Clinical Research Unit: Mapping FEU-NRMF into Global Standards of Research

Cerelyn E. Dacula, MD

GCP… PI... SC… SI… CDA… CRO… CRA… ICF… EC… PD… SIV… AE… SAE… CRF…

These acronyms and many others are our daily jargons in clinical research. Acronyms that set the stage in every clinical study at our clinical research unit.

Part of FEU-NRMF's mission is to develop socially responsible professionals who adhere to global standards in research. I remember in 2015 when Dr. Policarpio Joves, then the Vice-Dean of the Institute of Medicine summoned me to his office. Together with Atty. Antonio Abad, the vision for the creation of a dedicated clinical research unit was formed. Dr. Joves enthusiastically asked me to initiate it. Having just returned to the country with a Masters Degree in Vaccinology and Pharmaceutical Clinical Development from the University of Siena, Italy, I felt that the program will greatly benefit from the leadership of one who has more experience in the field. I had only one person in mind.

Dr. May Emmeline B. Montellano was the former chair of the FEU-NRMF Dept. of Child Health. Mama May, as she is fondly called, was instrumental in my career. She was the only one who urged me to enroll in my Masters' degree despite the 24-hour deadline. A seasoned trialist, she has been involved in numerous studies during her 25 years as researcher. She has been cited in many journals, both local and international. With her at the helm, I am very optimistic that we are already on our way to putting the FEU-NRMF on the map of international research.

In 2016, the FEU-NRMF Clinical Research Unit was born. Nestled at the 2nd floor Josephine Cojuangco Reyes (JCR) building situated at Rolex St., West Fairview, Quezon City, the unit has several rooms for the different processes in the conduct of clinical trials. It has rooms separate for disease awareness lectures, informed consent form (ICF) process, physical examination, laboratory processes, vaccination, investigational product, data management, monitoring, and storage area. It is equipped with a Pharmaceutical Bio-refrigerator, a -20ºC and -70ºC freezer, and other medical equipment. Several medical and paramedical professionals including specialists, general physicians, nurses, medical technologists, pharmacists, midwives, and encoders are part of the research team. All members of the team have certificates in Good Clinical Practice (GCP) and other special certificates like International Air Transport Authority (IATA) for the transport of dangerous goods among medical technologists and nurses; encoders certificates for different platforms of electronic data capture like iMedidata, Clinflash, and InForm.

The Clinical Research Unit can be used for different types of clinical studies such as on-site investigator or sponsor-initiated clinical trials, community-based, hospital-based, observational, or epidemiological.

As of present, most of the ongoing studies are sponsor-initiated clinical trials. Sponsor-initiated clinical studies identify Principal Investigators (PI) who could work on their product. Once the PI is selected, Confidentiality Disclosure Agreements (CDA) are sent to initiate the conduct of the feasibility study. During the feasibility study, the Sponsor thru a Clinical Research Organization (CRO) asks for their requirements per protocol. The feasibility questions include site capacity to enroll required participants, site equipment, laboratory tests, available rooms, emergency measures, and personnel. Soon after evaluating the site, the Sponsor would then send a Selection Letter. Upon site selection, parallel submission of protocol to the Philippines Food and Drug Administration (PFDA), Single Joint Ethics Review Board (SJREB) and/or Institutional Ethics Review Committee (IERC) as well as contract and budget negotiations ensues. Once a written approval of protocol is received from all reviewers and

contract and budget negotiations are agreed upon, the investigator's meeting and site initiation visit (SIV) follows. During the SIV, all staff involved in the study will be trained about the protocol, apart from the self-training online they would require. After a thorough review of the protocol and all the training fulfilled, the site then is activated and the conduct of clinical study per protocol is started.

Dr. Montellano has had several vaccine trials as Principal investigator (PI) since the unit was created. As Principal Investigator, she has the overall responsibility and oversight in the conduct of clinical trials. It is defined in detail in ICH-GCP Section 4.1. Investigator ICH E6 (R2) Good Clinical Practice. To wit, "The investigator should be qualified by education, training, and experience to assume responsibility for the proper conduct of the trial, should meet all the qualifications specified by the applicable regulatory requirements, and provide evidence of such qualifications…" In very simple terms, not everyone can be a PI unless he/she is fully qualified.

The first clinical trial conducted at the site was with the Dengue vaccine. Unfortunately, I was unable to be part of the study at that time. I worked as a consultant initially at PFDA to which subsequently I became a Medical Specialist. As many would recall, the Dengue vaccine became a controversial topic-the conduct of clinical trials themselves included. It consequently also loomed over a number of clinical trials conducted in the country around that time.

It was probably divine intervention, or should I say, stars aligned as when I ended my work at PFDA, the other vaccine studies at the CRU were ongoing. It was when I started to be working as a Sub-investigator (Sub-I). Just like the PI, a sub-investigator also has to be qualified by education, training, and experience. As a sub-I in a clinical trial, one's main focus is the safety of the patient. The Sub-I thoroughly explain the whole study during the informed consent process in a way that is understandable to the participant's level or in the case of pediatric studies, their legally-acceptable representatives. Once consented, they are carefully screened with the Inclusion and Exclusion Criteria. If they are eligible for the study, the subsequent procedures are then completed. But it does not end with their enrollment. While in the study, per protocol, the Sub-I monitors their safety, any adverse events (any medical event which may or may not be related to the study treatment), concomitant medications, and for females of child-bearing potential, cases of pregnancy.

In March 2020, the country was placed in a complete lockdown because of the pandemic. At that time, we still had clinical studies ongoing. No one was ever prepared when COVID-19 came, especially in clinical trials. Unlike the lockdown, we could not halt the participant's monitoring. It was really a challenge and we encountered several difficulties as movements became restricted for both the staff and the participants. We improvised by doing home visits while in full personal protective equipment (PPE). During the home visits, we made sure about their well-being, did the blood sample collections, and even provided support in kind, out of the staff pocket. However, for some participants, they cringe when our staff would visit them wearing an outer-space-like suit. As known to everyone during the height of the pandemic, when a medical personnel visits houses, it would mean that somebody is infected and could again lead to a community quarantine. But we had to continue as we have limited choices in fulfilling our obligations from the signed contract of the study as well as to our participants.

Ironically though, the pandemic paved the way for several studies in the unit especially with COVID vaccines. It was really a challenge and it was at this point that I had to step up as well in becoming the Study coordinator (SC) while working at the same time as a sub-investigator. As an SC, I had to oversee all teams, from the sub-investigators, med techs, nurses, surveillance team, and encoders in accordance with GCP and the protocol. In addition, I had to report any study update to the PI, the Ethics Committee, and the Institution. An SC also has to deal with the clinical research assistants (CRAs) as representatives of the Sponsor, doing the monitoring visits and reviewing if the study is being conducted per protocol.

At that time, very little was still known about the novel COVID-19 virus. We carefully had to plan systematically the flow of our participants while completing procedures per protocol to minimize exposures and cross-contaminations. We had to deviate from the protocol by performing first a COVID-19 Rapid Ag test on all participants while all staff had regular nasal swab tests. Only participants who tested negative can proceed with the informed consent process and mind you, there were a lot who did not make it even to this first step.

A very important step in the conduct of any clinical trial is the informed consent process. Pre-pandemic, the process is conducted in a closed-door room on the 2nd floor of JCR to carefully give the participants

privacy and ample time to fully understand the study. But this practice was not possible during the height of the pandemic. To minimize exposure of both the participants and the staff and ensure adequate ventilation, we utilized the open parking space at JCR instead. Here, the sub-investigators still perform the process one-on-one with the participant, ensuring that they were also given ample time to fully understand the study and that they were not duly influenced by anybody. We work in plastic-covered cubicles while in double masks, face shields, and personal protective gowns. Imagine the environment we had to endure during hot, humid days as well as during rainy days. But then again, we all want to get out of the pandemic. With all our hearts and sweat, we were able to even surpass Sponsor's expectations. As to the other procedures required in the protocol, we also had to utilize the lobby of JCR to complete blood extractions, pregnancy tests, and others. Post-vaccination, the participants are then assisted back to the parking lot for a 30-minute observation while also being trained to complete their electronic diary reporting.

As all vaccine companies raced for COVID-19 vaccines at that time, we had several days spent until almost midnight to finish the enrollment of participants. I can still vividly remember how eerie it was to drive on a wide Commonwealth road when we went home as there were no cars or people around. But we came through. We pride ourselves on the thought that we have somehow contributed to the ending of COVID-19 as a worldwide emergency health concern through our work in research.

To date, the conduct of clinical studies at the unit is almost back to normal. We however still maintained the ICF process at a well-ventilated area at JCR while all other procedures can now be conducted at the main unit on the 2nd floor. We have already catered nine clinical studies and two more to start from different pharmaceutical companies. For the completed studies, the Sponsor thru the CROs performs close-out visit. At this point, all trial-related events and processes that transpired during the conduct of the study are reviewed and finalized. All these were also reported to the ethics committee. All documents are then sent out for archiving depending on the Sponsor's requirement, which could be from 10-30 years. Soon after the close-out, the Sponsor sends the copy of the Clinical Study Report which is usually followed by publications. Our completed studies on Dengue vaccine[1] and COVID-19[2] vaccine were already published in the Pediatric Infectious Disease Journal and the Lancet, respectively. The result of both vaccine studies has shown to be efficacious and has a positive benefit-risk outcome.

We hope that we can maximize the utilization of our unit in progressing clinical research in our institution. Soon, our mission can be quantified by the number of internationally recognized research conducted at CRU. All these in our aim to continually contribute to the advancement of science, new technologies, and vaccines. For the greater purpose of enhancing, saving, and prolonging one's life.

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The Coping Strategies of Medical Students in the Shift to Online Learning Setting

Lenisse Eleonor Q. Navarra, Jayson D. Nohara, Floree Jan F. Pinzon, Earvi Joy F. Ramos, Arianna B. Sietereales, Patricia Ann A. Silo, Faye Dominique V. Tungol, Maria Clarissa J. Vilog and Mari-Ann Bringas, MD

ABSTRACT

Background: The educational landscape has undergone a paradigm shift with the onset of the pandemic, necessitating the adoption of online learning as the new norm. This transition has wielded profound effects on various aspects of students' lives, particularly the adjustment from traditional classroom setups to virtual platforms. Within the medical realm, students face notable challenges in adjusting to this shift, given the practical nature of their field. Coping mechanisms play a pivotal role in influencing individuals' well-being and health. This study aimed to explore the diverse coping strategies employed by medical students as they navigate the transition from conventional face-to-face instruction to an online learning environment.
Methods: The research employed a descriptive, cross-sectional approach to identify effective coping strategies that mitigate the stress associated with the transition to online learning among medical students. Convenience sampling served as the chosen methodology, utilizing the validated and reliable 28-item self-report questionnaire developed by Charles Carver, known as the Brief Coping Orientation to Problems Experienced (COPE). This tool has undergone validation through numerous research investigations within the local context of the Philippines. The questionnaire aims to assess both effective and ineffective coping strategies in response to stressful life events. Data collection involved the administration of the survey via Google Forms, with responses synchronized to Google Sheets. Statistical analysis of the gathered data was conducted using Google Sheets, serving as the primary statistical software to calculate the average scores of respondents' answers.
Results: A predominant number of participants embraced problem-focused coping mechanisms to address challenges and stressors. The evaluation employed a Likert Scale rating system, ranging from 1 (indicating minimal engagement) to 4 (indicating extensive application). Among these strategies, problem-focused coping garnered the highest overall average score of 3.13, signifying its prevalent adoption. Emotional focus ranked next with an average score of 2.89, while avoidant coping strategies exhibited the lowest average score of 2.25. Notably, this coping strategy hierarchy persisted consistently across all academic year levels.
Conclusion: Medical students exhibit a diverse array of coping strategies when navigating the transition to online learning. The coping strategy most frequently employed is problem-focused coping, encompassing planning, active coping, and positive reframing. Following closely, emotional focus comes into play, with acceptance emerging as the predominant and potent coping strategy, highlighting students' inclination to embrace and acknowledge natural distress. Conversely, the least utilized coping strategy is the avoidant approach. This coping strategy hierarchy remained consistent across different year levels of medical education.

Key words: coping strategies, online learning, Coping Orientation to Problems Experienced (COPE), medical students

The emergence of online learning as the main educational mode since the pandemic's advent has significantly transformed the educational landscape. This transformation has governed substantial repercussions across various dimensions of students' lives, particularly concerning the shift from traditional physical learning to virtual platforms. Particularly for medical students, this shift poses a unique challenge, given the hands-on nature of their curriculum. Coping mechanisms, encompassing cognitive, emotional, and behavioral strategies, play a crucial role in navigating the stressors associated with medical schooling, encompassing high expectations, rigorous coursework, and the abrupt transition to online learning environments.

Coping mechanisms hold considerable sway over individuals' well-being and overall health, influencing their subjective sense of contentment. In this context, this study aimed to ascertain the predominant coping strategies employed by medical students during their adjustment to the swift transition from conventional face-to-face classes to the online learning landscape.

Studies highlight the impact of elevated anxiety levels on university students' psychological well-being and academic performance in the pandemic.[1] Stress has been found to detrimentally affect decision-making abilities, academic achievements, and empathetic capacities, all of which are integral to forming strong patient relationships.[2] It's noteworthy that the efficacy of coping strategies
can modulate the adverse impact of stress on academic performance, and some strategies might inadvertently yield less favorable outcomes. Lai, et al. underline stress's adverse influence on the learning environment. Multiple investigations indicate that remote learning-induced stress significantly impacts students' lives, with factors like familial issues, academic overloads, research demands, lackluster support services, admission concerns, and financial constraints contributing to the stress. Notably, medical students exhibited a higher prevalence of suicidal ideation compared to their qualified counterparts, underscoring the urgency of educational restructuring in the pandemic era. Reevaluating traditional medical education methods and bolstering students' crisis readiness could fortify their resilience and ease the transition from student to practicing physician.[3]

In the realm of psychological resilience and coping mechanisms, Wu, et al.'s study on Chinese undergraduate students revealed that females and medical students are more prone to adopting positive coping strategies compared to their male and non-medical counterparts.[4] Strengthening psychological resilience was correlated with adopting positive coping styles, indicating a potential avenue for enhancing students' mental well- being. Conversely, Barrot et al.'s research in 2021 highlighted the primary challenges introduced by the new learning paradigm, with students citing difficulties in their home- based learning environment.[5] Resource management, help-seeking, technical skills enhancement, time management, and control over the learning environment were the most frequently employed coping strategies. In another instance, a study among doctors- in-training at the University of Geneva disclosed the pandemic's adverse effects on their motivation and concentration due to suboptimal study conditions. Interestingly, students recruited to aid hospitals during staff shortages reported positive changes in self- perception, attesting to the impact of real-world exposure on their professional identity.[6]

While local studies have explored challenges and coping mechanisms among students, particularly in the context of online learning[7,8] limited research has specifically focused on identifying coping strategies among medical students.

This research seeks to identify the coping strategies harnessed by FEU-NRMF medical students to navigate the stress brought about by the transition to online learning. It specifically aims to compare coping strategies across different academic year levels and ascertain the most prevalent strategies within each level. Given the central role of online learning in today's education, our findings will be invaluable to the school, administration, and students alike. The data presented will empower authorities to safeguard student well-being by informing effective coping strategies. This information can serve as a foundational framework for the formulation of school programs and policies aimed at enhancing and reinforcing coping mechanisms beneficial to most students.

MATERIALS AND METHODS

Study Design, Population, and Inclusion Criteria

A descriptive, cross-sectional research design was employed to ascertain the efficacy of coping strategies in mitigating stress associated with the

transition to online learning among medical students. The study focused on the population of 1st to 3rd year medical students enrolled at FEU-NRMF during the academic year 2022-2023. Participants included officially registered regular students, while those with irregular academic loads, who applied for authorized withdrawal, or were on leave were excluded from the study. A conservative approach was adopted for estimating the sample size. The minimum sample size required was determined based on an expected proportion of 50%, a confidence level of 95%, and a margin of error of 5%, yielding a sample size of 385 participants.

Sampling Technique

The recruitment of respondents was conducted through each year level presidents and coordinators via posting of posters with an attached invitation link to participate in the study. It was posted across online platforms such as Facebook and Telegram to achieve the number of respondents needed for the study. The link directed the eligible participant to the Google Form containing the informed consent form and the questionnaire itself.

Data Collection

The data underwent processing and encoding using Google Forms, subsequently generating a corresponding Google Sheet. The execution of this study was subjected to review and obtained approval from the FEU-NRMF Institutional Ethical Review Committee (IERC). All participating respondents were informed about the study's objectives and voluntarily agreed to take part. One particular limitation of this research pertains to sample size, as larger samples offer more precise mean values, unveil potential outliers that could distort data within smaller samples, and decrease the margin of error. Additionally, due to its descriptive nature, this study cannot establish causal relationships from associations, given that it represents a one-time measurement of exposure and outcome. To corroborate and broaden these findings, further multi- institutional research is imperative.

Assessment Tool and Measurement Process

The 28-item self-report questionnaire by Charles Carver that developed the certified and valid Brief Coping Orientation to Problems Experienced (COPE),[9] which has been evaluated by many researcher investigations in the Philippines. It is a self-report questionnaire designed to measure effective and ineffective ways to cope with stressful life events. The content of the survey is composed of questions that may be useful in coping with such stressors that contribute to the shifting of class from face-to-face to online setting. Each item was graded based on a Likert scale which ranged between 1 ("I haven't been practicing this at all.") to 4 ("I've been conducting this a lot."). The scale is frequently used in health-care settings to assess how patients are emotionally reacting to a difficult situation. It may be used to assess how someone is dealing with a variety of adversities, such as a cancer diagnosis, heart failure, injuries, assaults, natural catastrophes, financial hardship, or mental illness. In therapeutic settings, the scale is useful for understanding how someone responds to stresses in both beneficial and negative ways. The scale can determine someone's primary coping styles with scores on the following three subscale: (a) Problem-Focused Coping (b) Emotion-Focused Coping(c) Avoidant Coping.

Data Analysis

The data underwent processing and encoding using Google Forms, subsequently generating a corresponding Google Sheet. Univariate analysis was employed using Google Sheet estimation of average of scores.

RESULTS

Out of 399 respondents, 116 were male (29%) and 283 were female (71%). Among them, 135 (33.84%) were 1st year medical students, 132 (33.08%) were 2nd year, and 132 (33.08%) were 3rd year. (Table 1)

Table 1. Demographic data of respondents towards the coping strategies of medical students in the shift to online learning setting.

	N (%)
Sex	
• Male	116 (29%)
• Female	283 (71%)
Year-Level Enrolled	
• 1st Year	135 (33.84%)
• 2nd Year	132 (33.08%)
• 3rd Year	132 (33.08%)

The use of Coping strategies (Table 2), presenting the highest total average score of 3.13 for problem focused. This is followed by emotional focus, with a total score of 2.89, and the lowest score for avoidant coping with a total score of 2.25. Each year level has the same ranking of use of the coping strategies.

Table 2. The three subscales of coping strategies of medical Students in the Shift to Online Learning Setting.

	Average Score (1 to 4)			
	1st Year	2nd Year	3rd Year	Total
Problem Focused	3.15	3.07	3.18	3.13
Emotional Focused	2.83	2.87	2.97	2.89
Avoidant Coping	2.19	2.23	2.32	2.25

Regarding the utilization of predictive positive outcomes (Table 3), the analysis reveals that within the set of employed problem-focused coping strategies, the planning strategy garnered the highest score at 3.25. This was trailed by active coping, scoring 3.21, followed by positive reframing with a total of 3.20. The least employed strategy within this category was the utilization of informational support, registering a score of 2.87. Notably, planning and active coping secured the top two positions in the ranking across various academic year levels. Conversely, the use of informational support was least favored among the year levels as a preferred coping strategy.

Within the emotional-focused strategies (Table 4), acceptance emerges as the prevailing coping mechanism, with an average total score of 3.42 among students. This is closely trailed by emotional support (3.09), humor (2.81), self-blame (2.76), and religion (2.71), with venting (2.53) recording the least adoption. The order of acceptance and emotional support remains consistent in their ranking across different academic year levels, securing the top two positions respectively. Nevertheless, the utilization of humor, self- blame, religion, and venting displays variation among the second and third-year levels. Specifically, 2nd-year students place religion as their third most employed strategy, followed by humor, self-blame, and venting. On the other hand, 3rd-year students prefer humor, self-blame, and venting over religion as their preferred coping mechanisms.

Table 3. The problem focused coping strategies of medical students in the shift to online learning setting.

	Average Score (1 to 4)			
	1st Year	2nd Year	3rd Year	Total
Planning	3.27	3.15	3.32	3.25
Active-Coping	3.26	3.15	3.21	3.21
Positive Reframing	3.22	3.13	3.24	3.20
Use of Informational Support	2.84	2.83	2.94	2.87

Table 4. The emotion focused coping strategies of medical students in the shift to online learning setting.

	Average Score (1 to 4)			
	1st Year	2nd Year	3rd Year	Total
Acceptance	3.39	3.39	3.48	3.42
Emotional Support	3.1	3.02	3.15	3.09
Humor	2.73	2.74	2.95	2.81
Self-blame	2.69	2.66	2.94	2.76
Religion	2.56	2.94	2.62	2.71
Venting	2.49	2.46	2.65	2.53

Among the avoidant coping strategies (Table 5), self-distraction secures the highest ranking, garnering an average score of 3.27. It is followed by behavioral disengagement with a score of 1.92, substance use with a score of 1.68, and lastly, denial, which registers the lowest score of 1.49. The order of self-distraction, behavioral disengagement, substance use, and denial remains consistent across all three academic year levels. The data underscores that, in terms of avoidant coping, a significant proportion of respondents resort to alternative activities like watching TV, reading, sleeping, and similar pursuits to divert their attention from the stress they are encountering.

DISCUSSION

In the abrupt transition to online learning, medical students employed a diverse array of coping

strategies. Among these strategies, problem-focused coping emerged as the prevailing approach (3.13), closely trailed by emotion-focused coping (2.89), while avoidant coping (2.25) was the least preferred strategy. Remarkably, this coping strategy hierarchy remained consistent across different year levels of medical education.

Table 5. The avoidant coping strategies of medical students in the shift to online learning setting.

	Average Score (1 to 4)			
	1st Year	2nd Year	3rd Year	Total
Self-distraction	3.29	3.23	3.28	3.27
Behavioral Disengagement	1.8	1.95	2.01	1.92
Substance Use	1.6	1.7	1.73	1.68
Denial	1.43	1.42	1.61	1.49

Problem-focused coping strategies involve actively addressing the root causes of stressors and challenges. These strategies empower individuals to take practical steps to manage difficulties.[10] Emotion-focused coping emphasizes managing one's emotional response to stressors. This approach involves regulating emotions and seeking emotional support from others.[11] Avoidant coping strategies involve attempting to distance oneself from stressors, often through denial or distraction. While this approach might offer temporary relief, it's generally considered less effective in the long term.[12] The consistent ranking of coping strategies across various year levels suggests a certain level of universality in the strategies chosen by medical students to navigate the challenges posed by the shift to online learning. There was no significant difference between the different strategies utilized by medical students under the 3 approaches across the year levels.

Coping is a common reaction of medical students to the perceived stress of transitioning to an online learning environment. According to research by J Li, et al (2022), high levels of student stress have long been linked to understanding of health care profession curriculums.[2] Problems that are readily solved are actively addressed by taking fast and effective action. Planning is a problem-solving coping strategy that entails creating plans and strategies to overcome obstacles. Requesting assistance and guidance is one example of how to use informational support. When a crisis persists or looks intractable, such as dealing with permanent loss or a failed relationship, the emphasis of coping turns to one of emotion. Internal emotional coping is a more cognitive or psychological reaction. Acceptance focuses on learning to live with the situation and accepting reality as it is. Positive reframing, on the other hand, is a coping strategy that focuses on the positive aspects of a challenging circumstance. Finally, avoidant methods may be used because they are simple to implement and give a short resolution, but they might be detrimental over the course of time. It is normal to deal with challenges by employing a variety of coping methods to reduce the psychological consequences of the shift to online learning, which has been aggravated by the pandemic.

Within this investigation, a notable majority of participants opted for problem-focused strategies when confronting challenges or stressors. It is evident that medical students exhibit a relatively sophisticated disposition in their coping approaches. Given the pivotal role acknowledged for the medical field amid the pandemic[6], medical students attribute substantial importance to their professional identity. This recognition prompts a proactive inclination toward employing problem-focused coping strategies as an effective mechanism. Problem-focused coping entails a problem-solving approach in which individuals directly address challenges or stressors to mitigate or eliminate them. For instance, a student experiencing stress in school might take steps to establish firmer boundaries between their academic and personal life, a tactic known as active-coping. The application of exercise can be categorized as a problem-solving coping mechanism, particularly under active-coping and planning. A study conducted by Garber (2017) delved into this aspect, revealing that 75% of respondents reported a degree of increased activity. Among the coping strategies[1], planning emerged as the preferred approach by most respondents.

Positive reframing involves adopting a more positive perspective on negative or challenging situations, reframing them as valuable lessons or opportunities for growth. Practicing self-care techniques, such as mindfulness meditation, exercise, and hobbies, played a pivotal role in mitigating stress and bolstering mental well-being among medical students. These strategies facilitated stress management, anxiety reduction, and the maintenance of focus, particularly amid the challenges posed by the transition to online learning, as highlighted in the research by Sood et al. (2020).[13]

In the work by Barrot, et al. (2021), an exploration was undertaken concerning the challenges of online learning faced by students during the pandemic and their coping strategies in our local context.[5] Through a mixed-methods approach, the study unveiled the diverse nature and extent of college students' online learning challenges. Among these, the most prominent challenge pertained to the home learning environment, while technological literacy posed the least challenge. The study further highlighted that the COVID-19 pandemic had a profound impact on both learning quality and students' mental well-being. In terms of coping strategies, students primarily employed resource management, help-seeking, enhancing technical prowess, time management, and exerting control over their learning environment.

Recognizing the importance of effective time management, medical students emphasized the need for a structured daily routine. Creating dedicated study intervals, incorporating breaks, and allocating leisure time contributed to upholding a sense of equilibrium and normalcy in their lives. This approach not only fostered organization but also mitigated stress, as observed in research by König et al. (2020).[14]

Adapting to the online learning paradigm, students enhanced their study techniques by harnessing digital resources, pre-recorded lectures, and interactive online platforms. Developing adeptness in online learning, including techniques for virtual lecture note- taking, resulted in heightened engagement and comprehension, as emphasized in the study by Bernard, et al.[15]

A study by Wurth et al. (2021) examined the perspective of medical students at the University of Geneva concerning the impact of the epidemic three months into its onset.[5] Employing an online self-administered survey, the study disclosed that a significant proportion of respondents (58.8%) felt a sense of isolation since the start of the epidemic. Frequently cited coping mechanisms included engaging in physical exercise and fostering increased communication with loved ones which is consistent with the findings of this study.

Engaging in emotion-focused coping involves managing emotional reactions to stressors. This approach centers on regulating emotions rather than resolving the issue itself, emphasizing emotional control and response management. An example of emotional- focused coping is acceptance, which emerged as the most frequently employed coping strategy among the respondents. This suggests that a significant portion of participants gravitated towards embracing natural distress. Emotional support, ranking as the second most prevalent emotion-focused coping style, entails expressions of empathy, affection, and compassion. Enhanced communication with loved ones through increased telecommunications emerged as an accessible coping strategy for medical students[16] affirming that robust emotional support networks aid in effective emotional management.

Acknowledging the significance of maintaining social bonds, medical students actively sought virtual avenues for connecting with peers and faculty members. Participation in virtual social events, engagement on discussion boards, and active involvement in online forums worked to counter feelings of isolation and nurture a sense of belonging within the medical community. Romero-Hall, et al. (2020)[17] underscored these aspects in their research. This is highlighted with the support services by the Guidance Counseling Office (GCO) at the medical institution, which offers an array of services tailored to students' coping needs. Amidst the pandemic, the GCO introduced an online platform designed to sustain a supportive connection with students during crises. The measures adopted encompass follow-ups with students, consultations with parents or guardians, collaborative discussions with faculty members, and engagement with specialists, psychiatrists, and psychologists. Through this initiative, they identified prevalent mental health challenges faced by students. According to GCO statistics, an estimated average of 75 students benefited from these projects between 2020 and 2022.

Humor, the third most utilized emotion-focused coping strategy, offers a lighter perspective, effectively employing laughter to confront challenges. This approach resonates with Freud's psychodynamic viewpoint, portraying humor as a potent defense mechanism that helps individuals confront issues and alleviate stress (Penson et al., 2007). The study by Savitsy, et al. (2022) affirmed the stress-moderating effect of humor, linking it to reduced anxiety levels among nursing students during the pandemic.[18] Yaprak, et al. (2018) explored humor as a personal trait fostering resilience and well-being through cognitive evaluations of stressful experiences.

Self-blame, ranking fourth in emotion-focused coping, involves holding oneself accountable for distressing events. This internal attribution can significantly influence emotions and behaviors in both immediate and subsequent stressful circumstances.

Religion and turning to spiritual beliefs for comfort, support, and guidance emerged as an effective approach for managing stress. In Korea, Kim and Park (2018) found that prayer meetings and meditation provided strength and tranquility, aiding academic stress management.[19] Similarly, in Sri Lanka, engaging in religious activities, including going to places of worship and seeking divine assistance, emerged as the most utilized coping strategy for stress arising from examinations.[20] Imperatori (2019) demonstrated positive links between religious coping and active coping as well as positive reframing.[21] Furthermore, religious coping mechanisms were associated with reduced perceived stress (Arévalo et al., 2008), while spirituality correlated with improved well- being and reduced stress (Peres et al., 2018).

Venting, the least employed coping strategy, allows individuals to express their worries, offering an avenue to release emotions rather than internalizing them. Achieving an optimal blend of emotion-focused coping techniques is essential for effective stress release and relief.

Avoidance coping entails cognitive and behavioral strategies aimed at evading direct confrontation with unpleasant demands. Individuals adopt avoidance coping to sidestep distressing thoughts or events. The most prevalent form of avoidance coping is self-distraction, where respondents engage in enjoyable activities like watching television or exercising to divert attention from stressors (Allens et al., 2010). Abouammoh et al. (2020) similarly found self-distraction to be a common avoidant coping technique among medical students.[22]

The current study disclosed varied coping strategies employed by medical students to adapt to online learning. Problem-focused coping, particularly planning, active coping, and positive reframing, emerged as the most frequently used strategy. Emotional focus, especially through acceptance, was prominent, indicating a willingness to acknowledge natural distress. Avoidant coping was the least employed strategy. Future research should explore the influences of demographics, values, and motives on students' coping mechanisms and their impact on academic performance. This study's results can inform the development of school policies that promote effective coping strategies, tailored to individual personalities and needs. Factors like diet, lifestyle, family background, health conditions, and known diseases should also be investigated further.

The study is limited to the convenience sampling and the online data collection methods employed which can introduce several biases that could affect the generalizability and accuracy of study findings. Convenience sampling involves selecting participants who are readily available or accessible. Individuals who are more easily reachable or motivated to participate may differ in important ways from those who are not, leading to a skewed sample. Those who choose to participate might have different characteristics, attitudes, or experiences than those who do not volunteer, leading to a sample that is not representative of the broader population. Participants in online surveys might not answer truthfully or accurately due to anonymity, lack of accountability, or social desirability bias. Acknowledging the biases shall help investigators to carefully interpret the results in light of these limitations.

CONCLUSION

Medical students exhibit a diverse array of coping strategies when navigating the transition to online learning. The coping strategy most frequently employed is problem - focused coping, encompassing planning, active coping, and positive reframing. Following closely, emotional focus comes into play, with acceptance emerging as the predominant and potent coping strategy, highlighting students' inclination to embrace and acknowledge natural distress. Conversely, the least utilized coping strategy is the avoidant approach. This coping strategy hierarchy remained consistent across different year levels of medical education.

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Effectiveness of Telerehabilitation in Improving Activities of Daily Living Among Poststroke Patients: A Systematic Review

Aaron Gerard Baligaya, Dave Ducat, Trisha Labucay, Janina Macabeo, Keith Mausisa, PTRP, PT, DPT, Kevin James Pagal, Patricia Mae Patriarca, and Bernard Kyle Valenzuela

ABSTRACT

Purpose: Telerehabilitation (TR) refers to the delivery of rehabilitation services using information and communication technology between healthcare professionals and post-stroke patients that has a potential to deliver quality, accessible, cost-effective, and efficient rehabilitation services in a remote location. The purpose of this systematic review is to determine the clinical effectiveness of TR in regaining functional skills among post-stroke patients in terms of Activities of Daily Living (ADLs).

Methods: The study conducted following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) checklist for systematic reviews of intervention. The databases utilized were PubMed, Google scholar, Cochrane Library, PEDro, ProQuest, EBSCOHost, and Lilacs. Articles were screened by title, abstract, and full text, and data were then extracted.

Results: The search yielded 11159 total articles. After screening, 8 articles remained for review and data extraction. Based on this review's data, the effectiveness of TR towards poststroke patients' improvement shows a significant improvement on activity on daily living as incorporated with motor function, balance and gait that is supported by various outcome measures.

Conclusion: Among post-stroke patients, TR showed to be beneficial in improving motor function, quality of life and motor performance of the activities of daily living. However, the clinical effectiveness of TR remains unclear. Further studies are needed to prioritize improvements concerning clinical effectiveness of TR.

Key words: Telerehabilitation, post-stroke, activities of daily living

Telerehabilitation (TR) utilizes technology to provide rehabilitation services to patients, allowing them to have more options, offer treatments more effectively, and overcome geographic barriers to healthcare access. In the face of the COVID-19 outbreak, healthcare had to adjust and prioritize safe healthcare delivery by reducing direct contact with patients. Currently, 2.4 billion individuals worldwide may require rehabilitation. Existing rehabilitation services have been affected in 60 to 70 percent of countries due to the COVID-19 pandemic. Even after lockdowns and vaccines, physical distance will likely become the new normal. This gave an opportunity for TR to come to light in physical therapy services. Experts describe TR as using information and communication technology to provide rehabilitation services that aim to produce a credible alternative or supplement to center-based rehabilitation treatments from a distance. It can provide a wide range of services, including patient and family education, counseling, assessment, intervention, continuous monitoring, and offline self-management programs. Rehabilitation practice generally depends significantly on objective measurement and standardized testing procedures to guide the diagnostic process and evaluate the outcomes of therapeutic interventions. Like face-to-face assessments, pain, swelling, range of motion, muscular strength, balance, gait, and functional tests may all be done virtually with a family member/caregiver's assistance. TR delivers high-quality musculoskeletal treatment on a one-on-one basis. Remote muscle-strengthening activities increase physical functioning and quality of life while

reducing discomfort. Earlier technology did not allow clinicians to get these measurements, necessitating skilled assistance on the other end. Perhaps the most major roadblock is physicians' inability to envision transforming what is typically "hands-on" therapy into a virtual medium. Telerehabilitation, according to Winters and Winters (2004), can help with self-efficacy and compliance with home programs by optimizing the timing, intensity, and duration of the rehabilitation program.[1] In line with rehabilitative research results and global social and demographic trends, bringing services into the home via technology has become the preferred form of care. The research says the most effective rehabilitation for patients is when done at home. If skills are taught in the environment in which they will be used, it is more likely to be learned and transferred to everyday activities. Thus, the effectiveness and feasibility of TR services need further exploration and clarification from various data of a collection of studies.

According to the study by Seron, et al., numerous researchers have investigated the effects of TR on several conditions in various patients.[2] In terms of increasing functional outcomes in patients with stroke, many researchers frequently conclude that TR is economical, and its effectiveness is equal to clinic-based rehabilitation in improving functional outcomes. However, current studies lack specific skills such as gross motor skills, functional fine motor skills, activities of daily living (ADLs), and quality of life in patients with stroke. Different musculoskeletal conditions also focus more on improving pain and joint mobility, motor recovery, or strength. According to Russell, et al., on which researchers compared the effectiveness of TR and in-person rehabilitation on ADLs in stroke, reported that there is only low or moderate-level evidence testing whether TR is a more effective or similarly effective way to provide rehabilitation. TR could significantly enhance the improvement of life, especially in surgery patients, yet the effects on physical outcomes are questionable. TR is effective in improving physical function, usual care is superior to usual care alone, and even treatment delivered exclusively through TR is more effective than face-to-face intervention in reducing pain and promoting improved physical function in a variety of musculoskeletal diseases. Besides these, TR programs make it more accessible over larger areas and lessen the economic limits by removing travel time and event expenditures. In contrast, services for rehabilitation are not considered important in Philippine rehabilitation settings. This may be understood given that facilities and resources should be directed toward more urgent medical concerns given the limited staff and inadequate healthcare resources. As stated in the study of Leochico, et al., the adoption of TR in the Philippines continues to be complicated by issues with stakeholders or the surrounding environment.[3] The lack of understanding, acceptability, and technical preparedness among stakeholders, as well as skepticism and resistance to change, are some of the internal challenges. The absence of standardized TR standards, a lack of local evidence, possible expenses, a lack of technological resources, data privacy concerns, dangers to patient safety, and ambiguous responsibility of rehabilitation providers are a few examples of external difficulties. Despite this pandemic, the TR program has the capacity to complete its rehabilitative aims; as stated in the study by Leochico, et al., human factors difficulties identified were a lack of stakeholder adoption, the availability of the knowledge and skills needed in e-health, and even concerns about data privacy.[3] Likewise, the lack of national e-health policies or laws, as well as a framework for health information systems, governance, and data privacy protections, is a widely known concern in developing countries. However, among all of these individual factors across sectors, the Internet was the most challenging in adapting to the telehealth approach in the Philippines. A more high-quality study is needed to verify the effectiveness of TR in regaining functional skills among post-stroke patients and the satisfaction of patients with TR while considering the current healthcare setting in the Philippines. In summary, the purpose of this study is to determine if TR has a significant effect on improving the activities of daily living (ADLs) of post-stroke patients. This systematic review seeks to achieve the following objectives: To determine the clinical effectiveness of TR in regaining functional skills among post-stroke patients in terms of ADLs and the viability and adaptation of TR in the Philippine healthcare setting. Secondary to this objective is to identify the patient satisfaction and cost-effectiveness of TR.

MATERIALS AND METHODS

Ethics Statement

The FEU-NRMF IERC ruled the study is exempted from ethical review since there was no participation of human subjects.

Study Design

This study conducted the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) checklist for systematic reviews of intervention. The PRISMA 2020 statement is a 27-item checklist addressing the introduction, methods, results, and discussion sections of a systematic review report; however, items that fall under meta-analysis were removed.[4] This study followed a guideline preferred for systematic review and meta-analysis steps adapted from Tawfik, et al. (2019).

Eligibility Criteria

The study was considered pertinent if it met the following criteria: Published in the English language or with English translation, studies that included post-stroke participants at all levels of severity and all types of strokes, undergoing TR delivered by physical therapists and functional skills were assessed using an outcome measure such as but not limited to Barthel Index, Stroke Impact scale and Fugl-Meyer assessment. Only randomized controlled trials and cohort studies were included in this review.

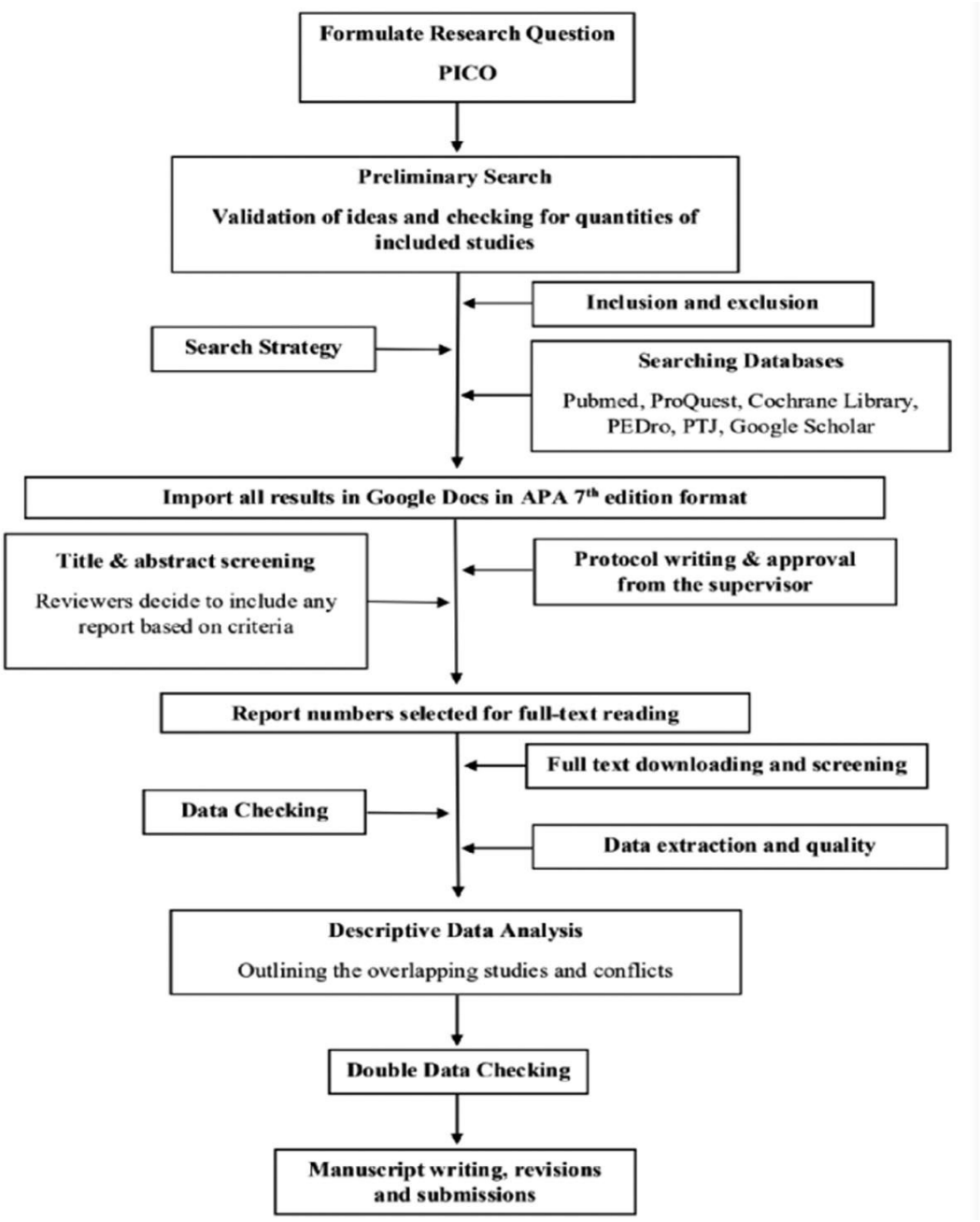

Figure 1. Guideline preferred for systematic review and meta-analysis steps adapted from Tawfik et al. (2019)

The review excluded studies that need paid access that is outside the FEU-NRMF partnered databases, incomplete study, studies produced prior to the year 2012, studies involving a non-stroke participant, mixed method or qualitative type, and studies that included other intervention/s outside physical therapy scope, robotics, and virtual reality. Articles that included pediatric patients as participants were excluded.

Information Sources

The researcher executed a comprehensive search of the following databases: Pubmed, Google Scholar, Cochrane Library, PEDro, ProQuest, EBSCOHost, and Lilacs. The researchers searched "TR and Cerebrovascular Accidents" from the year 2012 onwards on any stated databases. Searching for publications related to the themes was included in the electronic database search. The reference lists of included studies or pertinent reviews found were checked through the search to verify that all the materials were covered.

Search Strategy

A scoping search was done by using Google Scholar as the primary database to estimate the number of studies available on this topic with the following terms used "telerehab* AND stroke*" and a total of 9,960 studies were identified.

For the main search strategy, the following search terms for all databases were used: "telerehab* AND post-stroke patients", "telerehab* AND stroke*", AND "telerehab* AND cerebrovascular accident". A total of 4,880 studies were retrieved using "telerehab* AND post-stroke patients" from all databases; 11,159 studies for "telerehab* AND stroke*"; and 1,298 studies for "telerehab* AND cerebrovascular accident". As relevant studies were identified, researchers checked for additional relevant articles by hand searching and citation chaining.

Study Selection

This study used a PRISMA flow diagram as the "records identified through database searching" section displays the number of records retrieved by the database. Two groups of reviewers (consisting of three reviewers per group) independently screened the title and abstracts using standardized forms and determined the studies that fall under inclusion and exclusion. The same set of reviewers examined the rest of the data based on the complete text to confirm that they fit all the eligibility criteria. Team discussion, and a single third reviewer handled the inconsistencies to establish an agreement in the selection process. The reason for the exclusion of data was documented. (Figure 2)

Data Collection Process & Data Items

The following characteristics were collected from the studies included in the review: author, study design, participants, outcome measure/s, intervention, and result. To further appraise, a quality assessment for systematic review was conducted through a checklist. The third reviewer was the one that resolved any disagreements. To clear up any ambiguities, study authors were contacted. The Table 1 shows the list and definition of all outcomes for which data were sought, as well as the prioritization of primary and secondary outcomes, along with justifications.

Primary Outcome

The primary outcome was based on the following objectives: ADLs and adaptation of TR in the Philippine setting. This aimed to acquire a broad understanding of the effect of TR if studies are not included or eliminated based on the outcome measures, they utilized.

Secondary Outcome

The secondary outcomes were the following: Cost-effectiveness of TR was based on the efficacy, lesser costs of the interventions used, and availability of resources to the patients. Patient satisfaction with TR was based on their feedback, PT-patient interaction, challenges experienced during the consultation and rehabilitation, and other measures mentioned in the studies.

Quality Assessment

There were 2 quality assessment tools used in this study. Risk of bias for randomized controlled trials was assessed using the Cochrane Collaboration tool, while the quality assessment tool developed by National Heart, Lung, and Blood Institute (NHLBI)

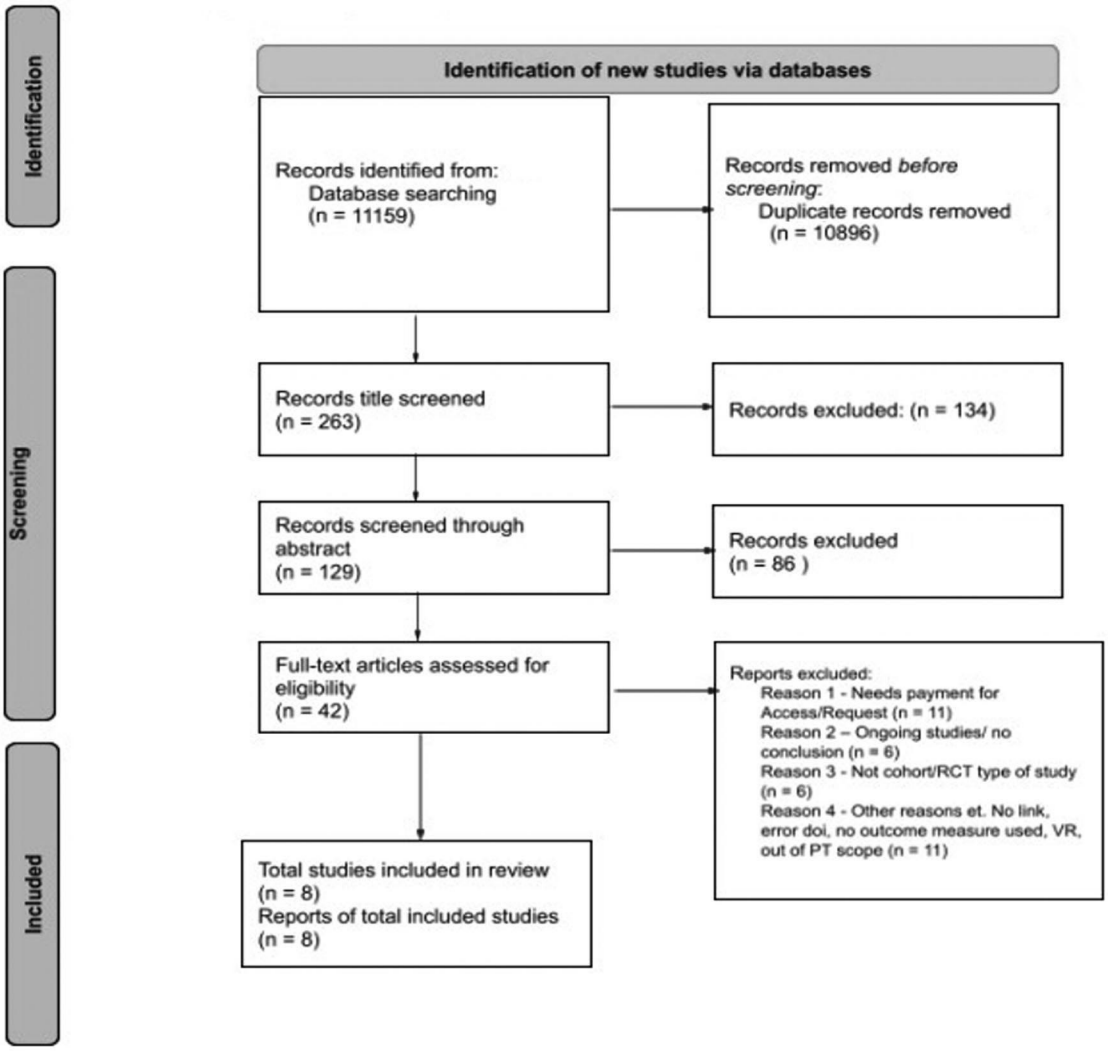

Figure 2. Study selection process using PRISMA 2020 flow diagram.

for Observational Cohort and Cross-Sectional Studies was used to assess the quality of the articles included in the review. This is a 14-question tool designed to systematically assess the internal validity of a study. Each question can be answered with yes, no, or not reported, and the number of affirmative responses was totaled. Two authors independently assessed the risk of bias in each study.

RESULTS

Study Selection

A search for articles produced a total of 11,159. However, after removing duplicates, only 263 articles remained whose titles were screened. Out of these, 134 were excluded, leaving 129 articles for abstract screening. After reviewing the individual abstracts, 42 articles were selected for full-text screening. Finally, after the complete screening process, only 8 articles were deemed suitable for inclusion in the review.

Study Characteristics

The 8 studies consisted of participants with post-stroke in regaining functional skills (ADLs with motor function, balance, and gait) that participated in daily home exercise programs, including strengthening exercises, balance training, range of motion exercises, patient education about stroke, practice tasks, games, and monitoring through video and telephone calls. (Table 1).

Table 1. Study characteristics.

Author/s	Study Design	Participants (n)	Outcome Measures (Primary; Secondary)	Intervention	Results of the Study
Chumbler et al. (2012)[5]	Randomized Controlled Trial	Ischemic or hemorrhagic stroke aged 45 to 90 years within the previous 24 months (n=52)	**Primary:** The motor subscale of the Telephone Version of the Functional Independence Measure (FONEFIM); The Overall Function Component of the Late-Life Function and Disability Instrument (LLFDI) **Secondary:** LLFDI Subscale Component Function: a) Upper Extremity Function; b) Basic lower extremity function; c) Advanced lower extremity function; and d) LLFDI Disability Component	Three 1-hour televisits, daily in-home messaging device monitored weekly, and five telephone intervention calls within 3-months period + Veteran Affair care, such as home health	Physical function of post-stroke patients was significantly improved with the Stroke TR (STeleR) intervention, with improvements persisting for up to 3 months after the intervention including 3 1-hour home visits and 5 telephone intervention calls were completed. Considering that there are limited resources available for stroke survivors, STeleR could be a useful adjunct to traditional post stroke rehabilitation.
Bellomo et al. (2020)[6]	Cohort study	Chronic stroke outpatients (n=25)	Fugl-Meyer Scale (FM)	At least 3 sessions with the WeReha for a minimum of 15 minutes each, (recommended 30 minutes for each session). Video-guided exercises with visual and voiced or ringing biofeedback for balance rehabilitation, strengthening the muscles of the legs and arms, and range of motion .	The FM scale scores ($p = .003$) and mRS scores ($p = .047$) were significant after treatment. In addition to conventional home exercise program, it could be used as a telerehabilitative resources.
Cramer et al. (2019)[7]	Randomized Controlled Trial	Stroke patients who had arm motor deficits (n=124)	**Primary:** Fugl-Meyer Arm motor Scale (FM) **Secondary:** Box and Blocks test and Stroke Impact Scale-hand motor domain	36 treatment sessions (70 minutes supported by videoconferencing which consisted of exercises, functional games and stroke education plus a 10-minute break; 18 supervised and 18 unsupervised) during a 6- to 8-week period	Compared with TR therapy, in-clinic therapy was comparable in effectiveness for improving function after 6 weeks since both groups improved their function. The TR group performed 1,031 arm movements per day, suggesting that TR may be useful for maximizing

					brain plasticity after having a stroke.
Deng et al. (2012)[8]	Randomized Controlled Trial	Chronic stroke with impaired ankle dorsiflexion (n=19)	**Primary**: Ankle DF	TR at home, between the participant and therapist, using a computerized movement training for the track group consisting of 60 training blocks per day with 3 trials per block amounting to 20 days of 3,600 trials. The group has a command of "track" on their computer screen, with target waveform, tracking response, and knowledge of results in each trial.	Compared to move group, the track group has significantly larger dorsiflexion during gait. Even though fMRI did not show significant differences in volume, percent volume, and intensity of cortical activation, there was a significant difference between 2 groups on the frequency count of the number of participants as the track group decreased their pretest to posttest measurements while the move group increased.
Dodakian et al. (2017)[9]	Cohort study	Poststroke with stable arm motor deficits (n=12)	**Primary:** Fugl-Meyer scale **Secondary:** Box and Blocks, Stroke Impact Scale (Hand motor subsection), NIH Stroke Scale, MMSE, Barthel Index, Geriatric Depression Scale	28 days of TR using a system delivered to their home consisting of 1 structured hour focused on individualized exercises and games, stroke education, and an hour of free play.	Participants had arm repetitions average of 24,607 ± 9934 individually and showed significant increase in arm motor status with 50% of them exceeding the MCID. There is also an increase in stroke prevention knowledge after daily stroke education via TR.
Sarfo et al. (2018)[10]	Cohort study	Stroke survivors (n=20)	Stroke Levity Scale (SLS), Modified Ranking Score (MRS), Montreal Cognitive Assessment (MOCA)	Post-stroke patients received Smartphone with the 9zest Stroke App® to deliver individualized, goal-targeted 5-days-a-week exercise program that was remotely supervised by a tele-therapist for 12 weeks.	Participants improved their motor impairments with high satisfaction from using 9zest Stroke App that has an individualized, goal-targeted exercise program for 5 days a week for 12 weeks.
Saywell et al. (2021)[11]	Randomized Controlled Trial	Hemispheric stroke (n=95)	**Primary:** Physical subcomponent of SIS **Secondary:** Grip strength, SSEQ, overall SIS	ACTIV: Each participants received 4 face-to-face visits, 5 structured phone calls, and personalized text messages for 6 months	ACTIV may not be an effective intervention in improving physical function compared to the usual care as there is nonsignificant difference between the groups measured by SIS.

Wu Msc et al. (2020)[12]	Randomized controlled trial	ischemic or hemorrhagic stroke (n=61)	**Primary:** FMA, BBS, TUG, 6MWT, MBI	ACUTE PHASE: Good limb position (No more than 2 hours in the same position); Breathing training (5-7 minutes, 2 times a week); Joint activity maintenance training(10 groups, 2 groups per day); Bed turning training(10 per group, 2 groups per day); Early balance training (10-15 minutes each time, 1 time per day); Early walking ability training(10 per group, 2 groups per day); RECOVERY PERIOD: Sitting-up training; Balance training(15 minutes each time, 1 time per day); Antispasmodic training(10 per group, 2 groups per day); Intensive Training of Active Activity Ability of Limbs;Walking function training; Activity Training of Daily Life Additional:home remote rehabilitation guidance uses the Internet-based TCMeeting v6.0 video conferencing system.	Both groups were significantly improved in terms of motor function and quality of life, but the intervention group showed greater improvement in Fugl-Meyer Motor Function Assessment, Berg Balance Scale, and Stroke-Specific Quality of Life Scale.

Clinical Effectiveness of Telerehabilitation

The review's data highlight the positive impact of TR on enhancing motor performance in daily activities for individuals recovering from strokes. Notably, among the eight studies considered, three showcased clinical effectiveness, with over half of the subjects surpassing the minimal clinically important difference compared to their baseline performance.

Wu, et al. (2020) conducted a study that underscored the efficacy of a secure and efficient TR exercise program.[12] This program was shown to assist stroke patients in recovering motor function and improving their daily living and overall quality of life. Similarly, studies by Sarfo et al. (2018)[10] and Bellomo et al. (2020)[6] reported favorable outcomes in post-stroke patients who engaged in daily exercise routines, encompassing upper and lower limb exercises. These exercises contributed to the enhancement of daily living activities as measured by the Barthel index. It is worth noting, however, that Deng, et al. (2012) reported limited improvements in physical activity following TR among post-stroke patients, suggesting the need for more extensive trials to assess the cost-effectiveness of this approach.[8]

The study by Huiqiong Deng, et al. (2012) provided insights into the improvement of ankle dorsiflexion through complex movement training within the framework of TR.[8] Other notable studies, including Bellomo, et al. (2020)[6], Cramer, et al. (2019)[7], Dodakian, et al. (2018)[9], and Wu, et al. (2020)[12], reported significant enhancements in Fugl Meyer scores, which is a common metric for evaluating patient mobility goals. While there were

positive trends observed in the Balance Berg Scale (BBS), this scale did not consistently meet the Minimal Detectable Change for individuals dealing with chronic stroke.

Patient Satisfaction in Telerehabilitation

The research review also delves into the aspect of patient satisfaction within the context of TR. The consensus among various studies is that patient satisfaction is closely intertwined with the success of TR programs.

Bellomo, et al. (2020) underlines that TR, exemplified by the WeReha program, is not intended to replace conventional therapy but rather complement it.[6] This perspective aligns with Cramer, et al. (2019), who asserted that TR is as effective as in-clinic therapy in improving arm motor function and stroke-related knowledge.[7] One notable recommendation from these studies is the importance of maintaining engagement through meaningful interactions with therapists. High levels of patient motivation were identified as key contributors to the effectiveness of TR interventions. Nevertheless, challenges such as internet stability and adherence issues, particularly in unsupervised home programs, posed potential hurdles to achieving optimal outcomes.

Given these findings, the incorporation of readily accessible and cost-effective technologies in TR setups emerged as a strategic approach. This approach, as highlighted by Saywell, et al. (2021), could significantly extend post-stroke rehabilitation to patients discharged to rural areas with limited access to traditional rehabilitation resources.[11] This becomes especially relevant in regions grappling with staffing shortages and resource constraints, offering a potential solution to address the accessibility gap in rehabilitation services.

Cost-effectiveness in Telerehabilitation

Dodaikan, et al. (2018) highlighted key barriers—access, cost, and compliance—that hinder optimal post-stroke physical rehabilitation.[9] The accumulated evidence across various studies demonstrates that TR effectively addresses these barriers. As indicated by Chumbler, et al. (2012), TR holds promise, particularly for individuals in low socioeconomic status and rural regions. Supporting this, Bellomo, et al. (2020) advocate for TR as a viable substitute for traditional post-stroke rehabilitation, especially in remote or underserved areas.

Considering potential internet instability, the WeReha program has strategically mitigated this concern by designing a setup that operates with limited dependence on continuous internet connectivity. Instead, intermittent connectivity is used solely for data uploads from patient activities. While Deng, et al. (2012) envisions TR not as a replacement but as a complementary element in the rehabilitation journey, it offers a positive outlook for managing costs, especially as healthcare expenditures continue to rise.[8]

Saywell, et al. (2021) further emphasize that leveraging readily available, cost-effective technology in TR setups can effectively extend post-stroke rehabilitation to individuals discharged to rural areas.[11] This becomes particularly significant in regions where staffing and resources are scarce, potentially bridging the gap in accessibility to rehabilitation services.

Table 2. Quality assessment for observational cohort and cross-sectional studies.

Quality assessment tool	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Total
Bellomo et al[6]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	NR	Yes	Yes	Yes	NR	Yes	Yes	12
Dodakian, McKenzie et al[9]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	NR	NR	NR	Yes	NR	Yes	Yes	10
Fred S. Sarfo, et al[10]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	NR	Yes	Yes	Yes	NR	Yes	Yes	12

Risk of Bias Assessment

National Heart, Lung, and Blood Institute (NHLBI) for Observational Cohort and Cross-Sectional Studies were used to assess 3 studies. To qualitatively evaluate the results, those above 12 were rated good, those below 9 were deemed to be poor, and those between 9 and 12 were fair studies. As a result, three out of three studies have a fair rate. (Table 2).

Five studies were evaluated using Cochrane Collaboration's tool; all were rated good in random sequence generation, allocation concealment, selective reporting, blinding and attrition bias. One study was reported unclear on other biases. (Figure 3).

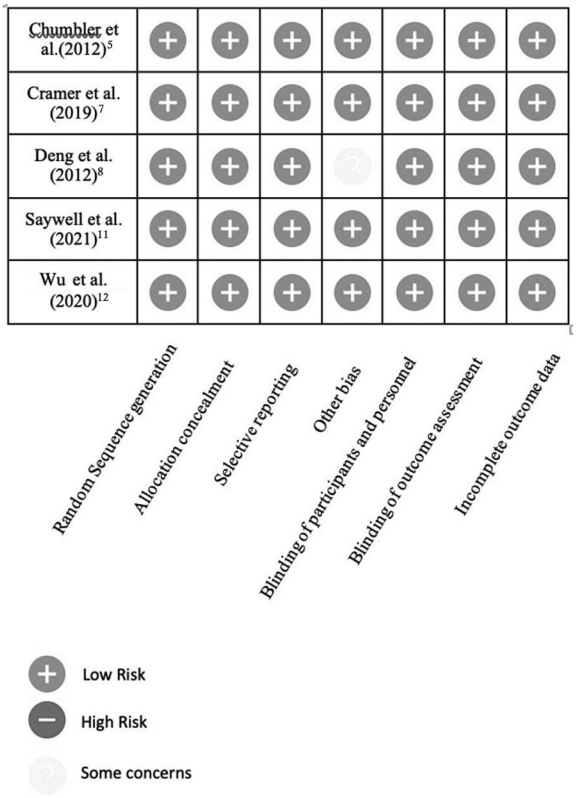

Figure 3. Risk of bias assessments for studies in a Cochrane review.

DISCUSSION

The study primarily aimed to assess the clinical effectiveness of TR in post-stroke patients' functional skill recovery for Activities of Daily Living (ADLs). The review encompassed eight studies, including randomized controlled and observational ones, involving 408 stroke patients within a 24-month period from stroke onset. The findings highlight the potential of TR in enhancing motor performance and ADLs, with several studies demonstrating clinical effectiveness surpassing the minimal clinically important difference. Wu Z, et al. (2020)[12], Sarfo FS, et al. (2018)[10], and Bellomo RG, et al. (2020)[6] underscore TR's efficacy in improving motor function and overall quality of life, albeit mixed results reported by Deng H, et al. (2012) pointing to the need for further research into cost-effectiveness.[8]

Patient satisfaction is identified as vital in successful TR programs. Alignment between Bellomo RG, et al. (2020)[6] and Cramer SC, et al. (2019)[7] emphasizes engagement's role in complementing traditional therapy, and patient motivation correlates with positive outcomes. Yet, internet stability and adherence challenges suggest strategies for sustaining patient commitment.

Recognizing barriers—access, cost, and compliance—Dodaikan S, et al. (2018) highlights TR's potential to overcome these challenges effectively. Aligned with Chumbler NR, et al. (2012)[5] and Bellomo RG, et al. (2020)[6], both supports TR as a great leverage of extending rehabilitation in underserved populations. WeReha's approach to mitigate internet instability showcases adaptability. Deng H, et al. (2012) emphasizes TR's complementary nature, suggesting cost-effective recovery strategies.[8] Saywell NL, et al. (2021) suggests technology adoption for post-stroke rehabilitation in resource-scarce regions.

Despite challenges, implications suggest that TR can enhance clinical effectiveness, patient satisfaction, and cost-effectiveness. Patient-centered approaches and technology integration are vital, yet further research is needed for optimal implementation.

In the Philippines, amid COVID-19 disruptions, TR offers an alternative to limited healthcare resources. Challenges persist, including provider readiness and data privacy concerns. The review encourages exploration of TR despite obstacles.

While not superior to conventional methods, TR complements clinical practice, aiding decision-making. The review's findings emphasize its effectiveness in improving motor function, ADLs, independence, and quality of life.

Limitations for this review were identified, which include time constraints, budget limitations, and reliance on existing data. Onsite data gathering was absent due to the systematic review's focus on existing resources, omitting physical interviews.

CONCLUSION

In summary, the reviewed studies collectively demonstrate that TR holds promise in improving motor function among post-stroke patients. However, variations in outcome measures, individual motivation, and technological considerations are pivotal factors influencing the success of TR interventions.

Contributions to the implementation of patient satisfaction were sought. Further studies should report on the clinical effectiveness of ADLs. In line with this, although the Philippine adaptation regarding the use of TR was deemed feasible, local experimental studies are encouraged to be conducted to support this claim.

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Prevalence and Profile of Microcytic Hypochromic Anemia in the Pediatric Population in a Tertiary Hospital

Liana Aira Quibael-Valencia, MD; Naomi S. Nochesada, MD and Mildred T. Rondilla, MD

ABSTRACT

Background: Microcytic hypochromic anemia may be attributed to a defect in heme synthesis or in globin synthesis. The most common causes of microcytic anemia in children are Iron Deficiency Anemia (IDA) and thalassemia.

Objective: This study aimed to determine the prevalence and profile of pediatric patients with microcytic hypochromic anemia in a tertiary hospital.

Methods: This study is a single center, descriptive cross-sectional study of patients ages 6 months to less than 19 years old diagnosed with microcytic hypochromic anemia in a tertiary in Quezon City from 2012-2019.

Results: This study shows the prevalence of IDA and thalassemia patients with 0.03% and 0.04% respectively among pediatric patients ages 6 months to less than 19 years old seen from 2012-2019. Patients with thalassemia had a mean age of 8.9 years (± 0.19) and 64.29% with family history of thalassemia. Sixty percent (60%) of patients with thalassemia were diagnosed as Alpha thalassemia and forty percent (40%) were Beta thalassemia. Patients with IDA had a mean age of 6.7 years (± 0.12) and majority were female (n=33, 69%). Majority presented with No stunting and No wasting among those with IDA or thalassemia. Thalassemia patients had lower mean hemoglobin (9.64 g/dL ± 1.02) and red cell indices; MCV (66.64 fL ± 8.42), MCH (21.68 pg ± 3.22) and MCHC (31.62 g/dL ± 1.93). Thalassemia patients had normal RDW-SD (35-56 fL) while those with IDA showed increased RDW-SD (>56 fL).

Conclusion: Thalassemia was more prevalent than IDA as the cause of microcytic, hypochromic anemia among the pediatric population seen in this tertiary hospital . Most patients with thalassemia had family history of thalassemia and majority were male whereas in IDA, majority were female. Both thalassemia and IDA showed decreased MCV, MCH and MCHC but lower values in thalassemia were observed. Patients with IDA showed increased in RDW and a normal RDW for patients with thalassemia.

Key words: Iron deficiency anema (IDA), thalassemia, anemia

Anemia is a worldwide problem affecting all age groups. Anemia is a condition in which the body does not produce enough red blood cells that contain hemoglobin which carries oxygen to the different organs and tissues. There are several pathophysiologic processes that cause anemia, most common of which is deficiency of iron which is necessary for the formation of normal hemoglobin. Anemia constitutes the world's problem of great magnitude and children represent one of highest population groups although some studies have suggested a decline in its prevalence. The cause of anemia varies with age. Anemia can be due to either decreased production which can be seen in nutritional deficiencies, bone marrow failure and aplasia or increased destruction as seen in congenital hemolytic anemias, autoimmune hemolytic anemia, drugs or microangiopathies.

Microcytic hypochromic anemia may be attributed to a defect in heme synthesis or in globin synthesis. In pediatrics, the differential diagnosis is generally limited to one of four diagnoses – iron deficiency, thalassemia, lead poisoning, or anemia of inflammation. It is defined as anemia with low mean

corpuscular volume (MCV) for age, race and sex. Studies have shown that the most common cause of microcytic anemia in children is secondary to iron deficiency anemia and thalassemia.[1] Many children who have microcytic anemia are symptomatic. It is usually detected as part of other screening programs or when blood count is obtained for another illness. Older children may present with pallor, fatigue, and irritability. Physical examination may show tachycardia at rest and a flow murmur, splenomegaly or bony deformation for cases of thalassemia. In the Philippines, iron deficiency anemia is the most alarming of the micronutrient deficiencies affecting a considerable proportion of infants (56.6%), pregnant women (50.7%), lactating women (45.7%) and male older persons (49.1%).[2]

Iron Deficiency Anemia (IDA) is the most common of nutritional deficiencies in childhood, affecting all socioeconomic levels. The global prevalence of anemia in young children is 43%. The Pakistan nutrition survey found that 65% of children between the ages 7-60 years old had IDA. Other studies have shown a prevalence rate of 75-78%. Factors leading to Iron deficiency in children are worm infestation, increased requirement to rapid growth and development, malabsorption, gastrointestinal and urinary losses.[3] Hemoglobinopathies are diverse group of inherited recessive disorders that include thalassemia and sickle cell disease. Thalassemia is among the most common genetic disorders worldwide. About 4.83% of the world population carry globin gene variants which include 1.67% of population heterozygous for α and β thalassemia, with high prevalence in Asia including Pakistan comprising of nine million carriers.[4]

In a study by Habib MA, et al., the prevalence of IDA was 33.2% (n=2372). Cross- sectional studies have shown that 77%-79% of pediatric cases with microcytic, hypochromic anemia were attributed to iron deficiency anemia while 13.5% -21% of cases were secondary to thalassemia.[1,5] Both iron-deficiency anemia and thalassemia co-existed in 5.5% of children.[1] Majority of children with microcytic, hypochromic anemia were males (53%- 60%).[1,4,5.6] It was reported to be most common in children 5-11 years old[1] in one cross-sectional study. Iron deficiency anemia was most common in children 1-6 years old,[4,7] in males (51.7%, n=3, 699) and in the lower socio economic status scale (SES) (58.5%, n=234).[7] Majority of children with iron-deficiency anemia were asymptomatic (69.9%, n=5, 022) to.[4] In another cross-sectional study, majority (85%, n=34) of children with iron-deficiency anemia had no history of bleeding whereas the remaining 15% n=6) had history of bleeding through rectum. Among 40 infants, 15 (37.5%) of them had positive occult blood in stool. Moreover, 30 (75%) had no history of parasitic infestation, whereas 10 (25%) were positive for either Entamoeba histolytica (vegetative form) (7/40), ascaris (2/40), or giardia (1/40).[6]

The mean (SD) of hemoglobin concentration in iron deficiency anemia was 8.34 (2.2 g/dl) and 8.44 (1.61) g/dl in thalassemia. While mean (SD) of MCV in iron deficiency anemia was 68.66 (11.23) fl and 51.22 (11.89) fl in thalassemia and mean (SD) of MCH in iron deficiency anemia was18.42 (4.39) pg and 16.23 (5.21) pg in thalassemia. On the other hand, mean (SD) of MCHC in iron deficiency anemia was 27.74 (10.34) g/dl and 26.05 (5.66) g/dl in thalassemia. Lastly, mean (SD) of RDW in iron deficiency anemia was 18.27 (2.83)% and 13.06 (1.11)% in thalassemia.

Currently, there is no local data available regarding the prevalence and profile of microcytic, hypochromic anemia among the pediatric population in a tertiary hospital. Hence, the results of this study provide a baseline reference for future research undertaking. Children are mostly undiagnosed and progress to develop permanent sequelae especially those in underdeveloped and developing countries The characteristic profile of these affected children can guide healthcare providers in early identification and proper management to prevent cognitive effect and associated health conditions. It will also impact on the community if the nutritional status of children and adolescents is addressed, that will lead to reduced morbidities and hospitalization and decreased healthcare costs among others.

This study aimed to determine the prevalence and clinical and hematological profile of microcytic hypochromic anemia, specifically iron-deficiency anemia and thalassemia, in the pediatric population in a tertiary hospital. where anticipatory guidance is included in the management of well and sick pediatric patients.

MATERIALS AND METHODS

Study Design

The study is a single-center descriptive cross sectional study of pediatric patients with microcytic hypochromic anemia for the years 2012-2019.

Study Population

Included were pediatric patients, 6 months to less than 19 years old, diagnosed with microcytic hypochromic anemia at FEU- Nicanor Reyes Medical Foundation from 2012-2019. Excluded were those with blood transfusion for the past six months and incomplete medical chart information.

Sampling Methodology

All charts of included patients were given designated numbers. Random selection of charts was done using random number generator- stat trek accessible at https://stattrek.com/statistics/random-number-generator.aspx.

Data Collection

After obtaining the approval by FEU-IRC, the principal investigator conducted the study. Data collection was done through review of medical records. Medical charts of all patients seen in FEU-NRMF Medical Center from 2012-2019 with microcytic hypochromic anemia were reviewed. The following data were collected: patient's age, sex, weight, height, nutritional status, peripheral blood examination composed of Hemoglobin, MCH, MCV, RDW-SD as well as result hemoglobin electrophoresis. Diagnosis of the patients was also included.

Sample Size

The sample size was estimated based on the reported prevalence of IDA in the Nutrition and Consumer Protection (2010) among infants. The minimum sample size required to determine an anticipated prevalence of 56.6% at 90 % confidence level and 7.5% margin of error was 118.

Data Processing and Encoding

Data was encoded using Microsoft Excel for tabulation and organization and statistical analysis was carried out using statistical tool SPSS.

Data Analysis

a. All data were analyzed using the statistical tool SPSS. The mean and SD were used for the analysis of age, hemoglobin, MCV, MCH, MCHC, RDW-SD. The frequency and proportion were used for a) age, which was categorized into 6-23 months, 2-4 years old, 5-11 years old, 12-14 years old and >15 years old, b) sex, c) nutritional status classified according to WHO's weight-for height or BMI-for age Z-score and height-for age or length-for-age Z score, d) presence or absence of family history of thalassemia, e) with or without intake of deworming drug, f) associated diagnosis and g) classification of patients as to Iron Deficiency Anemia, based on Mentzer's Index of > 13 or Thalassemia, further classified as alpha-thalassemia or beta-thalassemia, based on hemoglobin electrophoresis result

Limitation of the Study

The study was limited to a single-center, a tertiary private hospital in the outpatient and inpatient sections that cater mostly to low to middle class socioeconomic status.

Ethical Consideration

Research Ethics approval for this study was obtained from the FEU-IRC prior to the conduct of research. Data collection through review of medical records conformed with the Declaration of Helsinski Code of Ethics. Patient's information and personal data were secured by the researcher. All authors declared no conflict of interest. Since the study utilized review of medical charts, there were no anticipated risks and benefits for the patients, therefore no compensation was due for any patient. All information collected for this study was kept private and confidential. Their names did not appear in the analysis or in the reporting of the results. Confidentiality was ensured by concealing the identity of the patients through a code. Finally, all data records will be permanently deleted 3 months after completion of the study.

RESULTS

Table 1 shows that the majority of the pediatric patients who were diagnosed with IDA were aged between 6 months to 11 years old, and this was followed by patients aged 12 to 14 (8.33%), and patients aged 15 and above being the least (4.16%). 68.75% of pediatric patients with IDA were female. Most of them were not stunted and not wasted

(81.25%), 5 (10.42%) were wasted and 4 (8.33%) were stunted. Majority of the patients had not taken a deworming agent in the past 6 months (72.92%), and 14.58% of the patients had other associated diagnoses.

On the other hand, among 118 pediatric patients with hypochromic, microcytic anemia, 70 (59%) of them were diagnosed with thalassemia. The majority of the patients were aged five to eleven years old (47.14%), and this was followed by patients in the age group of two to four years old (20%). Most of the patients with thalassemia were male (55.71%). About 72.86% of the pediatric patients were not stunted and not wasted, 11.43% were overweight, 7.14% were wasted, 5.71% were obese, and 2.68% were stunted. Meanwhile, 64.29% of the patients said that they have a family history of thalassemia, while 20% had no family history of thalassemia, and 12.86% had unknown family history. Majority of the patients did not take a deworming agent for the past 6 months (77.14%), and 8.57% of the total pediatric patients diagnosed with thalassemia indicated other associated diagnoses.

Table 2 shows that patients with IDA had a mean hemoglobin of 10.93 g/dL (± 1.13), a low MCV, a mean MCH of 22.92 pg (± 2.71), a mean MCHC of 31.75 (± 2.21%) and increased RDW.

Patients with thalassemia, on the other hand, had a mean hemoglobin of 70.99 fL (± 7.06) and a much lower mean hemoglobin count of 9.64 g/dl (± 1.02), a lower MCV with a mean of 66.64 fL (±1.02), a mean MCH of 21.68 pg (± 3.22), a mean MCHC of 31.62 (± 1.93%) and normal RDW-SD(35-56 fL).

Table 1. Frequency and distribution of the demographic profile of pediatric patients at FEU-NRMF with microcytic hypochromic anemia from 2012 to 2019.

Characteristics	IDA (n = 48) (100%)	Thalassemia (n = 70) (100%)
Age (Mean ± SD)	9.6 ± 6.06	14 ± 11.47
- 6 to 23 months	14 (29.17%)	13 (18.57%)
- 2 to 4 years old	14 (29.17%)	14 (20%)
- 5 to 11 years old	14 (29.17%)	33 (47.14%)
- 12 to 14 years old	4 (8.33%)	4 (5.71%)
- > 15 years old	2 (4.16%)	6 (8.58%)
Sex		
- Male	15 (31.25%)	39 (55.71%)
- Female	33 (68.75%)	31 (44.29%)
Wasted (<-2)	5 (10.42%)	5 (7.14%)
Severely Wasted (<-3)	0 (0%)	0 (0%)
Stunting (<-2)	4 (8.33%)	2 (2.86%)
Severely Stunting (<-3)	0 (0%)	0 (0%)
Overweight (<+2)	0 (0%)	8 (11.43%)
Obese (<+3)	0 (0%)	4 (5.71%)
With wasting and stunting	0 (0%)	0 (0%)
No stunting, no wasting	39 (81.25%)	51 (72.86%)
Family history of thalassemia		
- Yes	0 (0%)	45 (64.29%)
- No	47 (98.57%)	14 (20%)
- Unknown	1 (1.43%)	9 (12.86%)
Intake of deworming agent in past 6 months		
- Yes	13 (27.08%)	16 (22.86%)
- No	35 (72.92%)	54 (77.14%)
Associated diagnosis	7 (14.58%)	6 (8.57%)

Table 2. Hemoglobin and RBC indices of pediatric patients with microcytic, hypochromic anemia at FEU-NRMF from 2012 to 2019.

Parameter	Iron Deficiency Anemia	Thalassemia
Hgb (g/dL) mean (SD)	10.93 (± 1.13)	9.64 (± 1.02)
MCV (fL) mean (SD)	70.99 (± 7.06)	66.64 (± 8.42)
MCH (pg) mean (SD)	22.92 (± 2.71)	21.68 (± 3.22)
MCHC (%) mean (SD)	31.75 (± 2.21)	31.62 (± 1.93)
RDW-SD n (%)		
Normal (35-56 fL)	5 (4%)	43 (36%)
Increased (>56 fL)	41 (41%)	20 (17%)
Decreased (<35fL)	1 (1%)	8 (7%)

Table 3 shows that majority of the patients experienced anemia due to thalassemia with 70 (59.32%) pediatric patients, followed by 48 (40.67%) pediatric patients with IDA. There were more female (68.8%) patients with IDA compared to male patients (31.2%). There were 42 patients (60%) diagnosed as alpha thalassemia with a mean age of 7.1 years (± 0.11). Of these, 23 (32.8%) were female and 19 (27.1%) were male. 28 (40%) patients were diagnosed as beta thalassemia with a mean age 5.4 years (±0.02), 20 (28.5%) of which were male and 8(11.4%) were female.

Table 3. Frequency and proportion of the causes of microcytic, hypochromic anemia in all pediatric patients at FEU-NRMF from 2012 to 2019.

Causes	n (%)	Age in years mean (SD)	Male n (%)	Female n (%)
IDA	48 (40.67)	6.7 (± 0.12)	15 (31.2%)	33 (68.8%)
Thalassemia	70 (59.32)	8.9 (± 0.19)	39 (55.7%)	31 (44.3%)
Alpha Thalassemia	42 (60)	7.1 (± 0.11)	19 (27.1%)	23 (32.8%)
Beta Thalassemia	28 (40)	5.4 (± 0.02)	20 (28.6%)	8 (11.4%)

Table 4 shows that the prevalence of patients ages 6 months - less than 19 years old with IDA is o.03% and thalassemia is 0.04% at a tertiary hospital from 2012-2019.

Table 4. Prevalence of IDA and Thalassemia patients at tertiary hospital from 2012 to 2019.

Year	IDA	Thalassemia
2012 to 2019	0.03%	0.04%

DISCUSSION

Anemia in children is one of the major public health concerns affecting people across all ages. Several studies conducted about anemia have allowed the development of different programs and policies aimed to reduce the increasing number of pediatric patients with anemia. However, these studies remain insufficient, especially in the Philippines where to date, there are still no local data available regarding the prevalence and profile of microcytic, hypochromic anemia among the pediatric population.

Based on the findings of the present study, the primary cause of microcytic, hypochromic anemia in the pediatric population was thalassemia (59.32%), followed by Iron Deficiency Anemia (IDA). The findings of the present study support the claim of Aydogan et al[1], where the common causes of anemia in the pediatric population are IDA and thalassemia. Majority of the pediatric patients in the study were female, contrary to the study of Habib, et al[4] where majority of the patients diagnosed with anemia were male. In the current study, 64.29% of the patients with thalassemia had family history of thalassemia which supports the study of Habib et al[4], that thalassemia is among the most common genetic disorder worldwide, with 4.83% of the world's total population carrying globin gene variants of thalassemia and is more prevalent in Asia. This study was conducted in a tertiary hospital in the Philippines, and the same study findings were obtained. In the present study, patients with thalassemia had lower MCV, MCH and MCHC which supports the study of Zafar et al[5]. In this study, hemoglobin levels of patients with thalassemia were lower than those with IDA which opposses the study of Zafar, et al[5].

The study revealed that the profile of microcytic hypochromic anemia among the pediatric population: 54.2% were female and 45.8% were male, with a mean age of 9.6 (± 6.06) for patients with IDA and 14 (±11.47) for patients with thalassemia and for nutritional status, majority of IDA (81.25%) and thalassemia (72.86%) patients presented with no wasting and stunting. Some studies suggest a different outcome compared to present study findings, which may be due to certain limitations during the study period.

Note that the research was done in a single medical institution done within a specific period of time, a smaller sample size and investigated only two causes of anemia – IDA and thalassemia and therefore cannot fully represent the possible findings for other pediatric patients with microcytic, hypochromic anemia. While this study was conducted in the Philippines, there can be other external factors affecting the prevalence of anemia in specific regions. While the findings of the present study indicated sufficient information regarding the prevalence of anemia in the institution, the data may not be enough to generalize the prevalence for other population. Furthermore, with a margin of error set at 7.5%, the study results may not truly represent the prevalence and profile of patients with microcytic, hypochromic anemia.

CONCLUSION AND RECOMMENDATION

This study showed that thalassemia was the most common cause of microcytic, hypochromic anemia among pediatric patients seen in this tertiary hospital. This was followed by Iron Deficiency Anemia (IDA), which was supported by a strong family history of thalassemia. This study also revealed that age, sex and family history of thalassemia can increase the risks of developing microcytic, hypochromic anemia. Both thalassemia and IDA showed decreased hemoglobin, MCV, MCH and MCHC but lower values were observed in thalassemia. Increased RDW-SD was seen in IDA patients and a normal RDW-SD for patients with thalassemia.

This study may be used to bridge the gap between the previous and current studies, and to also assess what programs or assistance can be provided in order to address microcytic, hypochromic anemia. The characteristic profile of these affected children can guide healthcare providers in early identification and proper management to prevent cognitive effect and associated health conditions. It will also impact on the community if the nutritional status of children and adolescents is addressed, that will lead to reduced morbidities and hospitalization and decreased healthcare costs among others. Further studies should be conducted in order to determine the progress and trends in pediatric diagnosis, treatment and management of anemia.

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Improving Scapular Kinematics on a Patient with Idiopathic Adhesive Capsulitis: A Case Report

Keith R. Mausisa, PTRP, PT, DPT

ABSTRACT

Adhesive Capsulitis (AC) is a common shoulder disorder caused by excess scar tissue formation in the joint that presents with pain and marked loss of motion leading to functional deficits. Over time, it promotes adhesion formations in the scapulothoracic structures that contribute to scapular dyskinesis, adding to shoulder pain and sub-optimal performance of the shoulder complex. Improving the scapular kinematics while also providing the conventional PT treatment can be implemented, offering a more comprehensive approach towards AC rehabilitation and may further address the persistent pain. This case report aimed to investigate the effect of improving scapular kinematics, by implementing scapular stabilization exercises, on shoulder pain and function in a patient with AC.

The patient was a 44-year-old female, diagnosed with right AC who is currently under the thawing stage with no pre-existing condition. She initially complained of sharp pain on the right shoulder upon end-range motions. The patient's goal is to do activities of daily living with less noted shoulder pain.

By the end of the 6-week program, improved scapular kinematics was achieved. The patient got 21 points on the Shoulder Pain and Disability Index (SPADI) as supported by the increased shoulder range of motion, improved scapular positioning with and without weights, and elimination of rapid downward rotation and early elevation of the scapula during resting and weighted shoulder movements.

This case report suggests that improving scapular kinematics may play a vital role in the management of AC as an adjunct as the shoulder mobility does not depend on the glenohumeral joint alone, but the whole shoulder complex which includes the scapula.

Key words: scapular kinematics, idiopathic adhesive capsulitis

Adhesive Capsulitis (AC) is a common self-limiting shoulder disorder caused by excess scar tissue formation in the joint that presents with pain and marked loss of motion leading to functional deficits.[1] It usually progresses in three stages, namely: freezing (2-9 months), frozen (4-12 months), and thawing stage (5-26 months).[2] As it transitions from these stages, AC will start with a slow onset of dispersed, intense shoulder pain that worsens at night followed by progressive loss of glenohumeral joint (GH) motion in all planes, especially external rotation, and finally, a gradual decrease of pain and return of motion will be noted as it reaches the thawing stage.[2] Despite the self-limiting nature of the disease, studies have cited that close to half of patients with AC suffer from persistent symptoms, resulting in up to ten years' functional limitation.[3]

For this case report, AC will refer to a patient suffering from pain and restricted shoulder motion with evidently altered scapular kinematics. As the joint heals from the inflammation, the persistent symptoms such as pain and shoulder stiffness can be attributed to the prolonged immobilization of the GH joint promoting adhesion formations in this joint and the other areas of the shoulder complex as well. Specifically, the scapulothoracic structures may suffer the same immobility complication that contributes to scapular dyskinesis, thereby impairing the scapular kinematics that adds to shoulder pain and sub-optimal performance of the shoulder complex.[4-7] Scapular kinematics describe the positioning of the scapula

on the thorax and its movement during motion.[7] An alteration of the normal scapular kinematics is termed as the scapular dyskinesis (SD) and is a poorly recognized dysfunction that is mostly overlooked by clinicians due to a lack of recognition and skills in examination and evaluation.[6] Nevertheless, it has a relevant role in projecting the shoulder's degree of freedom.[6] For instance, Ludewig, et al., have noted that an increased upward rotation of the scapula was seen in patients with AC as a compensatory mechanism to maximize the shoulder's limited motion from its previous stages where restrictive motion is mostly observed.[8]

Clinicians may have difficulty with scapular assessment as to its kinematics since determining the presence of SD can be quite complicated because of the lack of examinations that could quantify it in an individual.[7] For this case report, a combination of quality (direct obs ervation)[6] and quantifying (lateral scapular slide test)[9] tests were adapted. These tests are clinically able to track the scapular kinematics changes on a patient at rest and during motion with and without weights. Changes such as asymmetrical scapular positioning, winging, the early elevation of scapula, rapid downward rotation of the scapula, and shoulder shrug were observed on this patient upon initial evaluation. As for the functional outcome measure, Shoulder Pain and Disability Index (SPADI) was conducted as proven to be the most valid and most reliable in detecting the activity limitation and participation restriction in patients with AC.[10]

As mentioned, scapular dyskinesis is an anticipated secondary complication due to immobilization brought by the AC combined with the compensatory mechanisms to minimize the pain felt, but often neglected in treatment. A faulty positioning or movement when accumulates, can jeopardize the mechanisms involved in certain structures possibly resulting in pain. Agarwal, et al. have demonstrated that improving the scapular kinematics has shown positive outcomes in improving the pain and functionality of the shoulder in patients with AC.[4-6,11] For this case report, a normal scapular position at rest will refer towards scapular retraction, posterior tilt, and external rotation.[7] A large deviation from this at rest may possibly produce abnormal movement patterns as the shoulder starts to move. Therefore, the intervention towards improving the scapular kinematics on this patient will focus on strengthening her weakened scapular stabilizers that would promote the near normal to normal scapular positioning at rest and stretching of her periscapular muscles that cause the deviation. Strengthening exercise will be based on open and closed kinetic chain exercises such as muscle activation using isometric exercise, wall push-ups, lawnmower exercise, and resisted scapular retraction.[6-7] Stretching exercise will include unilateral corner stretch, forward elevation, external rotation, horizontal adduction, & internal rotation combined with an application of a hot moist pack.[6,12-13] Scapular mobilization will also be included to improve the flexibility of her stiffened scapula.[4]

Providing a stable base function on the patient's scapula through mobilization and stabilization exercises balances it from the push and pulls of its muscle group stabilizers, thereby maximizing the potential functional performance of her shoulder complex as it gains its ability to handle perturbations coming from the shoulder movements with or without weights.[14] Thus, the purpose of this report is to investigate and describe the implementation of scapular mobilization and scapular stabilization exercises on shoulder pain and function in a patient with AC under the thawing stage.

THE CASE

The University of Montana – Rehab Essentials has permitted to conduct this case report as part of the completion requirement for the doctorate physical therapy program. Institutional Ethical Board Review approval was not necessary with the type of research utilized for this study. The patient also successfully signed the consent form to participate in this study. Risks of discomfort and potential benefits upon doing the intervention were also explained to the patient carefully.

The patient was a 44-year-old female who has been suffering from her condition for nearly two years. She denied any traumatic event that could have precipitated such condition, which continued for several months and has impacted her activities of daily living (ADL) due to restricted motion of her right shoulder accompanied with sharp pain. Ten months before the initial evaluation (IE), she was prompted to see a primary care physician (PCP). After the patient interview and seeing the result of her shoulder's radiograph, she was medically diagnosed with right idiopathic adhesive capsulitis. She was then referred to physical therapy (PT) for rehabilitation management. She started attending her PT sessions since then, in an outpatient PT clinic setting.

Improvements in her shoulder range of motion (ROM) and the onset of pain from early ROM to late ROM were noted. Unfortunately, due to the COVID-19 pandemic crisis, she had to stop attending her PT sessions. For the past five months, the patient could do her ADLs and work from home but at a limited shoulder ROM since end-range motions exacerbate the pain.

At the initial evaluation (IE), the patient's chief complaint was a sharp pain and decreased ROM on her right shoulder. Her vital signs on the initial evaluation were as follows: 112/65 mmHg on her left brachial artery for blood pressure; 73 bpm taken via pulse oximeter; the respiratory rate of 15 cycles per minute; 36.4ºC taken on right axillary and 99% O_2Sat on room air which was assessed using a pulse oximeter. The patient has a healthy body mass index (BMI) of 21.6 but claims that she does not observe an active lifestyle but observes more of a proper balanced diet. The right shoulder pain, as reported by the patient, is aggravated during the end-range of shoulder motions, both actively and passively, with a pain scale (P/S) of 5/10. Furthermore, she also noted pain traveling up to her proximal lateral forearm with a dull, aching pain characteristic when shoulder pain is aggravated repeatedly. She reports that it is relieved by massaging her shoulder and putting it in an adducted and internally rotated position.

Other than pneumonia (~25 years ago), patient has no other pertinent medical history to report. A comprehensive systems review revealed unremarkable medical findings. Patient denies smoking and drinking alcoholic beverages. Patient only takes vitamin C tablet once a day. All in all, the patient self-reported good health except for her current AC condition, which has been bothersome on execution of office work and house chores. Her main goal for the physical therapy is to perform ADLs and office work routine with no difficulty and less pain on her right shoulder.

Clinical Impression

The collected data from the patient interview is in line with the typical characteristics of patients under the thawing stage of AC: the disease progression, restricted active and passive range of motion (ROM) suggestive of a capsular restrictions and absence of symptoms from other systems that may warrant further differential diagnosis. For this case report, the patient has proven to be a good physical therapy candidate for the following reasons: being consistent with the given medical diagnosis; currently on thawing stage, which denotes that this is the stage where physical therapy treatment is most effective[2]; absence of comorbidities that may delay the outcome of the study; and is willing to participate in this study. The examination section will determine if the patient fits appropriately in the intervention proposed in this case report. It will include scapular assessment and a set of tests and measures to quantify possible impairments, activity limitations, and patient participation restrictions. It will also serve as the baseline data to track improvements or regression of scapular kinematics and the patient's functioning.

Examination: Test and Measures

The examination started with the patient answering an outcome measure and can be found in Table 1. The patient completed the Shoulder Pain and Disability Index (SPADI), which assesses her participation restriction and activity limitation regarding her current condition.

Shoulder Pain and Disability Index

SPADI is a self-reported questionnaire consisting of 13 items distributed in two subscales, the pain assessment subscale, and the disability assessment of the shoulder subscale. It has two versions, the visual analog scale, and numeric rating scale. For this report, the numeric rating scale was utilized. The outcome measure lets the patient rate each described activity or phenomena on an 11-point scale corresponding to each item's intensity level. The scores can be interpreted either by percentage or by points. The subscale score was computed by getting the sum of points from the subscale items, divided by the total subscale point

Table 1. Shoulder pain and disability index results.

	Initial Evaluation	4th Session	8th Session	12th Session
Pain Subscale Score	72% or 36 points	38% or 19 points	22% or 11 points	16% or 8 points
Disability Subscale Score	65% or 52 points	27.5% or 22 points	18.75% or 15 points	16.25% or 13 points
Total Score	67.69% or 88 points	31.54% or 41 points	20% or 26 points	16.15% or 21 points

and multiplied by 100. The total score was computed by adding the total subscale scores from the pain and disability subscale.[15] The total score of the test ranges from 0-100, with a higher score indicating severe disability.[15] For this patient, she got a total score of 67.69% or 88 points. Table 1 shows the changes in subscale and total scores throughout the report. The Minimal Detectable Change (MDC) is 19.7 points, and the Minimally Clinically Important Difference (MCID) is 20 points or 43% change from the baseline value.[15] SPADI has good validity and reliability (ICC = 0.84-0.95, Cronbach's α = 0.86-0.96)[15] in terms of assessing for patients with AC as endorsed by the American Physical Therapy Association (APTA) from the published clinical practice guideline.[12]

Gross shoulder ROM was then assessed using a goniometer. It was found that right shoulder motion is significantly limited in all planes, especially in the abduction and internal rotation. Data for ROM values can be found in table 2. Gross muscle strength (MMT) was also assessed, the right shoulder and scapular muscle groups were one grade weaker than those on the left side ranging from Grades 4-5 out of 5. During the examination, it was also observed that she has a low pain threshold that may necessitate for a lesser aggressive approach, especially in static stretching exercise.

The examination then proceeded with the scapular assessment consisting of direct observation and modified lateral scapular slide test. Due to limited validated scapular testing, the adapted tests were either supported by recent studies or recognized orthopedic organizations. The overall data for the scapular kinematic assessment are shown in Table 3.

Table 2. Range of motion data.

Range of Motion Action	Right AROM				Left AROM			
	IE	4th Session	8th Session	12th Session	IE	4th Session	8th Session	12th Session
SH Flex.	120º	128º	158º	158º	180º	180º	180º	180º
SH Abd.	52º	80º	100º	152º	180º	180º	180º	180º
SH IR	15º	50º	70º	70º	60º	70º	70º	70º
SH ER	30º	34º	50º	90º	90º	90º	90º	90º

Note: AROM – Active Range of Motion. IE – Initial Evaluation. SH – Shoulder. Flex – Flexion. Abd – Abduction. IR – Internal rotation. ER – External Rotation.

Table 3. Scapular kinematic changes.

I. Direct Observation of Scapula						
Initial Evaluation						
	Resting Scapula		Holding 1kg-bag during shoulder flexion		Holding 1kg-bag during shoulder abduction	
	R	L	R	L	R	L
Winging	✓	✗	✓	✗	✓	✗
Early elevation of scapula	✓	✗	✓	✗	✓	✗
Rapid downward rotation	✗	✗	✓	✗	✓	✗
Shoulder shrug	✓	✗	✓	✗	✓	✗

4th Session						
	Resting Scapula		Holding 1kg-bag during shoulder flexion		Holding 1kg-bag during shoulder abduction	
	R	L	R	L	R	L
Winging	✓	✗	✓	✗	✓	✗
Early elevation of scapula	✓	✗	✓	✗	✓	✗
Rapid downward rotation	✗	✗	✓	✗	✓	✗
Shoulder shrug	✗	✗	✓	✗	✓	✗
8th Session						
	Resting Scapula		Holding 1kg-bag during shoulder flexion		Holding 1kg-bag during shoulder abduction	
	R	L	R	L	R	L
Winging	✗	✗	✓	✗	✓	✗
Early elevation of scapula	✗	✗	✗	✗	✓	✗
Rapid downward rotation	✗	✗	✗	✗	✓	✗
Shoulder shrug	✗	✗	✓	✗	✓	✗
12th Session						
	Resting Scapula		Holding 1kg-bag during shoulder flexion		Holding 1kg-bag during shoulder abduction	
	R	L	R	L	R	L
Winging	✗	✗	✓	✗	✓	✗
Early elevation of scapula	✗	✗	✗	✗	✗	✗
Rapid downward rotation	✗	✗	✗	✗	✗	✗
Shoulder shrug	✗	✗	✓	✗	✓	✗

II. Modified Lateral Scapular Slide Test Changes

	Initial Evaluation		4th Session		8th Session		12th Session	
	R (in cm)	L (in cm)	R (in cm)	L (in cm)	R (in cm)	L (in cm)	R (in cm)	L (in cm)
Arms at side	10	8.5	9	8	8.5	7.5	7	7.5
Hands on hips	9.5	8	8.5	7.8	9	7.2	8	7.2
Scaption at 90 ° with 1 kg load	12	10.7	10	9.5	9.2	9	8.5	8

Direct Observation

The scapula is observed in three scenarios, during resting and while holding a 1-kg bag while doing shoulder flexion followed by shoulder abduction. The scapula is observed for winging, the early elevation of the scapula, rapid downward rotation, and shoulder shrugging during these scenarios. The less you observe these scapular movements the better scapular kinematics there is. For this test, the patient was noted with winging and elevated scapula while at rest, but shoulder shrug and rapid downward rotation appear to be present upon movement with weights.[6]

Modified Lateral Scapular Slide Test (MLSST)

The distance between the inferior angle of scapula and T7 of the patient was recorded at arms at side, hands-on waist, and scaption at 90º with a 1-kg load. The MDC applicable for this patient ranges from 0.67-1.40 cm.[16] Table 3 shows the MLSST measurement changes throughout the PT sessions. Although MLSST has no diagnostic criterion for shoulder pathology, it showed good to high intra- and inter-rater reliability from which the collected data can precisely project a mispositioned and asymmetrical appearance of the patient's scapula on various positionings reflecting the scapular kinematics bilaterally.[16]

Intervention

The success of physical therapy treatment in patients with AC does not solely depend on achieving the full ROM but focuses more on the dynamics of a large decline of shoulder pain, improved functional performance, and patient satisfaction.[12] This was the intervention program's basis in attaining the mentioned outcome.

The patient was seen for six weeks. She was treated twice weekly and received the following interventions: scapular mobilization, scapular stabilization exercises, stretching exercises combined with the application of hot moist pack (HMP), and glenohumeral peripheral joint mobilization (PJM).

Scapular Mobilization

Increasing the scapular mobility via scapular mobilization has garnered immediate positive outcomes as it directly affects the increased shoulder ROM as it promotes relaxation to stiffened adjacent soft tissues.[17] It is important to start the intervention with this mobilization to prepare the scapula for motions that need to be executed in the next exercises. The mobilization was done with the patient side-lying on the uninvolved side facing the therapist while the involved arm was supported over the therapist's shoulder. The scapular borders are then cupped by the therapist on opposite sides to move it side to side, up & down, and upward & downward rotation. This was performed for 25 repetitions per direction orientation, e.g., 25 reps for side to side, 25 reps for up & down maneuver.

Scapular Stabilization Exercises

This is widely studied among patients with subacromial impingement syndrome (SIS) but rarely is being studied among patients with AC. Both populations have been extensively studied and concluded that improving the scapular kinematics can improve the shoulder motion and reports of pain, ergo the adaptation of this exercise into the AC patient for this case report.[4-6,11,17] The exercises are composed of isometric exercises and open and closed kinetic chain exercises. The isometric exercises were initially done to engage and activate the scapular stabilizer muscles, keeping the patient from substituting other muscles during execution. In the first two weeks, it was performed with the parameter of six seconds hold for ten repetitions and was then progressed according to the patient's tolerance (Table 4). It has been said that SD is the result of imbalanced muscle strength of scapular stabilizers, specifically the upper trapezius and a weakened lower trapezius and serratus anterior, thus strengthening of these was the main focus for the given scapular stabilization exercises.[18] The strengthening of scapular adductors was also implemented to aim for the symmetry with the left scapular positioning from which a painless and full functioning shoulder can be seen.[7,14] On the strengthening exercise proper, the open kinetic chain exercise was composed of prone overhead raise, dynamic hug and diagonal exercise, side-lying forward flexion, and lawnmower exercise (Table 5).[19] The closed kinetic chain exercise would be wall push-ups progressed to 45˚ incline push-up and then progressed to platform walks according to patient's tolerance; also, gym ball scapular exercise. Both open and closed kinetic chain exercises were executed ten repetitions each and were progressed accordingly (Table 4).

Table 4. Scapular stabilization exercises progression.

1st – 3rd Session	4th – 8th Session	9th – 12th Session
Isometric Scapular Retraction and Depression (6 sec hold, 10 reps for 1 set)	Isometric Scapular Retraction and Depression (10 sec hold, 10 reps for 2 sets)	Isometric Scapular Retraction and Depression (10 sec hold, 10 reps for 2 sets)
Prone Overhead Raise (10 reps for 1 set)	Prone Overhead Raise with 2 lbs of dumbbell (10 reps for 1 set)	Prone Overhead Raise with 2 lbs of dumbbell (10 reps for 3 sets)
Dynamic Hug and Diagonal Exercise	Dynamic Hug and Diagonal Exercise (using 2 lbs dumbbell,10 reps for 1 set)	Dynamic Hug and Diagonal Exercise (using 2 lbs dumbbell,10 reps for 3 sets)
Lawnmower (using 2 lbs dumbbell for 10 reps)	Lawnmower (using 2 lbs dumbbell for 10 reps for 1 set)	Lawnmower (using 2 lbs dumbbell for 10 reps for 3 sets)
Side-lying forward flexion (10 reps for 2 sets)	Side-lying forward flexion (using 2 lbs dumbbell, 10 reps for 1 set)	Side-lying forward flexion (using 2 lbs dumbbell, 10 reps for 3 sets)
Wall Push-ups (10 reps, 1 set)	45 degree Push-ups (10 reps for 2 sets)	Platform Walk (10 reps for 2 sets)
Gym Ball Scapular exercise (10 reps each direction for 1 set)	Gym Ball exercise (10 reps each direction for 2 sets)	Gym Ball exercise (10 reps each direction for 3 sets)

Table 5. Scapular stabilization exercise description.

Exercise	Description
Isometric Scapular Retraction and Depression	Patient is in side-lying position and asks the patient to retract or depress her scapula and applies a resistance to medial border or inferior angle of scapula, respectively.[26]
Prone Overhead Raise	Patient is in prone position with the arm raised above the head while it is in accordance with the lower trapezius' muscle fibers.[19]
Dynamic Hug	Patient is standing with her back on the wall, knees bent, and feet are shoulder width-apart. The starting position of the upper limb is in such a way that the elbow is flexed by 45°, shoulder is abducted by 60°, and slightly internally rotated. The limb is then moved in a hugging motion as far as possible.[19]
Diagonal Exercise	The starting position is the arm positioned at contralateral hip and then raised in a diagonal pattern such that there is a combination of shoulder flexion, horizontal abduction, and external rotation while in sitting position.[19]
Side-lying Forward Flexion	Patient does forward flexion of the upper limb up to 135° while on side-lying position.[19]
Lawnmower exercise	The patient stands with the knees slightly bent and the hip extended (butt out). Starting position would be the arm at the contralateral leg and then raised diagonally with trunk extension, trunk rotation and the scapula retracted. [19]
Push-ups	Two hands are placed on a surface that is slightly wider than patient's shoulders. Both arms and legs are straightened. Then patient slowly lowers her body and then pushes herself back-up.
Platform Walk	Two hands are placed on a surface that is slightly wider than patient's shoulders. Both arms and legs are straightened. Then patient moves one hand at time going in and then out which counts as one repetition.
Gym Ball Scapular Exercise	Patient stands with hand placed on the gym ball against a wall, bringing the arm upwards, downwards and side to side.

Stretching Exercise

This is combined with an application of HMP for a maximum of 20 minutes to help tolerate a painful stretch, followed by the stretching exercises. The stretching exercise includes unilateral corner stretch, forward elevation, external rotation, horizontal adduction, & internal rotation.[7] Each parameter observed was 15 seconds hold for three repetitions each.[20]

Glenohumeral Joint Mobilization

The glenohumeral joint was placed in its resting position while the therapist distracts the joint with one hand, and the other hand applies the directional force on the humeral head. For this case report, both posterior and caudal glide was performed on the patient.

Aside from the physical therapy sessions, the patient was also instructed with a daily home exercise program, consisting of strengthening and stretching exercises that mimic the given intervention program above (Table 6). The only difference would be that the patient will be doing it by herself. As observed, there was minimal load given for the strengthening exercises to promote stimulation of the under-activated scapular stabilizers which will aid bring back the normal scapular kinematics.

Outcomes

The patient was seen twice weekly for a total of 12 sessions. The patient was able to tolerate all the given interventions and was able to complete the treatment sessions without adverse effects noted such as, but not limited to, worsening of pain, and decline of available ROM. The following outcomes were observed:

4th Session/Week 2

As early as two weeks from starting the program, some outcome measures have already shown meaningful improvements to the patient. Her initial SPADI score of 88 points went down to 41 points (MCID = 20 points)[15] and the shoulder shrug on resting position was eliminated. The scapular positioning on various positions has narrowed its difference from the unaffected shoulder as seen in table 3, subsection II.

Table 6. Home exercise program.

Exercise	Instruction
a. **Strengthening**	Patient does the same scapular stabilization exercise instructions from Table 5.
b. **Stretching**	
Unilateral Corner Stretch	Patient stands in a corner of the wall. Patient places her hand (affected side) on the wall at shoulder level and slowly rotates the trunk towards the contralateral side as far as possible. Hold it for 15 seconds and repeat it three times.
Forward Flexion	Patient lies supine and grasps the wrist of the affected side. While maintaining the elbow straight of the affected side, the other hand raises the arm overhead as far as the patient can tolerate. Hold it for 15 seconds and repeat it three times.
External Rotation	Patient lies supine or in sitting position while holding a wand/stick. A towel is placed between the elbow of the affected side and her trunk. During the stretch, patient will hold the towel in place by tucking it at her side while her hand holds the wand. Meanwhile, the hand of the unaffected side pushes the wand away from the body as much as the patient can tolerate. Hold for 15 seconds and repeat it three times.
Horizontal Adduction	Patient lies supine with the affected shoulder taken across the body with the elbow straight. The other hand will try to push the affected side further towards the body and is held for 15 seconds, repeated three times.
Internal Rotation	Patient lies on the affected side with its upper arm and elbow bent at 90˚. The patient slowly pushes the back of her wrist downwards up to the range that the patient can tolerate. Hold it for 15 seconds and repeated three times.

The ROM changes were also noted but with minimal improvement as to her shoulder external rotation.

8th Session/Week 4

Continuous recovery was noted as to ROM, SPADI, and MLSST measurements. By direct observation of the scapula, the early elevation of the scapula and rapid downward rotation during shoulder flexion was now eliminated. The patient showed the greatest difficulty in executing shoulder abduction accompanied by pain and stiffness at its end-range. Shoulder internal rotation with shoulder abduction by 90º was now noted as the first shoulder ROM achieved fully with minimal pain noted (P/S: 3/10).

12th Session/Week 6

Upon the conclusion of the treatment program, the SPADI score improved to 21 points (MCID = 20 points).[15] Total SPADI score also contains two subscales which were tracked throughout the sessions as seen in table 1. The pain subscale score improvements support the patient's subjective reports of improved quality of life by being able to carry weighted objects without pain and do overhead reach with minimal difficulty which was reflected on the patient's disability subscale. An improvement in her scapular kinematics was also noted as manifested by timely elevation of the scapula and downward rotation on various positions (Table 3). The patient's MLSST findings were also noted with great improvement from initial evaluation to 12th session with 3 cm difference on arms at side, 1.5 cm difference with hands on hips, and 3.5 cm difference on scaption at 90 degrees with 1-kg load (MDC = 0.67-1.40 cm).[16] All shoulder ROM showed great progress as seen in table 2, and her gross shoulder muscle strength as well was observed for its improvement. The shoulder flexion improved by 38º and shoulder abduction by 100º. As for the shoulder rotation while the shoulder is abducted in 90º, shoulder internal rotation improved by 55º and shoulder external rotation improved by 60º. In the overall 6-week treatment program, the patient's goal of improving her performance in office works with less noted pain was achieved.

DISCUSSION

Scapular dyskinesis (SD) is often overlooked by clinicians despite its relevance in the shoulder's degree of freedom and associated shoulder pain.[6] SD is one of the anticipated complications caused by the AC condition brought by several compensatory mechanisms on its previous stages to maximize the available shoulder ROM. In this case report, the added scapular kinematics-focused exercises are beneficial for the patient which highlighted the strengthening of the scapular adductors, serratus anterior, lower trapezius, and minimizing the participation of the upper trapezius.[6,18,21-22]

As compared to the initial evaluation, pain at rest and available ROM has greatly recovered leading to improved activities of daily living performances. According to the findings, clinically meaningful differences were observed on scapular initial positioning which eventually led to improvements of the scapular kinematic. McQuade and colleagues argued that in improving shoulder mobility and scapular kinematics, the scapula has to develop the ability to handle perturbation coming from the constant push and pulls of muscles surrounding it which warrants a balanced activation of its stabilizers.[14] Thus, no normative value concentrated on the affected shoulder was aimed as to the positioning of the scapula, but its symmetry was more emphasized since the shoulder resilience observed from the normal side describes the painless and functional shoulder for this patient. Therefore, the narrowed differences in MLSST measurements were more considered. Residual deficits such as winging and shoulder shrugging upon carrying a 1-kg load during shoulder flexion and abduction denote that further strengthening of the scapular adductors and minimizing the activity of the upper trapezius is needed.

Successfully addressing the rapid downward rotation and early elevation of the scapula on various positions of the patient, on the other hand, may have caused the improvements in pain and disability as supported by the study of Mohamed, et al., stating that normalizing the scapular kinematics among patients with AC, a meaningful difference in shoulder flexion and abduction of 7.8º and 4.98º, respectively, were noted as early as two weeks from initiating their program.[11] Their study utilized a proprioceptive scapular re-training approach in restoring the normal scapular kinematics which could have helped address the shoulder shrugging of the patient during shoulder flexion and abduction with weights since prolonged SD may have damaged the correct proprioception-related muscle mechanisms.[11]

Numerous studies with different approaches to address AC condition was successfully conducted and recorded improvements having statistically significant differences in range of motion as the common measurement for comparison of the studies. Johnson, et al. proved that just in the third treatment, patients who had posterior glide mobilization can attain as much improvement in shoulder external rotation versus the anterior glide.[23] Ibrahim, et al., on the other hand, showed that as early as four weeks, the static progressive stretch was indicated to be an effective adjunct in increasing the shoulder motion.[24] In addition to that, Donatelli's case report addressing adhesive capsulitis in a specific multi-approach has also demonstrated that by sixteen weeks, a full, pain-free shoulder movement is achievable in his patient.[25] Arguably, enhancing the scapular kinematics by strengthening the scapular stabilizers alongside the stretching and joint mobilization of the shoulder may have effectively aided the patient's recovery as reflected by the noted improvements in her ROM and SPADI.

Nevertheless, the lack of reliable and valid assessments for scapular kinematics and lack of reference values specific for patients with AC under the thawing stage in utilizing scapular kinematic assessments were the external limitations for this study. As for the internal limitations, the duration of stretching should have been 30 seconds for a more effective deformation of the muscle fiber[20] and could have resulted in a larger improvement than documented in this report. The HEP given could have been more tailored into a program that complements the intervention given during her PT sessions rather than mirroring the exercises given on her PT sessions. Lastly, one of the most important aspects that should have not been missed especially to patients with AC would be the pain education. Giving this prior to the initiation of the program might positively influence the patient's pain perception and increase her pain tolerance making it possible to progress the program better.

On the other hand, information regarding Filipino patients with AC in response to physical therapy intervention programs is almost non-existent and further research is needed to establish an evidence-based approach towards it. Moreover, the lack of stage-specific AC research interventions needs to be in detail in the inclusion criteria of studies for accurate reference of the efficacy of each treatment utilized.

CONCLUSION

The implementation of scapular mobilization and stabilization, as seen on the utilized outcome measures, reflected positive responses. This suggests that it may play a vital role in the management of AC. Thus, adding it to the treatment program may contribute to faster improvement of the shoulder pain and mobility.[6,8,11]

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