fact that older age population are less active on social media and less likely to participate in online surveys (Aerny-Perreten et al. 2015). Current study serves as a pilot study for future studies to evaluate the effectiveness of various sports related injury prevention strategies on reducing injuries sustained in Ultimate players. Future studies may determine the correlation of the level of awareness and sport related injury prevention strategies, and may also include questionnaire in dual language. This will create the basis for clinical reasoning on the lack of practice on certain injury prevention strategies.

CONCLUSION

Ultimate players in Selangor, Malaysia generally have a moderate to good awareness on the various sports related injury prevention strategies. The practice of these injury prevention strategies is based on good practice according to the current available evidence. Despite the usage of protective equipment and practice of cool-down session are not strongly supported by evidence in reducing sports related injuries, most Ultimate athletes practice them. Benefits of adequate sleep needs to be educated to the athletes as the majority is lacking good appropriate sleep duration. Physiotherapists may provide education for athletes especially Ultimate players and coaches, to promote the importance and benefits of different sports-related injury prevention strategies to reduce the likelihood of injuries, thus enhancing sports performance.

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CONFLICT OF INTEREST

The author declares no conflict of interest.

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ORIGINAL ARTICLE

Career Choice after Graduation among Physiotherapy Students Attending Public Universities in Malaysia

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ABSTRACT

Background and Objectives: Students always find it difficult to choose what they want to do after graduation despite having spent a solid three to four years of study and faced multiple challenges to graduate. There is evidence suggesting a great number of physiotherapy students chose not to work as a physiotherapist after graduation. Therefore, the objectives of this study were to determine the career choice after graduation and factors influencing career choices in physiotherapy students. **Methods:** A cross-sectional survey was undertaken on final-year undergraduate physiotherapy in four public universities offering physiotherapy courses in Malaysia. The questionnaire used in this study consisted of three main sections: demographic information, career choice, and factors influencing career choice after graduation. **Results:** Of 120 respondents, not even half (i.e., 57 [47%]) intended to work as a physiotherapist, as low as 26 (22%) intended to further study and as high as 37 (31%) were undecided or had no plan at all. The main factors that influenced their choice to work were previous working experience (15 [26%]), family members (11 [19%]), and the intention to serve the community (9 [16%]), while the choice to further study was influenced by the desire to further physiotherapy knowledge (19 [40%]) and enter a profession that requires a specific qualification (7 [15%]). Age, current study level (diploma/bachelor's degree), and previous educational background, were found to be associated with career choices (all $p < 0.05$). **Conclusion:** Majority of the final year bachelor's degree students intended to work while diploma students intended to further study. Age, current program, and previous education background, were highly associated with the students' career choice.

Keywords: After-graduation, career choice, physiotherapy students, Malaysia

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INTRODUCTION

Career is defined as a way of making a living, life-long process of learning, lifetime single profession which may include a series of positions or jobs, living and working experiences, leisure-time activities, hobby and education (Klover 1983). Career choice is an individual blueprint, and the process determining it requires knowledge, skill, and a specific educational program verified through a certificate or degree (Angela 2014; Humayon et al. 2018). A broad range of career opportunities are available for physiotherapy students: working in the public or private hospitals, healthcare centres, clinics, sports centres, nursing homes, special schools, health promotion agencies, or furthering study to become a lecturer or researcher. In Malaysia, two job posts being offered in the public healthcare sector are Medical Rehabilitation Officer (Physiotherapy) and Medical Rehabilitation Assistant (Physiotherapy). As of 2020, 1440 physiotherapists were working in the government facilities (Health Indicator 2021 2021). In the education sector, most of the physiotherapy educators and clinical instructors in public institutions and private institutions were Doctor of Philosophy (PhD), Master or bachelor's degree holders.

Several studies had explored undergraduate physiotherapy students' career choices after graduation in which the majority of the students chose to work rather than further study into higher education after completing their studies but the number of those who chose to further study after graduation varies greatly between countries (George et al. 2019; Ibikunle et al. 2013; Jain et al. 2011; Naidu et al. 2013; Narin et al. 2018; Ohman et al. 2001; Prendushi 2017). Specifically, in India and Albania, Jain et al. (2011) and Prendushi (2017) found that as high as 84% and 90% of their undergraduate physiotherapy students intended to further study after graduation. On the contrary, Narin et al. (2018) reported only 33% of undergraduate physiotherapy students in Turkey intended to further study after graduation. The differences in career choice after graduation among undergraduate physiotherapy students in previous studies were found to be related to factors such as career goal, appealing profession, job opportunities, financial, and social issues (George et al. 2019; Jain et

al. 2011; Naidu et al. 2013). To date, although there were at least seven studies that have been done investigating physiotherapy students' career choices after graduation, none of these studies were from Malaysia (Jain et al. 2011; Marques et al. 2018; Naiduet al. 2013; Narin et al. 2018; Ohman et al. 2002; Ohman et al. 2001; Prendushi 2017). Given that job opportunities, salaries, career growth, and even sociodemographic status differ between Malaysia and other countries, repeating similar study in Malaysian context may or may not produce similar findings. Therefore, the objectives of the present study were to determine: (1) the career choice after graduation and factors influencing career choices, and (2) the association between demographic factors and Cumulative Grade Point Average (CGPA) with the career choice after graduation among final year diploma and bachelor's degree physiotherapy students attending four public universities in Malaysia.

MATERIALS AND METHODS

Participants

Sample size was estimated by using the Raosoft calculator with margin of error, confidence level, and response distribution set at 5%, 95%, and 50%, respectively. Representative from each institution involved were contacted to identify the total number of final year physiotherapy students in each institution. From the total 173 final year physiotherapy students identified (International Islamic University Malaysia, Kuantan, or IIUM [n = 22], Universiti Teknologi Mara, Puncak Alam and Bertam, or UiTM [n = 107], Universiti Kebangsaan Malaysia, Bangi, or UKM [n = 17] and University of Sultan Zainal Abidin, Kuala Nerus, or UniSZA [n = 27], 120 was required. A quota sampling method was then used (Figure 1).

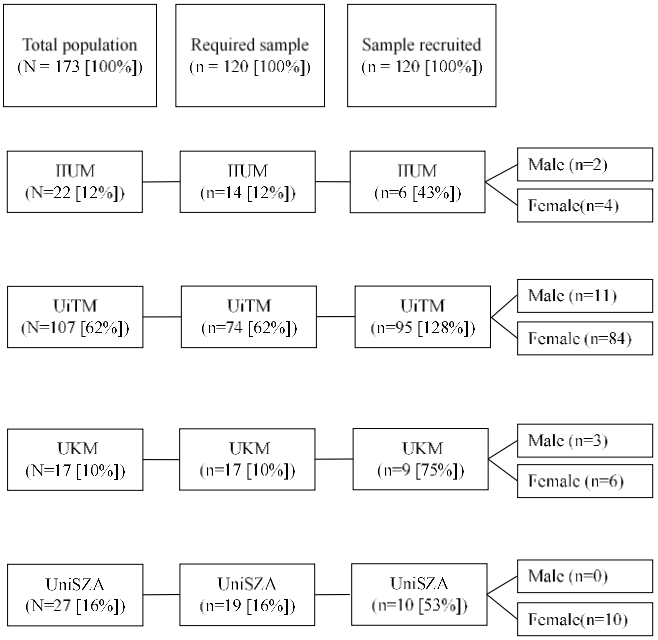

Figure 1: Number of total populations, required sample and recruited sample from each university. Data are represented as n (%).

Data collection

Data collection was conducted through an online platform (Google form application) where the link of the survey was distributed via the students' representative in each study setting using Whatsapp application. All participants were given one month to complete and return the questionnaire. Information such as email and contact number of the primary investigator were provided for enquiries.

Ethics approval

This study was approved by the the Human Research Ethics Committee of Universiti Teknologi Mara (approval ID: REC/10/2020). The inclusion criteria were full-time undergraduate physiotherapy students who were currently in final year of study.

Measurement

The questionnaire used in this study was adopted from Intention After Graduation Survey (IAGS 2016), Jain et al. (2011) and Ohman et al. (2001). The original questionnaire had been reviewed by professionals, evaluated in a pilot study, and tested on participants from previous studies for face and content validity (Jain et al. 2011; Ohman et al. 2001). The questionnaire consisted of seven sections. Section one (S1) was on the participant's information sheet and consent form. Section two (S2) consisted of 17 questions on demographic information, factors of choosing to study physiotherapy, and information sources about physiotherapy courses. Section three (S3) and four (S4) consisted of questions on career choice after graduation. Participants were directed into other three different sections (S5-S7) depending on their answers in S3-S4 to determine the factor influenced on each career chosen earlier in S4.

Data analyses

Data were analysed by using the IBM SPSS statistical software version 21. Descriptive statistical analysis was used to describe the demographic data, career choices, and factors influencing career choices. Association between demographic factors (age, ethnicity, house location, family size, birth order, household income, previous education) with the career choice after graduation were analysed by using chi-square test of independence (parametric) and Fisher's exact test (non-parametric). Association between CGPA (CGPA < 3.5 vs ≥ 3.5) with the career choice after graduation were analysed by using independent student t-test.

RESULTS

Based on Figure 1, a total of 120 students returned the survey form with response rate from UiTM (95 [128%]), UKM (9 [75%]), IIUM (6 [43%] and UniSZA (10 [53%]). Among the respondents, more than half (71 [59%]) were bachelor's degree students while 49 (41%) were diploma students. Further details of the survey respondents are described in Table I.

Table I: Details of the survey respondents (n=120)

Demographic	No. of respondents n (%)	Survey respondents	
		Diploma, n (%)	Degree, n (%)
Gender			
Male	16 (13.3)	5 (4.2)	11 (9.2)
Female	104 (86.7)	44 (36.7)	60 (50.0)
Age, Mean (SD)	21.6 (1.74)	20.4 (1.72)	22.5 (1.15)
House location			
Urban	65 (54.2)	25 (20.8)	40 (33.3)
Rural	55 (45.8)	24 (20.0)	31 (25.8)
Family size			
Less than 5	39 (32.5)	12 (10.0)	27 (22.5)
More than 5	81 (67.5)	37 (30.8)	44 (36.7)
Birth order			
Oldest child	21 (17.5)	11 (9.2)	10 (8.3)
Middle/youngest	99 (82.5)	38 (31.7)	61 (50.8)
Average family income (RM)			
Below 2,000	41 (34.2)	15 (12.5)	26 (21.7)
2,001 – 4,001	33 (27.5)	14 (11.7)	19 (15.8)
4,001 – 6,000	12 (10.0)	5 (4.2)	7 (5.8)
6,000 above	34 (28.3)	15 (12.5)	19 (15.8)
Previous level of education			
Diploma	32 (26.7)	-	32 (26.7)
Foundation	18 (15.0)	-	18 (15.0)
Matriculation	21 (17.5)	-	21 (17.5)
SPM (Sijil Pelajaran Malaysia)	48 (40.0)	48 (40.0)	-
Pre-Diploma	1 (0.8)	1 (0.8)	-
Scholarship			
Yes	32 (26.7)	10 (8.3)	22 (18.3)
No	88 (73.3)	39 (32.5)	49 (40.8)
Clinical placement			
Yes	109 (90.8)	38 (31.7)	71 (59.2)
No	11 (9.2)	11 (9.2)	-
Family member/relative in PT			
Yes	7 (5.8)	2 (1.7)	5 (4.2)
No	112 (93.3)	47 (39.2)	65 (54.2)
CGPA			
Mean (SD)	-	3.4 (0.3)	3.5 (0.3)
Below 3.5	61 (57.5)	27 (25.5)	34 (32.1)
Above 3.5	-	3.4 (0.3)	3.5 (0.3)

Data are presented as n (%) unless otherwise stated. Abbreviations: CGPA, cumulative grade point average.

Career choice after graduation

Over two-thirds (83 [69%]) of the survey respondents have a certain plan on what to do after graduation with 57 (47%) intended to work, 26 (22%) intended to further study while the rest were uncertain and no plan at all (34 [28%] and 3 [3%]). Respondents who were uncertain or had no plan at all after graduation were then further asked for their opinion to continue into higher education and only 22 (18%) would consider the option.

Among the 57 respondents that intended to work after graduation, 12 (21%) and 45 (79%) were diploma and bachelor's degree respondents respectively. Most (50 [88%]) of them intended to work as a physiotherapist in Malaysia while 3 (5%) intended to work abroad and 4 (7%) were undecided where to work. Details of the working preferences of the respondents were further described in Figure 2.

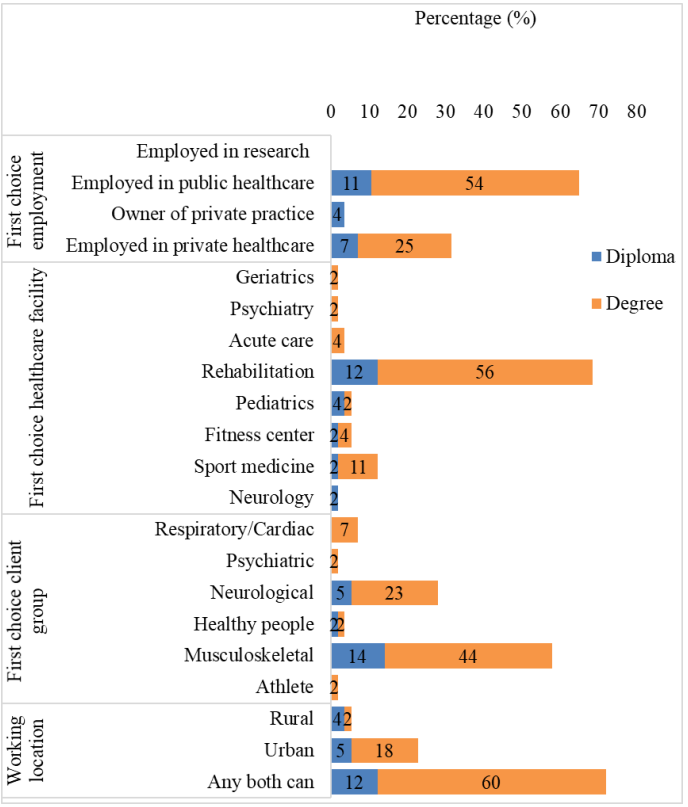

Figure 2: Details on the working preferences by respondents who intended to work after graduation (n=57)

There were 48 respondents, of which 35 (73%) diploma and 13 (27%) bachelor's degree respondents who intended to further study after graduation, into bachelor's degree and postgraduate program, respectively. Most of the respondents (39 [81%]) chose full time study while 9 (19%) chose part time study. Among the top five specialized areas of interest were musculoskeletal (23%), cardiorespiratory (15%), neurology (15%), paediatric (15%), and geriatric (15%). Among the reasons of choice were passion and enjoyment in the field of interest.

Factors that influenced career choice after graduation

Three main factors that influenced the respondents' choice to work after graduation were working experience (15 [26%]), family members (11 [19%]), and desire to serve the community (9 [16%]). Three main factors that influenced the respondents' choice to further study after completing their current studies were to specialize in a particular area/skill (19 [40%]), to enter a profession with specific requirements (7 [15%]), and to further undergraduate knowledge (7[15%]).

Association between demographic factors and CGPA with career choices after graduation

The association between demographic factors and CGPA with career choices after graduation was analysed from 83 respondents who have initially planned their career choices after graduation. Based on Table IIa and Table IIb, the respondent's current program [$X^2(1, n = 83) = 26.585$, $p < 0.001$], age [$t(81) = 16.83$, $p < 0.001$], and previous education program [$X^2(3, n = 83) = 26.826$, p

< 0.001] were found to be associated with the career choices after graduation. Gender (p > 0.05) was found to be not statistically significant with the career choices after graduation.

Table IIa: Association between demographic factors and career choices (n=83)

Demographic	Career choice		χ^2 statistic (df)	*p-value*
	Work n (%)	Further study n (%)		
Current program				
Diploma	12 (36.4)	21 (63.6)	26.585 (1)	<0.001 [a]
Bachelor Degree	45 (90.0)	5 (10.0)		
Gender				
Male	44 (63.8)	25 (36.2)	-	0.054[b]
Female	13 (92.9)	1 (7.1)		
Ethnicity				
Malay	54 (67.5)	26 (32.5)	-	0.548[b]
Non-Malay	3 (100.0)	-		
House location				
Urban	29 (63.0)	17 (37.0)	1.521 (1)	0.217[a]
Rural	28 (75.7)	9 (24.3)		
Family size				
Less than 5	20 (64.5)	11 (35.5)	0.398 (1)	0.528[a]
More than 5	37 (71.2)	15 (28.8)		
Birth order				
Oldest	11 (57.9)	8 (42.1)	1.331 (1)	0.249[a]
Middle/youngest	46 (71.9)	18 (28.1)		
Household monthly income (RM)				
Below 2,000	19 (76.0)	6 (24.0)	2.141 (3)	0.544[a]
2,001 – 4,001	17 (73.9)	6 (26.1)		
4,001 – 6,000	6 (60.0)	4 (40.0)		
Above 6,000	15 (60.0)	10 (40.0)		
Previous education program				
SPM	12 (36.4)	21 (63.6)	26.826 (3)	<0.001 [a]
Foundation	12 (92.3)	1 (7.7)		
Matriculation	12 (100.0)	0 (0.0)		
Diploma	21 (84.0)	4 (16.0)		
Scholarship				
Yes	18 (75.0)	6 (25.0)	0.628 (1)	0.428[a]
No	39 (66.1)	20 (33.9)		
Clinical placement				
Yes	56 (76.7)	17 (23.3)	-	<0.001 [b]
No	1 (10.0)	9 (90.0)		
Relatives in the physiotherapy profession				
Yes	4 (66.7)	2 (33.3)	-	1.000[b]
No	53 (68.8)	24 (31.2)		

Data are presented as n (%) unless otherwise stated. [a] Pearson Chi-Square test; [b] Fisher's Exact test.

Table IIb: Association between age and CGPA with career choice (n=83)

Demographic	Career choice		Mean diff. (95% CI)	t-stats (df)	*p-value*
	Work Mean (SD)	Further study Mean (SD)			
Age	22.8 (0.87)	19.4 (0.84)	3.43	22.8 (0.87)	19.4 (0.84)
CGPA	(3.02, 3.83)	16.83 (81)	<0.001[a]	(3.02, 3.83)	16.83 (81)

[a] Independent t-test

DISCUSSION

The present study found that not more than half (47%) of the undergraduate physiotherapy students in Malaysia chose to work while few chose to further study after graduation. With regard to the level of undergraduate study, most of the diploma respondents intended to further study while the bachelor's degree respondents intended to work after graduation. These study results were aligned with George et al. (2019), Naidu et al. (2013) and Narin et al. (2018) where undergraduate physiotherapy students in Saudi Arabia, South Africa, and Turkey chose to work with only a few chose to further into postgraduate study. Gotlib et al (2012) found a different career choice in six European countries where a majority of the undergraduate physiotherapy students in Latvia and Czech chose to work, the United Kingdom chose to further into postgraduate study only, and Poland, Spain, and Malta chose to further into postgraduate study while working after graduation. Prendushi (2017) also found a similar finding to Gotlib et al. (2012) as a majority of the undergraduate physiotherapy students in Albania also chose to further into the postgraduate study while working after graduation.

Most of the respondents who intended to work as a physiotherapist in Malaysia was parallel to Jain et al. (2011) and Janaudis-ferreira et al. (2016) as undergraduate physiotherapy students in India (59%) and Canada (96%) also wanted to work as physiotherapists in their own countries, respectively. Jain et al (2011) stated that the factors that influenced the undergraduate physiotherapy students to work in their own country were the career opportunities and the increasing role of physiotherapists in their healthcare system. Based on the Ministry of Health Malaysia data, the ratio for Malaysian physiotherapists was increased by the year 2018 to 2019 from 1: 22,790 to 1: 22,864 per population (Health Human Resources 2018 (as of 31 December); Health Fact 2019: References Data for 2018 2019; Ministry of Health Malaysia 2020). The WCPT physiotherapy: population ratio in Malaysia is still lower when compared to other countries in the Asia Pacific Western region such as Australia (14.3: 10,000), Hong Kong (4.8: 10,000), and Singapore (3.6: 10,000) (World Physiotherapy 2021). The annual number of clients' admission into government hospitals in Malaysia for physiotherapy rehabilitation service were also increased by the year 2018 to 2019 from 2,795,331 to 2,860,850, the third highest after child and antenatal client's admission in the government hospitals (Ministry of Health Malaysia 2020). This difference in the physiotherapist ratio per population and the increased number of clients' admission for physiotherapy rehabilitation in Malaysia could be an indicator of the need for physiotherapists to fulfil the demand for human resources within the country.

For career choice to further study after graduation, only a small number of bachelor's degree respondents (6%) intended to further into postgraduate study, despite this survey was conducted during the peak of the COVID-19 pandemic where job offers have been low. However, this is not the issue for Malaysian physiotherapy students alone as Narin et al. (2018) also reported a similar finding in which as high as 67% of the bachelor's degree

physiotherapy students in Turkey were not interested to further into postgraduate study. On the other hand, these findings were in contrast with Amin et al. (2020), Fabunmi et al. (2020), and Jain et al. (2011) as they reported most of Pakistan (78%), Nigeria (94%), and India (90%) bachelor's degree physiotherapy students were interested to further into postgraduate study.

Furthermore, diploma respondents who intended to further study into bachelor's degree program for entering a profession with a specific requirement could be related to the Allied Health Profession Act 2016 (Act 774) (Law of Malaysia 2016). Act 774 seeks to enforce the registration and regulate the practice of the allied health profession in the country (Atikah 2021). The act was currently postponed as the council members were still reviewing and refining the policy and eligibility standard for the registration as allied health profession practitioners (Atikah 2021). For now, the minimal requirement to practice as a physiotherapist in Malaysia is still diploma level (World Physiotherapy 2021). However, in the future when Act 774 is in full enforcement, the minimal requirement to practice as a physiotherapist would be bachelor's degree level. Therefore, this could be in part explained why many of the diploma respondents wanted to pursue study into bachelor's degree program.

Factors that influenced career choice after graduation

Most of the respondents who chose to work after graduation was influenced by previous working experience, family members, and wanted to serve the community while respondents who intended to further study after graduation were influenced to enhance their physiotherapy knowledge and enter a profession with a specific requirement. Career goal was found to be the fourth factor that influenced the respondents in both career choices. These results differ from a study by George et al (2019) as they found that career goal was the main factor that influenced the undergraduate health science students in Saudi Arabia choices to work or study after graduation. Contrary to expectation, there was scarce literature found on the factors that influence career choice to work after graduation for undergraduate physiotherapy students. A likely explanation for this was that many of the previous studies were more focusing on factors students in choosing to study physiotherapy, choices of the working institution, working location, and specialized physiotherapy area to work in.

For the factors that influenced respondents' choice to further study after graduation, there were slightly different findings from Gotlib et al. (2012) and Qamar et al. (2017) as many undergraduate physiotherapy students in Europe and Pakistan chose to further study solely because either they wanted to increase the job opportunities or having profitable careers that provide better remuneration. The difference between these findings can be explained through the level of undergraduate students in these studies. In Gotlib et al. (2012) and Qamar et al. (2017), bachelor's degree students were recruited while the current study recruited diploma and bachelor's degree students. Furthermore, many of the respondents that chose to further study after graduation in the current study were the diploma respondents. Therefore, there could be different standpoints between diploma and bachelor's degree students. However, it was not the case for Malaysian physiotherapy students as both stated that they wanted to further study to enhance their physiotherapy knowledge in a particular area. Increased job opportunities and gaining better income were the fifth and sixth factors influencing their choice to further study after graduation.

Association between demographic factors with career choice

Another possible explanation on the significant difference of career choice after graduation can be explained also through their age, and previous level education. Bachelor's degree students spent longer time than the diploma students. Estimated time spent for diploma students to complete their study was at least three years while for bachelor's degree students, they need at least four years for those from Matriculation and Foundation and six to seven years for those from diploma graduates to complete their studies from their age of 17 (SPM leavers). Therefore, students' age and duration to complete their undergraduate studies can be related to the lack of motivation to further into postgraduate study among bachelor's degree respondents while the diploma respondents can go into bachelor's degree program for another four more years.

There were several limitations in this study. Firstly, this study only takes students in public institutions and does not include private institutions to represent all of the undergraduate physiotherapy students in Malaysia. Second, the birth order (eldest, middle, and youngest child) of the respondents was unable to determine based on the number of family sizes. Third, more than half of the survey from returned were from UiTM (95 [79%]) then followed by UniSZA (10 [8%]), UKM (9 [8%]), and IIUM (6 [5%]) students that lead the results to be biased towards the university that participated the most. From quota sampling, only 74 respondents were needed from UiTM students. However, as the survey form were distributed through representative from each institution, we had received 95 respondents (128%) from UiTM within one-month period of data collection which was beyond of our control. Last, this study used a cross-sectional study design where only one-time measurement was undertaken which were unable to measure the changes in career choice from beginning till final year of study in physiotherapy which is an interesting gap for future studies.

Despite those limitations, the findings from this study facilitate discovering and understanding the career choices after graduation and factors influencing undergraduate physiotherapy students in Malaysia that, to our knowledge, have never been studied yet. These findings can benefit other physiotherapy students and secondary school students in Malaysia to understand

what most physiotherapy students plan in their future indertaking. This study may benefit Malaysia's institutions or organizations in developing more career development opportunities for the physiotherapy profession to meet the demand for human resources.

CONCLUSION

Bachelor's degree physiotherapy students were more intent to work because of their working experience, family, and wanted to serve the community. Diploma physiotherapy students mainly intended to further study into higher education as they wanted to further their physiotherapy knowledge and enter a profession with a specific requirement. Age, current program, and previous education background, were associated with the students' career choice.

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CONFLICT OF INTEREST

The authors declare no conflicts of interest.

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CASE STUDY

A Brief Program of Pulmonary Rehabilitation is Effective for Intensive Care Unit Survivor with Post-Covid-19 Infection

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ABSTRACT

This case study described a successful pulmonary rehabilitation program (PRP) for an 18-year old female of intensive care unit (ICU) survivor. This patient had a history of COVID-19 infection and ventilated for 14 days with a total six weeks hospitalization. The patient presented with post COVID-19 syndrome and with sensorimotor axonal polyneuropathy on discharged from ICU. Her comorbidity includes epilepsy and newly diagnosed diabetes mellitus. She was referred to our outpatient clinic with reported physical limitation and dyspnea. She has marked reduction in grip and ankle strength, reduced exercise tolerance and was wheelchair-bound. She underwent five sessions of PRP which consists of aerobic conditioning, strengthening, balance, stretching and walking exercise. Following the completion of PRP, the patient regained walking ability without foot drop, increased gait speed, had good balance and coordination, better hands grip, and exercise tolerance. PRP plays an important role for optimal recovery of patient with post COVID-19 syndrome.

Keywords: COVID-19, ICU survivor, polyneuropathy, pulmonary rehabilitation

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INTRODUCTION

COVID-19 is a highly infectious respiratory disease which has infected more than 199 million people worldwide and resulted in 4.2 million deaths so far (WHO 2021). Scientific evidence shows that patients who undergo invasive ventilation in intensive care unit (ICU) have a 50% of prevalence developing respiratory and limb muscle weakness (Medrinal et al. 2020). It is therefore reasonable to expect that a large proportion of COVID-19 ICU survivors will develop such weakness.

Tankisi et al. (2020) reported critical illness myopathy and polyneuropathy as the consequences of COVID-19 infection, with symptoms of foot drop due to weakness of ankle dorsiflexors muscles. Acute unilateral foot drop is a common presentation, however bilateral foot drop is rare, as there are limited number of data been reported. The compression of deep peroneal nerve, common peroneal nerve, or sciatic nerve are the most common aetiology of unilateral foot drop (Stewart 2008). Unilateral compression neuropathy for lower extremity is commonly presented, caused by peroneal nerve palsy. Peroneal nerve entrapment is often caused by external compression commonly following anaesthetic drugs, prolonged hospitalization, limb casting, tight bracer, compression wrapping, and pneumatic compression device usage (Poage et al. 2016).

Guidelines from an international team of expert physiotherapy researchers and clinicians recommended early physiotherapy in the ICU to prevent ICU-acquired weakness (Thomas et al. 2020). Based on the individual deficits in COVID-19 patients, various international expert groups suggested comprehensive multidisciplinary rehabilitation such as pulmonary rehabilitation to improve respiratory, physical and psychological impairments (Spruit et al. 2021; Polastri et al. 2020; Vitacca et al. 2020). Pulmonary rehabilitation was a feasible, safe, and effective therapeutic option for COVID-19 patients independent of the disease severity (Gloeckl et al. 2021). PRP for ICU survivor with post-COVID-19 infection results in improvements of patient reported outcomes, namely dyspnoea, limbs strength and exercise capacity (Thomas et al 2020; Vitacca et al.2020; Parker et al. 2021). To date there have been limited reports i.e., a few case studies and series internationally but none in Malaysia on recovery and rehabilitation in COVID-19 patients using PRP (Parker et al. 2021; Negrini et al. 2020; Gloeckl et al. 2021). Therefore, in this paper, we report our findings for a COVID-19 ICU survivor of patient recovery and rehabilitation following PRP.

CASE STUDY

An 18-year-old post COVID-19 female patient with a background history of epilepsy was referred to us on 7th May 2021 for PRP. The patient presented to Emergency Department (ED) with history of unresponsiveness in addition to urinary incontinence, fever, and headache for two days with shortness of breath. She was then tested positive with COVID-19 and newly diagnosed with diabetes at ED ward with blood glucose 36 mmol/L. She was treated as diabetic ketoacidosis (DKA) with hyperosmolar hyperglycaemic state (HHS) secondary to sepsis. She was intubated for airway protection for 14 days and subsequently developed foot drop during ICU hospitalization. During her ICU stay, she developed ICU-acquired weakness with MRC scale less than 48. The Nerve Conduction test (NCS) was used to evaluate neuromuscular integrity with results showed sensorimotor axonal polyneuropathy.

The patient was hospitalized in the ICU for a total of 23 days, and transferred out to medical ward for eight days before being discharged home. She was referred for PRP as an outpatient at four days after discharge. She was accompanied by a caregiver, wheelchair-bound when attending our PRP. Initial examination using the Manual Muscle Testing (MMT) showed her bilateral shoulder flexion, elbow flexion, and wrist extension power were at 3/5; while the power of hip flexion, knee flexion, and ankle dorsiflexion were 2/5, 3/5 and 1/5 respectively with MRC scale less than 48. Modified Dyspnoea Borg's scale was 7 in resting position. Patient was not able to perform 6-minute walking test (6 MWT), with marked desaturation (to 90%) during 6-minute walk test.

During the first session, an electrical muscle stimulation was administered to her ankle dorsiflexor bilaterally (parameter setting: pulse rate 150hz, pulse width 300ms, output intensity 45mA). We started a structured PRP of 60 minutes duration consist of upper limbs (UL) and lower limbs (LL) strengthening, aerobic, balance, and stretching exercises. Functional gait training was facilitate using a walker. Additionally, the patients were given a home exercise booklet that include strengthening, endurance and balance exercises, and re-education on functional training walking for home exercise. On her second visit, she was able to walk independently with a high stepping gait accompanied by a caregiver. She was compliance to her home exercise booklets as instructed daily. She showed progress on her UL and LL with her MMT measurement. Prior to physiotherapy treatment, her MMT for bilateral UL with shoulder flexion was 4/5, elbow flexion was 4/5, and wrist extension was 5/5. Similarly, for her LL MMT with hip flexion 4/5, knee flexion 4/5, and ankle dorsiflexion was 2/5 with MRC total score less than 48. Modified Dyspnoea Borg's score was 0 in the resting position. She completed the 6MWT and achieved 180m distance but with high stepping gait. Therefore, we stopped electrical stimulation and continue with functional exercise for the PRP second session. We added endurance type exercise training with moderate intensity targeted Borg Rating of Perceived Exertion (RPE) between 12 to 14. Patient was instructed to rate her exertion on the scale during exercise activities. The mode of exercise includes cycling (15 minutes), walking (10 minutes), stepping on 1-inch step board (10 minutes) and strengthening exercise of bilateral UL and LL for a total duration of 60 minutes. Exercises intensity was progressed for 5 – 10% weekly for both UL and LL from the previous exercise prescription. Each muscles group were prescribed with 8 – 12 repetitions (2 – 4 sets), two minutes rest, with frequency of two to three sessions weekly. We advised the patient to increase walking for 20 – 30 minutes daily as tolerated.

After the ninth week (3rd session), she was able to walk with normal gait independently and completed 6MWT with 350m walking distance. Her MMT for bilateral shoulder flexions, elbow flexions, wrist extensions, hip flexions, knee flexions, and ankle dorsiflexion restored power of 5/5 with MRC score of 60. Modified Dyspnoea Borg's score was 0 at resting position. Similarly, with previous prescription, the patient was instructed to rate her exertion on the scale during exercise activities with targeted RPE between 12 to 14. The mode of exercises was progressed with cycling (15 minutes), walking (20 minutes), stepping on 1-inch step board (10 minutes) and strengthening exercise of UL and LL (15 minutes) for total duration of for 60 minutes with frequency of three sessions weekly.

After four months (5th session) of brief PRP, she had restored her pre-COVID-19 functional status. Her 6MWT completed with distance achieved at 534m. She achieved normal grip strength measured using JAMMAR with 30kg for right hand and 28kg left hand in comparison with a healthy population reference range of similar for her age and sex (Massy-Westropp et al. 2011). She has resumed her study and able to travel around independently without any residual symptoms. We continued her exercises prescription with targeted RPE between 12 to 14. The mode of exercises prescribed maintained with cycling (15 minutes), walking (20 minutes), stepping on 1-inch step board (10 minutes) and strengthening exercise of UL and LL (15 minutes) for total duration of for 60 minutes with frequency three sessions weekly. Table 1 shows the outcomes at week 1, 3, 6, and 16.

DISCUSSION

Our findings offer first insight into the recovery of post COVID-19 ICU survivor in Malaysia. This is the first case of post Covid-19 syndrome presented with sensorimotor axonal polyneuropathy that underwent a brief PRP. Anecdotally, our experience in treating ICU COVID-19 survivor with brief PRP has indicated a recovery from acute post COVID-19 symptoms. Our report shows that

Table I: Results of outcome measures used at week 1, week 3, week 9 and week 16

Week Post Hospital Discharged	Ambulation status	Medical Research Council (MRC)	MMRC Dyspnea score	Borg's score at rest	6MWD	Hand grip	
						Right	Left
Week 1	Wheelchair	30	4	0.5	Unable to perform	15kg	14kg
Week 2	Walk independently with close supervision (high stepping gait)	46	2	0	180m	-	-
Week 9	Walk independently	60	1	0	350m	-	-
Week 16	Walk independently	60	0	0	534m	30kg	28kg

PRP is feasible (despite low adherence rate of pulmonary rehabilitation sessions), is safe with no adverse events, and beneficial to improve exercise performance and quality of life for post COVID-19 ICU survivor. To the best of our knowledge, this is the first case study investigating the effects of a pulmonary rehabilitation in ICU survivor post COVID-19 patient in Malaysia.

In a recent systematic review, Negrini et al. (2020) reported the level of evidence of PRP in COVID-19 patients to be low. However, our case study indicates that recovery of exercise performance can be accelerated when COVID-19 patients was referred to pulmonary rehabilitation after the acute phase of the disease. This result is consistent with other study based on 6MWD, suggesting of improvement by a minimal important difference of 30m in patients with respiratory diseases (Gloeckl et al. 2021).

A significant proportion of ICU COVID-19 survivors require physiotherapy as part of their recovery. Healthy patients with mild symptoms of COVID-19 might need a few sessions, while more severely ill patients might need a few months of rehabilitation similar to our case study which is tailored to her needs. We believed that a PRP that consists of a structured exercise program incorporated with progressive aerobic, balance, and strengthening exercises improved patient's reported limited physical limitation, dyspnoea, UL and LL strength as well as quality of life for ICU survivor post COVID-19.

Our exercises prescription and very early rehabilitation in outpatient setting (within four days after discharge from the hospital) enable her to resume her studies. Furthermore, the patient was very compliant to her home exercise prescription with five times frequency weekly without supervision. Her adherence toward PRP at the hospital and home program reflected in her excellent recovery following COVID-19 despite our limitation during the movement control order (MCO) period with 70% reduction of face-to-face appointment. However, the five sessions of supervised physiotherapy session within four months and five sessions of unsupervised weekly at her own time had improved her condition beyond expectation.

We assessed muscle strength using both the MRC scale and handgrip dynamometry. These tools have been recommended as standard tools for diagnosis of ICU-acquired weakness and the associated post-intensive care syndrome (Van Aerde et al. 2021; Jaffri A & Jaffri UA. 2020; Ulutaş et al. 2021). The MRC was assessed in 12 muscle groups and then individual scores are combined into a sum-score, which result in an overall estimation of motor function. Summed scores below 48 out of 60 and below 36 out of 60 indicate significant and severe weakness, respectively (Van Aerde et al. 2021; Jaffri A& Jaffri UA. 2020; Ulutaş et al. 2021). Similarly, hand-held dynamometry is a reliable and objective measure of global strength in physical impaired subjects and can be used to assess and monitor strength recovery in the longitudinal follow- up time (Ulutaş et al. 2021). Hand-held dynamometry was reported as a reliable tool in critically ill patients who had powerful enough strength to overcome gravity (MRC ≥3) in lower and upper muscles (Van Aerde et al. 2021; Vanpe et al. 2011).

We have observed significant physical weakness based on the MRC and handgrip dynamometry measurement in critically ill patient recovering from COVID-19, highlighting the need for ongoing physical rehabilitation in COVID-19 ICU survivors. Detailed analysis of both ICU care and early follow-up of COVID-19 patients may allow identification of the most favourable management strategies of patients with severe COVID-19 (Parker et al. 2021). A limitation of this study is that it is a single case study and therefore, our findings may not reflect the general outcomes of PRP in ICU survivors.

CONCLUSION

Our case study shows that a brief PRP is effective, feasible, and safe for post COVID-19 ICU survivor. PRP is an important component in helping patients to return to their optimum level of independent activities of daily living.

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CONFLICT OF INTEREST

The authors declare no conflicts of interest.

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CASE STUDY

Web-Based Game-Focused Exercise in the Home Setting as an Alternative to Hospital-Based Exercise for Stroke Survivors: A Case Study

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ABSTRACT

Stroke survivors require continuous exercise therapy to minimize post stroke weakness and functional decline that eventually affect their motivation level and quality of life. However, frequent hospital-based therapy has become less feasible during COVID-19 pandemic due to fear of infection and other restrictions. Therefore, an alternative exercise method is needed in a home setting. One approach, namely game-focused exercise, has received much attention in recent research, and good evidence has been documented. However, the delivery of game-focused exercises in a home setting with a remote supervision from therapists has not been well researched. This case study dicusses the effects of a web-based, game-focused exercise conducted in the survivor's home setting on the motivation level and quality of life. The case was a 58-year-old post-stroke patient, with good cognitive status (Montreal Cognitive Assessment score = 28) who was recruited to undergo the intervention from February to March 2021. The subject performed a game-focused exercise program using a web-based Checkercise® board for 40 minutes per session, twice a week for eight weeks. The intended outcome of the intervention was measured using the Intrinsic Motivation Inventory (IMI) and Short Form-36 (SF-36) questionnaire. The study results have shown that web-based Checkercise® is doable in the home setting and yielded satisfactory outcomes, with improvement in overall motivation level by 30%, mainly in the subscales of interest/enjoyment, perceived competence, and perceived choice. Further, the subject demonstrated a better health state, illustrated by the lower score in the pressure/tension subscale (22% reduction) of the IMI and increased physical and mental health components score of the SF-36, by 29% and 60%. In conclusion, web-based, game-focused exercise using the Checkercise® board is beneficial in enhancing post-stroke motivation level and quality of life, and may be considered as a therapy option for this population during COVID-19 pandemic time.

Keywords: Stroke, game-focused exercise, web-based, home-based

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INTRODUCTION

Stroke is a major cause of disability in many countries. It was reported that, in 2019, there were nearly 12.2 million incident cases of stroke,101 million prevalent cases of stroke and 143 million disability-adjusted life-years (DALYs) due to stroke globally (Feigin et al. 2021). Annually, about 15 million new cases were reported worldwide, with 5 million survivors left permanently disabled, placing a burden on family and community (World Health Organization 2021). This substantial number of people with a stroke-related disability who require continuous and long-term rehabilitation and healthcare support places a great burden on the healthcare system in most Asian countries including Malaysia (Wijaya et al. 2019). Rehabilitation remains the mainstay of treatment to combat post-stroke disability. Physiotherapy, being a main part of the multidisciplinary rehabilitation program is important, aiming at improving post-stroke physical functions with the use of multiple modalities such as therapeutic exercise, electrophysical agents, manual therapy, virtual reality therapy, mirror therapy, robotic therapy, biofeedback electromyograph therapy and acupuncture (American Heart Association Stroke Council 2016; Australian Government National Health and Medical Research Council 2017; Heart and Stroke Foundation of Canada 2016; Kementerian Kesihatan Malaysia 2012). During hospitalization for acute and sub-acute stroke, the service is provided and normally continued in out-patient settings once the stroke patient is discharged.

Due to the coronavirus disease 2019 (COVID-19) pandemic, rehabilitation facilities have become less accessible for patients with a stroke where reports have shown that as much as 39% of stroke survivors who

had a stroke in 2019 claimed deprived of rehabilitation therapies, including physiotherapy (Stroke Association 2020). Lack of intensive rehabilitation hinders the opportunity for recovery especially during the critical time window of endogenous plasticity and improvement post-stroke (Lee et al. 2015). Functional impairments caused by stroke lead to dependency in daily living activities, which consequently reduces the motivation level (Mahmoud et al. 2016) and health related quality of life (Kwon et al. 2018).

One solution to these problems is the use of tele-stroke rehabilitation in the patients' home environment as an alternative to hospital-based rehabilitation. Many studies have analysed the effectiveness of tele-rehabilitation, with the majority reporting that tele-rehabilitation is comparable to in-clinic rehabilitation in terms of improving motor, language, and cognitive functions (Laver et al. 2020). The online rehabilitation program includes telephone-based, web-based video conferencing and virtual reality-based exercise. However, web-based video conferencing was the most utilized tele-rehabilitation, and this approach has been reported to contribute towards better motivation level (Chemtob et al. 2019; Yeh et al. 2011) and improved quality of life (Wu et al. 2020) after stroke, which can be detected using Brunel Mood Scale and Treatment Self-Regulation Questionnaire and Stroke Specific Quality of Life, respectively.

Another approach that is considered motivating is game-focused exercise. Therapeutic exercise with a focus on gaming is the most utilized physiotherapy modality for stroke survivors in the recent times. The game actions performed by stroke survivors in the game-focused stroke rehabilitation interact with game challenges such as soccer, boxing, athletics, and others. It can be delivered either through robotic-assisted (Bustamante Valles et al. 2016; Kim et al. 2015; Nijenhuis et al. 2015; Olafsdottir et al. 2020; Park et al. 2019; Wolf et al. 2015) or virtual based therapy (Standen et al. 2017; Wittmann et al. 2016); with the individual session normally conducted in the form of home-based exercise. Gamification improves attitudes towards and enjoyment of exercise and shapes behavior in terms of increase in exercise activity (Goh & Razikin 2015).

To date, despite being increasingly used in physiotherapy, both tele-rehabilitation and game-focused exercise has never been combined to provide a new training experience for stroke survivors undergoing rehabilitation in a home setting. Combining the two training programs may create a more enriched environment and yield favourable outcomes. In this case study, we report the use of a web-based, game-focused exercise on a 58-year-old post-stroke patient, who was referred for physiotherapy in a state hospital of Kelantan, Malaysia. The case study aims to determine the effects of a web-based, game-focused exercise conducted in the survivor's home setting on motivation and quality of life.

THE CASE STUDY

The subject was diagnosed with left cerebrovascular accident (CVA) and associated right hemiparesis for three months prior to enrolment into the study. He had ischemic stroke secondary to uncontrolled hypertension. There was no other history of other medical conditions except hypertension. He was prescribed with aspirin and metoprolol once daily and he is currently on a regular follow-up for the ischemic stroke. His main functional problems at the initial physiotherapy session were: (1) difficulty with high level walking tasks such as ascending and descending stairs and walking outdoor due to right-sided weakness and fatigue, and (2) some unsteadiness during prolonged standing. However, he had never used or was prescribed any ambulatory aids since diagnosed with stroke. He claimed that his fitness level has declined since the stroke onset, and he currently performs once per week walking exercise for about 20 to 30 minutes per session in his residential area.

Due to the COVID-19-related Movement Control Order (MCO) imposed by the government and fear of infection, he was not keen to attend face-to-face hospital based-physiotherapy. Thus, as an alternative intervention, we prescribed a home exercise program for him with the use of a newly designed web-based game-focused exercise termed as Checkercise® board (Figure 1). The Checkercise® board is specifically designed to facilitates stroke survivors' recovery and contains exercises in the form of games similar to the 'snake and ladder' game board which comprised of fate, competition and reward elements.

Prior to starting the exercise, his functional status was screened, and he has shown the ability to: (1) walk continuously for ten meters independently without a walking aid, (2) perform basic activities of daily living such as walking, stepping up and turning without a walking aid, and (3) hold a glass full of water in the non-affected hand. He has no other co-morbidities which limit exercise participation such as orthopedic conditions resulting in joint deformities. He is slightly overweight, with a body mass index calculated as 26.3 kg/m^2. His vision and hearing sensation were normal. He has a good cognitive function, which is indicated by a Montreal Cognitive Assessment score of 28.

The subject performed the web-based Checkercise® board exercises at a metronome pace, two times per week, under remote monitoring by the researcher (Figure 2 and 3). Exercise adherence and the level of exercise intensity (e.g. low, moderate, vigorous) were monitored using practice sessions checklist and Borg Scale Rate of Perceived Exertion, respectively. Table I shows the exercise program details which were based on frequency, intensity, time and type (FITT) principle. The exercise duration for each task was two minutes interspersed by two minutes rest with a total of ten exercises to be performed in each exercise session for an estimated duration of 40 minutes. All selected exercises focused on advanced and challenging task-

Figure 1: Some examples of exercises included in the Checkercise® board

oriented activities to trigger automatic responses, divided attention and multi-tasking ability.

As mentioned earlier, the design of the Checkercise® board is similar to the 'snake and ladder' game board. To use the Checkercise® board, the subject was first required to report his pre-exercise vital sign. To 'start', he had to roll a dice by pressing 'dice symbol' Exercises performed would depend on where his counter landed on the board each time the dice was rolled, as each space shows a different exercise task. There was also a possibility of being penalized during the training if their counter landed on 'penalty spaces', such as spaces which indicate 'slide back a few spaces, and 'move to a certain board number'. The game-based circuit exercises were considered completed when his counter arrived at a space that indicated 'finish'. Eventually, he had to report post-exercise rate of perceived exertion using a Borg Scale after completing each exercise video.

In this case, we decided to focus on two outcomes, namely motivation level and self-rated quality of life. Two standardized tools were used to assess the

Table I: Description of the web-based game-focused exercise (Checkercise® board)

Formula	Resistance exercise	Balance exercise	Aerobic exercise
	Repeated sit to stand	**Walking on balance beam**	**Alternate jab**
Frequency	2 sessions/week	2 sessions/week	2 sessions/week
Intensity	Speed at 50 beats per minute	Speed at 30 beats per minute	Speed at 100 beats per minute
Time	1 minute	1 minute	1 minute
Technique	Alternate seated to standing (without load)	Walking on balance beam (follow rhythm)	Repeated jab punching (follow rhythm)
Progression	Alternate seated to standing (lifting up 2 kg of dumbbell)	Tandem walking (follow rhythm)	Repeated double jab punching with defense (follow rhythm)
	Repeated partial squat	**Figure of 8 walking**	**Alternate hook**
Frequency	2 sessions/week	2 sessions/week	2 sessions/week
Intensity	Speed at 30 beats per minute	Speed at 45 beats per minute	Speed at 100 beats per minute
Time	1 minute	1 minute	1 minute
Technique	Standing, partial squats with arm support as needed (without load)	Figure of 8 walking (follow rhythm)	Repeated hook punching (follow rhythm)
Progression	Standing, partial squats with arm support as needed (Lifting up 2 kg of dumbbell/speed at 50 beats per minute)	Figure of 8 walking while holding cup of water	Repeated alternate hook with kicking (follow rhythm)
	Repeated step up & down	**Walking with instruction**	**Double jab & hook**
Frequency	2 sessions/week	2 sessions/week	2 sessions/week
Intensity	Speed at 70 beats per minute	-	Speed at 100 beats per minute
Time	1 minute	1 minute	1 minute
Technique	Standing, alternate steps-ups on the 8-inches step (without load)	Walking & stop (closed eyes in static standing)	Repeated double jab punching with hook (follow rhythm)
Progression	Standing, alternate steps-ups on the 8 inches step board (Lifting up 2 kg of dumbbell/speed at 75 beats per minute)	Walking while sudden change instruction	Repeated double jab punching with hook & squat (follow rhythm)
	Standing; repeated hip raise	**Walk & touch cones**	**Double jab**
Frequency	2 sessions/week	2 sessions/week	2 sessions/week
Intensity	Speed at 45 beats per minute	Speed at 20 beats per minute	Speed at 100 beats per minute
Time	1 minute	1 minute	1 minute
Technique	Standing, alternate raises hip (without load)	Walk & touch cones cuboid shape (follow rhythm)	Repeated double jab punching with defense & kick (follow rhythm)
Progression	Standing, alternate raises hip (Lifting up 2 kg of dumbbell/speed at 50 beats per minute)	Walk & touch cones hexagon shape (follow rhythm)	Repeated double jab punching with squat (follow rhythm)
	Standing; repeated heel raise	**Backward walking**	**Cross straight**
Frequency	2 sessions/week	2 sessions/week	2 sessions/week
Intensity	Speed at 70 beats per minute	Speed at 45 beats per minute	Speed at 100 beats per minute
Time	1 minute	1 minute	1 minute
Technique	Standing, alternate raises heel (without load)	Backward walking (follow rhythm)	Repeated cross straight punching (follow rhythm)
Progression	Standing, alternate raises heel (Lifting up 2 kg of dumbbell/speed at 75 beats per minute)	Backward walking (follow rhythm for 2 minutes)	Repeated 4 times cross straight punching with squat (follow rhythm)

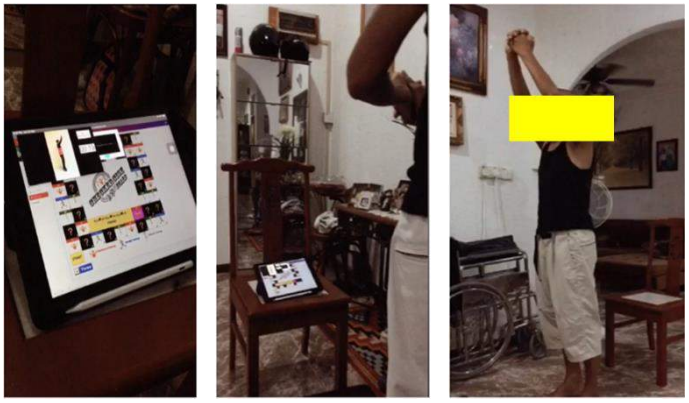

Figure 2: Photos of the subject performing web-based game-focused exercise at home

targeted outcomes, which were Intrinsic Motivation Inventory (IMI) and Short Form-36 (SF-36) Bahasa Malaysia version. The inventory consists of four subscales with a total of 22 questions that were calculated separately; 1) interest and enjoyment (seven questions); 2) perceived competence (five questions), perceived choice (five items) and pressure and tension (five items). The IMI has an adequate reliability value, indicated by Cronbach's α coefficient (ICC = 0.85) (McAuley et al. 1989). The score ranges from 1 to 7 (1 indicates 'not at all true'; 4 indicates 'somewhat true'; 7 indicates 'very true') and a higher total score signifies a higher level of motivation level (high 7.00-4.67; average 4.66-2.34; low 2.33-1.00) except for the pressure and tension subscale (the lower score the better). As for the SF-36 Bahasa Malaysia version, the questionnaire contains eight health state domains (36 questions)

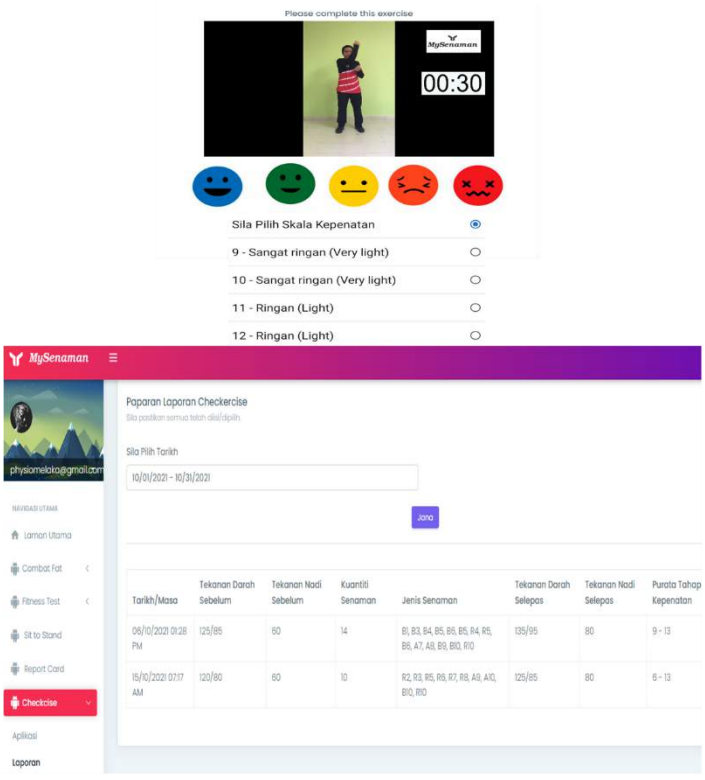

Figure 3: The web-based game-focused exercise monitoring platform

namely: (1) physical health component represented by physical functioning (ten questions), role limitation due to physical health (four questions) and pain (two questions), (2) mental health component represented by social functioning (two questions), role limitation due to mental problem (three questions) and emotional wellbeing (five questions), and (3) physical and mental health component represented by general health (five questions) and energy/fatigue four questions). The SF-36 was shown to have moderate to high test-retest reliability in stroke survivors (0.57 < ICC < 0.8) (Dorman et al. 1998) and adequate to good correlation with the EuroQol (r = 0.66), EuroQol-5 Dimensions (EQ-5D) (r = 0.68) (Katona et al. 2015) and Health Related Quality of Life in Stroke Patient (0.47 < r < 0.79) (Ojo Owolabi 2010). The total score ranges from 0 to 100, with higher scores indicating a better quality of life.

Table II: Changes in all outcomes post-intervention (week 8)

Measures	Baseline	Week 8	Changes
Short Form-36			
a. Physical component	38.3	49.2	29%
b. Mental component	43.7	70	60%
c. Overall	55	70	27%
Intrinsic Motivation Inventory			
1. Interest/enjoyment	4.6	6.5	41%
2. Perceived competence	4.6	6.4	39%
3. Perceived choice	4.4	5.2	18%
4. Pressure/tension	3.6	2.8	22%

At the start of the intervention, the subject's general score of IMI indicated that he has an average level of motivation, in the subscales of interest/enjoyment (4.6/7), perceived competence (4.6/7) and perceived choice (4.4/7). He scored 3.6/7 in the pressure/tension subscale, indicating moderate stress level. On the SF-36 assessment, his physical and mental component scores were only 38.3 and 43.7 out of 100, respectively with an overall score of 55. Through the trial, the subject was able to perform all 16 web-based sessions with a 100% attendance rate. He reported no complains of any adverse effects between or after each exercise session. The subject perceived the web-based application as easy to use and provided interesting experience, which helped him adhere to his exercise therapy. After eight weeks of intervention, the subject showed improvement in overall motivation level by 30%, with a significant increase in the score of interest/enjoyment (6.5/7), perceived competence (6.4/7), and perceived choice (5.2/7) subscales, with a change of 1.9 points, 1.8 points and 0.8 points, respectively, in these subscales. Further, the subject felt less pressure/tension with a 22% reduction in the score of this subscale. Increment in physical and mental component of SF-36 by 29% and 60% was also found, with his overall score perceived as 70 out of 100 at week 8 of exercise. The subject's changes in all outcomes post-intervention are shown in Table II.

DISCUSSION

The purpose of this case study was to evaluate changes in motivation level and quality of life of a stroke survivor following a web-based game-focused exercise using a Checkercise® board. Due to the unavailability of similar combined training interventions in previous studies, we cannot compare our results directly with past research. However, we will discuss our findings with reference to studies with similar training components.

We found improvement in our subjects' motivation level, as indicated by favourable changes in all IMI subscales score following the web-based exercise using Checkercise®. This finding is consistent with the results of 21 chronic stroke survivors in an earlier study by Nijenhuis and co-researchers (2015) following virtual reality-based therapy for six weeks. Similar to us, the researchers used IMI as the outcome measure for motivation level. Our study findings also support the findings of another study (Yeh et al. 2011) which demonstrated positive improvement in motivation level among individuals with stroke, traumatic brain injury and spinal cord injury, assessed using the Brunel Mood Scale. They pointed out that a video conferencing was beneficial in improving balance among 14 participants who enrolled in the study. Chemtob and colleagues (2019) likewise reported improvement in the motivation level of 24 individuals with spinal cord measured using the Treatment Self-Regulation Questionnaire after one hour of weekly tele-rehabilitation session using video conferencing for eight weeks compared to a standard routine.

We believe that the improvement in our subject's IMI score was partly contributed by the interesting and enriched exercise environment induced by the game-focused exercise. Each exercise task in the Checkercise® board offers a rather challenging experience as subject needs to response to multisensory stimuli and cueing, cognitive stimuli, and perform various limb integration movements to optimize neurology recovery potentials (Nithianantharajah & Hannan 2006). Training in such an enriched environment can promote neuroplasticity (Livingston-Thomas et al. 2016) and facilitate personalized motivation and cease stress and anxiety among stroke survivors (Hordacre et al. 2016; Rosbergen et al. 2017).

We also found that our subject exhibited an improvement in the better quality of life as measured using a SF-36 following the eight-week intervention. Corroborating our findings, Wu and colleagues (2020) described results after a tele-stroke rehabilitation using web-based video conferencing designed for 61 community-dwelling stroke survivors for a 12-week period compared to a telephone- based program. They detected a significantly greater improvement in quality of life, measured using a Stroke Specific Quality of Life scale. In another randomized controlled trial in the United States, Forducey and colleagues (2012) evaluated the effects of a 6-week telephone-based education on 32 subacute and chronic stroke survivors compared to the usual face-to-face session. They reported that the telephone-based education resulted in improved quality of life, which was assessed using a Short Form-12 quality of life questionnaire.

The element of enriched exercise environment could also be a factor affecting stroke survivors' activity engagement in rehabilitation sessions (Janssen et al. 2014). It has also been found that significant improvements in functional and cognitive ability were gained following enriched training environment and sustained up to three to six months post-intervention (Khan et al. 2016; Rosbergen et al. 2017). As functional and cognitive ability are pre-requisite to satisfactory quality of life, these could explain the positive change in the score of SF-36 in our subject. Active participation of our stroke survivor in the web-based Checkercise® program may have also enhanced his self-management ability. Self-management ability significantly influences goal setting and achievement for self-management behaviour, emotional state and functional mobility (Hwang et al. 2021). We believe that with the increased in self-management ability, our subjects are more efficient in his daily activities, hence improved sense of general state and perceived quality of life (French et al. 2016).

Our study is subjected to one main limitation. As a case study, its findings could not represent or be applicable to any other stroke patients. A stroke patient with different socio-demography and medical backgrounds may respond differently to the web-based game-focused intervention. However, our study has somehow demonstrated that a carefully selected stroke survivor could be effectively trained to use of a web-based exercise application and successfully completed a challenging, enriched exercise program with a minimal remote supervision. Web-based exercise using the Checkercise® board could be performed as a daily routine in the home environment without professional supervision, especially for those who may have difficulty receiving rehabilitation at the centre for various reasons. This advanced therapy is suitable among stroke survivors with higher-functionality level in regaining their pre-morbid life state.

CONCLUSION

We demonstrated that a web-based, game-focused exercise using the Checkercise® board is beneficial in enhancing post-stroke motivation level and quality of life and may be considered a therapy option for stroke survivors during the COVID-19 pandemic time.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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SPECIAL ISSUE

The Development of Physiotherapy Education in Malaysia: Historical and Challenges

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Physiotherapists were trained abroad in countries such as Australia, the United Kingdom, New Zealand, and India before the Ministry of Health (MOH) started the School of Physiotherapy in 1974. The school was a single-story building located in front of the General Hospital Kuala Lumpur. The program offered was Diploma in Physiotherapy but the students were awarded Certificate in Physiotherapy. Several years later the award title was changed to diploma. Each batch of students had around 20, selected from each state and all were given scholarship. They were bonded for five years with the government. The Malaysian Certificate of Education (*Sijil Pelajaran Malaysia)* was the entry requirement but there were students who had a *Sijil Tinggi Persekolahan Malaysia (STPM).*

The subjects were biomedically orientated including anatomy, physiology, histology, pathology, and psychology, providing a strong foundation to the program. Students also needed to learn many conditions in medicine, orthopaedics, surgery, dermatology, otorhinolaryngology, paediatrics, gynaecology, and obstetrics, neurology, etc. The educational experience focused on knowledge and skills, driven by competency for graduation hence rote learning was commonly used in the mastery of knowledge and skills. The lecturers were medical doctors from General Hospital Kuala Lumpur and basic sciences were taught by lecturers from the Medical Faculty of the *Universiti Kebangsaan Malaysia* (UKM) nearby. All the physiotherapy subjects were taught by the principal and two tutors. There was frequent cancellation of classes when the medical doctors were called to see the patients; students were sent to the wards for observation or bedside teaching by the tutors. The assessment was conducted at the end of the year and throughout the year, small tests were given by the tutors. The failure rate was known to be significantly high and hence the attrition.

Resources such as references were scarce in the school; the students had to go to the UKM Medical Faculty library and the anatomy laboratory facility for anatomy practical. The medical faculty library has limited references in physiotherapy so the students relied on the tutors' notes or wrote their own notes. Students purchased some physiotherapy textbooks that shipped from the United Kingdom (UK) that often took months to arrive. It took several years later that physiotherapy books were available at the book shop (Kamal Book Store) which sells medical books.

The School of Physiotherapy moved to the second floor of the Institute of Orthopaedic in General Hospital Kuala Lumpur in 1979. Clinicians were taken to fill the post for tutors and in the early 90' more clinicians were sent to the United Kingdom to be trained as physiotherapy tutors. The number of students increased with the availability of more tutors. The tutors were sponsored to further their bachelor's degrees with the University of Northumbria and Teesside.

In 2004, the school was transferred from General Hospital Kuala Lumpur to the Institute of Allied Health Sciences in Sungai Buloh. This transfer marked the end of hospital-based education for all health sciences in MOH. A branch Institute of Allied Health Sciences was set up in Johor Bharu in the year 2010 when more physiotherapists were required in district hospitals and much later in primary care facilities. However, the physiotherapy education conducted in the MOH remains at the diploma level from its inception till today.

UKM was the first public university to offer the Bachelor of Physiotherapy with honours in the year 2002. It started with only 20 students and kept a low enrolment for several years. The students who enrolled in the program were known to have good entry-level of *STPM* or matriculation, their choice was medicine or dentistry, but were unable to gain entry. The earliest batches of students seeking employment in Singapore had a commendable performance at the licensing examination. This has made UKM the only university from Malaysia recognized by the Singapore Allied Health Professions Council (AHPC) for the Bachelor of Physiotherapy qualification.

Universiti Technologi MARA (UiTM) started the Diploma in Physiotherapy in 1991 and the bachelor program in 2004. The collaboration for post-registration physiotherapy education between UiTM and Teesside was initially aimed to upgrade the teaching staff to the bachelor level; but became very popular due to its shorter duration (one and a half years part-time) as compared to the programs conducted in the local universities offering transfers of credits requiring three years for full time and double the period for part-time study.

UKM was able to start the postgraduate programmes in 2005 and *UiTM* in 2013 when the staff returned from abroad after their post-graduate study. The postgraduate programs in UKM are by research while *UiTM* offers Master by research and course work. Later, doctoral degree was offered by these two universities.

Few years later, International Islamic University Malaysia (IIUM) and *Universiti Sultan Zainal Abidin* (UniSZA) also started the physiotherapy education. *IIUM* conducts a bachelor program and *UniSZA* diploma program respectively.

Although public universities are fully funded by the government, they experienced great challenges when first commencing the physiotherapy programmes whether diploma or bachelor's degree. There was a lack of teaching staff and physical facilities. Lecturers from the School of Physiotherapy and senior clinical instructors were teaching part-time for the subjects related to physiotherapy; the biomedical subjects were taught by the lecturers from the medical faculty. Classes were held in either temporary or rented premises, usually in the evening and weekend.

During clinical placements, the heads of department were concerned about the appropriateness of the level of the clinical instructors who are mainly diploma to supervise the bachelor's degree students. Often, questions were raised on the expected level of teaching and learning for the bachelor's degree level students. The lecturers from the universities had to go to the clinical areas to provide clinical supervision on a regular basis. Other challenges faced by public universities are fund allocation, administrative bureaucracy, and the lack of resources to maintain robust research activities. As there are more and more institutions including private institutions providing physiotherapy education, there are great constrain for clinical placement facilities. On-site physiotherapy clinics were set up to provide alternative clinical placement for students and as a source of income. This is also a strategy to reduce the rising cost of clinical education as many clinical facilities do not accept students voluntarily (McMeeken 2008).

Physiotherapy education in private institutions commenced in 2005 offering Diploma in Physiotherapy. These private institutions are owned by individual businessmen, political parties, state governments, and private healthcare companies. Over a period of ten years, there are around 20 institutions that offer physiotherapy programs. Some institutions set up branch campuses almost in every state. The marketing strategies of these institutions successfully create public awareness of health sciences programs specifically physiotherapy which can be observed from the popularity of choices made by parents and prospective students.

The main revenue of private institutions is from the students' fees which are paid by the *Perbadanan Tabung Pendidikan Tinggi Nasional* loan (PTPTN), bank loan, parents' Employees Provident Fund (EPF), or personal savings. In the beginning, there is no restriction on the number of enrolments and intakes. The multiple intakes each year and lack of regulation in physiotherapy education are the concern of many stakeholders. Over a short period of time, there is a large number of physiotherapy diploma graduates seeking employment in limited medical facilities. Private institutions were questioned on the quality of program delivery for the low unemployment rate, which later affects the enrolment of some institutions.

However, the diploma physiotherapy graduates later were able to seek employment in private physiotherapy centres, fitness centres, non-governmental organizations, chiropractic centres, and elderly homes, or continue their studies to the bachelor's level. The private institutions were able to offer either franchised or homegrown programs when the institutions were upgraded to university college and university status. The Malaysian Qualification Agency (MQA) also established a standard for all health science programs. To regulate the enrolment, institutions are required to comply with the teacher-student ratio, and a quota was imposed for new programs.

Private institutions face similar challenges as public institutions when they first started the physiotherapy programs. There is the lack of qualified lecturers/clinical instructors and insufficient clinical placement facilities. Private institutions need to establish internal and external audits for quality assurance, to be prepared for the changing MOH and MQA policies. Furthermore, they need to find solutions to reduce attrition rate, improve graduate employability rate, and maintain sustainability. Employability is always a measure of private institutions' performance, branding, and accountability. It is generally accepted that employability is determined by graduates' quality and attributes which may not be the fact (Cheng et al. 2021).

When MOH put up the requirement for clinical instructors with five years of experience to be made available during students' placement, those clinical placements under the MOH were affected. With the increase in the entry requirement for all health science programs from three credits to five credits for SPM in 2016, many colleges experienced a drastic drop in student enrolment. Some colleges were forced to close the branch campuses. The lack of lecturers was overcome by the recruitment of lecturers from abroad particularly from India.

Physiotherapy education in Malaysia has evolved in the last 40 years during the remarkable transition but there are many areas for improvement to be considered. Other developed countries such as Australia (Chipchase et al. 2006), the United States of America, and the United Kingdom took 100 years to develop physiotherapy education of unparalleled quality, internationally recognized, renowned for their research and teaching methodologies, and immense employment prospects for their graduates.

The future development of physiotherapy education in Malaysia needs to focus on effective pedagogy. The curriculum content should reflect physiotherapy practices and not be filled with content burdening the academic staff with the task of transmitting a vast amount of knowledge and students absorbing and reproducing the knowledge (Cousin, 2006). There are various educational frameworks such as threshold concepts (Meyer & Land 2003) and ways of thinking and practicing (McCune & Hounsell 2005) which are promising educational ideas for physiotherapy.

Students need to be equipped with strong clinical reasoning to be effective physiotherapy practitioners, they should be provided with opportunities to engage in different clinical reasoning strategies allowing them to expand their views of physiotherapy practice and adopt a patient-centred approach (Brazette Cruz et al. 2014). Traditionally, most clinical placement follows the 'one clinical instructor to two students' model which may not be cost-effective and productive. This results in the student spending less time with their instructor and lacking the benefits of peer learning such as discussion and practice (Fairbrother et al. 2016). The Capacity Development Facilitator model (CDF) developed by the University of Sydney Work Integrated Learning (WIL) Team could be an alternative model for addressing the challenges of clinical education which universities can consider adopting (Fairbrother et al. 2016).

As knowledge grows and changes, the university needs to think carefully about what students need to be able to know, do, and value for graduation and beyond. It is impossible to teach and include everything desired (Barradell 2017) but it is necessary to prepare graduates for different practice needs (emphasis on chronic conditions and longer-term illness, as well as prevention through maximizing health and wellness) and a broader skillset such as new roles, greater interprofessional working, and skills in digital technologies. (McAllister & Nagarajan 2015). The advances in information and communication technologies result in changes to the healthcare environment. Physiotherapists today are under pressure to produce better outcomes in less time with less money and minimal resources (Barradell 2017). University and college leadership needs to be sensitive to the changing environment of practice and the increased expectation to produce work-ready graduates who have the capabilities to develop beyond the defined abilities. The future should see the need for greater partnership between the universities and practice to ensure the development of physiotherapy in clinical practice, education, and research. Universities can be more innovative in pooling the resources working in a win-win situation to enhance the development of Malaysian physiotherapy education. The Malaysian Physiotherapy Association as the professional body should take a greater regulatory and supportive role to ensure the standard and quality of Malaysian physiotherapy be it education or practice.

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SPECIAL ISSUE

Studying Physiotherapy during COVID-19 Pandemic: A UKM Graduate's Reflection

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No one in their right mind had thought that part of his or her journey in gaining knowledge would take a 360-degree turn. The whole world was struck with the emergence of novel Corona Virus 2019 (n-Covid 19). On 11th March 2020, World Health Organization (WHO) declared COVID-19 as global pandemic (www.who.int.). Realizing this crucial situation, Malaysia's Government decided to enforce the first Movement Control Order (MCO) starting March 18th ending May 12th, 2020. Let's jump back to that time, shall we? I am in my 3rd Year 2nd semester (or semester 6 out of 8) in Universiti Kebangsaan Malaysia (UKM). My main concerns at that time: industrial training both local and oversea, medical, paediatric and surgery postings, and starting my final year project journey. Exactly a week before the MCO was enforced, our supposedly posting hospital at that time, Hospital Kuala Lumpur (HKL), did not accept our placement because they were busy handling COVID-19 cases, and we were scattered throughout Peninsular Malaysia to complete our posting as one of the requirements for each subject. But this idea was later scrapped out since the whole nation was enforced with MCO at that time.

Alhamdulillah, I managed to get back to my hometown 2 days before MCO was enforced. The first few days, weeks or I would say month were kind of respite for me. Well, we got to 'rest' until we don't know when (at that time) – my first full Ramadan at home after 3 or 4 years of not be able to be do so and just be happy with this 'selfish temporary happiness' with my family around. Official academic calendar only resumed after 1½ months to 2 months post MCO. Obviously at that time we were still at home, learning online. Our supposedly placements were cancelled for that semester and evaluation method was changed, OSCE was done online but not live and yes, lots and lots of looking at screen for study purposes. Honestly, I felt touched for the first time when I saw one of our therapists conducting her teaching online on HUKM gym. Maybe I miss them: the environment, the opportunity to touch patient the people and more. Indeed, it is one of the favours that God had given to us previously but we selfishly took it for granted. Doing OSCE online, was a full-day headache for me. We were given 3 questions at 9 am in the morning and needed to submit before the midnight. Yes, you had A LOT of time to prepare and everything, but the 'burden' stayed with you until you clicked submit and verified your video had been successfully submitted. This headache lasted for 3 weeks as we did our OSCE during weekend and we needed family members to 'act' as the patient. Compared to previously done OSPE and OSCE, although more nerve-wrecking, but it only lasts for half a day, 3 days consecutively. I guess OSCE online is not a thing for me. Oh yeah, our oversea industrial training was cancelled, and local industrial training was pushed to next year. I'm beyond sad at that time, that's it. Hope that the next batch would be able to do so in this coming future.

Our final year did not start with a good note, to be honest. We started with one day clinical posting before another MCO commenced on early October 2020 (Hashim et al. 2021), our posting was postponed for around a month, and our classes were split into 2 groups whereby each group took turns for clinical posting and professional exam. Pros and cons? Kinda sad because we were unable to see half of our friends while also grateful as we finally got to go for physical clinical posting again. Well, you cannot get all the apples for yourself, right? Our 2nd semester of the year was also hit with another MCO in June 2021. It was also the year where I did not go back to my hometown for both *Hari Raya Puasa* and *Hari Raya Haji*. It sure felt different, at least for me. My first ever *raya* that I was away from my families, planning and managing the house with friends on how to make *raya, raya*. I must say, it was tiring when you needed to manage the house with only 2 manpower in the house to divide the chores: cleaning, cooking, some mini decorating etc. Only God knows my mixed feelings when I first heard the *takbir raya* and made a video call with my family. But I was grateful to have families and friends that always support me. Being a close contact individual? Happened a few times to me, my classmates, and housemates. Although frustrating, it was not the time to play victim. We needed all the supports that we can get. On the other side, quarantine period gave me extra time to focus on my research. Being in the pandemic era, the way research was conducted also changed drastically; from meeting with supervisors to collecting data face-to-face, we needed something that can be

done remotely or online. This seemed easy at first, but it was not.

Furthermore, all final year and postgraduates' students were conducting the same way of research, I would say everyone was already sick and tired of answering questions and attending interviews online, thus somehow hinders our efforts in gathering participants.

"And they plotted and planned, and Allah too planned, and the best of planners is Allah" (Qur'an 3:54)

Being a course that heavily relies on physical handling, I would say physiotherapy is least effective to be done through online; it is a hard pill to swallow at first. After been exposed to several clinical postings pre-COVID, I felt something was amiss during the initial wave of COVID-19 in Malaysia. Of course, compared to previous batches, we were already lacking one semester worth of posting. Not to mention our final year clinical hours were reduced because of this global pandemic. But, instead of whining all day, ask yourself what you can do to better improve yourself with whatever tools and access that you had. Everyone has their own struggles and that's what makes us unique in every way. Stop comparing yourself with others. Instead, the person that you should be comparing is you from the past. Progress is still a progress, even half a step at a time. Everyone's here resembles a unique piece of puzzles. The shape needs to be precise to complete the bigger picture. That's us as a profession. We need each other and every hands-on deck to further improve this profession. Whatever happens, happens. And what had happened is already a history. Whether you like it or not, it shapes you to who you are right now. The good, the bad, the in between or whatever you may called it. Don't forget to always be grateful as you are still breathing till now. You might dislike it at first, but trust me, it will not matter much in the future. In fact, it is indeed bittersweet memories, once in a lifetime kind of experience.

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