

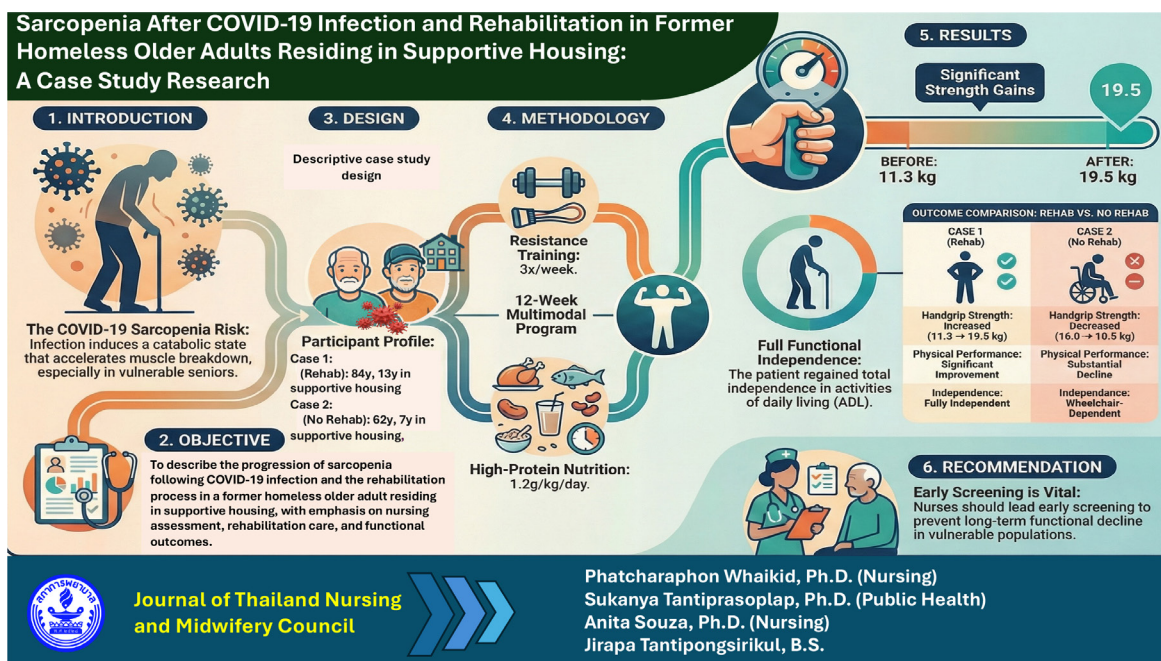
Sarcopenia After COVID-19 Infection and Rehabilitation in Former Homeless Older Adults Residing in Supportive Housing: A Case Study Research

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Extended Abstract

Introduction Sarcopenia is a multifactorial geriatric syndrome characterized by progressive loss of skeletal muscle mass, muscle strength, and physical performance, leading to functional decline and increased mortality among older adults. Major contributing factors include malnutrition, chronic inflammation, comorbidities, and physical inactivity. Coronavirus disease 2019 (COVID-19) infection induces a severe inflammatory and catabolic state that accelerates muscle protein breakdown, particularly in older adults with limited physiological reserve. During the post-acute phase, prolonged immobilization, fatigue, reduced physical activity, and inadequate nutritional intake further increase the risk of sarcopenia. Older adults with a history of homelessness are particularly vulnerable due

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to long-standing nutritional deficits, multimorbidity, and social disadvantage. Although supportive housing provides a structured care environment, evidence regarding post-COVID-19 sarcopenia and recovery among former homeless older adults remains limited.

Objective This study aimed to describe the progression of sarcopenia following COVID-19 infection and the rehabilitation in former homeless older adults residing in supportive housing, with an emphasis on nursing assessment, rehabilitation care, and functional outcomes.

Design This study employed a descriptive case study design.

Methodology The participants were two cases: an 84-year-old former homeless man who had resided in a supportive housing facility for 13 years and a 62-year-old former homeless man who had resided in the same supportive housing facility for 7 years, who were purposively selected for comparison based on similar exposure to COVID-19 infection and comparable baseline risk of sarcopenia. Following recovery from COVID-19 infection, post-infection screening was conducted as part of routine health monitoring. Sarcopenia risk and status were assessed using standardized screening and diagnostic criteria recommended by the Asian Working Group for Sarcopenia 2019. Nursing assessment focused on muscle strength, and physical performance. A multidisciplinary rehabilitation program was implemented, coordinated by nurse researchers in collaboration with supportive housing personnel. The program included individualized resistance exercise, balance and gait training, and mobility exercises performed three times per week. Nutritional management emphasized adequate energy intake and protein supplementation, with a recommended protein intake of 1.2 g/kg body weight/day. Ongoing nursing monitoring supported adherence, safety, and continuity of care throughout the rehabilitation period. Case 1 participated in the rehabilitation program, while Case 2 did not engage in the program and maintained usual daily activities. Clinical indicators were monitored 4 points of time in both cases (T1: 3 months post-COVID-19, T2: 1-year follow-up, T3: pre-rehabilitation baseline conducted 6 months after T2, and T4: post-rehabilitation assessment. A cross-case analysis was conducted to examine similarities and differences in sarcopenia progression and functional outcomes.

Results Across the 4 time points, Case 1 had calf circumference of 26.5, 23.5, 25.5, and 27.0 cm, respectively; handgrip strength of 15.5, 10.85, 11.3, and 19.5 kg, respectively; physical performance score of 17.4, 20.91, 12.00, 10.71, respectively. Appendicular skeletal muscle mass index (ASMI) at T1 and T4 was 6.74 and 7.56 kg/m², respectively. In Case 2, calf circumference was 28.5, 28.0, 28.5, 28.0 cm, respectively; handgrip strength was 16.0, 17.5, 16.0, 10.5 kg, respectively; physical performance score was 19.08, 22.33, 20.55, 27.95, respectively. ASMI at T1 and T4 was 6.30 and 5.55 kg/m², respectively.

Recommendation This case study highlights the importance of early nursing-led screening for sarcopenia following COVID-19 infection, particularly among vulnerable older adults. Supportive housing can serve as an effective setting for post-COVID-19 rehabilitation when structured exercise, nutritional support, and multidisciplinary collaboration are integrated into routine care. Nursing practice should emphasize early identification, individualized rehabilitation planning, and continuous functional assessment to promote recovery and prevent further functional decline. Further research is recommended to examine post-COVID-19 sarcopenia management strategies in supportive housing.

Keywords sarcopenia/ post-COVID-19/ former homeless/ older adults/ supportive housing

Received 24 December 2025, Revised 15 March 2026, Accepted 24 March 2026

ภาวะมวลกล้ามเนื้อน้อยภายหลังการติดเชื้อโควิด-19 และการฟื้นฟู สมรรถภาพของผู้สูงอายุในสถานคุ้มครองคนไร้ที่พึ่งที่เคยไร้ที่อยู่อาศัย: การวิจัยแบบกรณีศึกษา

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บทคัดย่อขยาย

บทนำ ภาวะมวลกล้ามเนื้อน้อย เป็นกลุ่มอาการของผู้สูงอายุที่มีสาเหตุจากหลายปัจจัย โดยมีลักษณะสำคัญคือการลดลงของมวลกล้ามเนื้อ ความแข็งแรงของกล้ามเนื้อ และสมรรถภาพทางกายอย่างต่อเนื่อง ซึ่งส่งผลให้เกิดการถดถอยของการทำหน้าที่ของร่างกาย เพิ่มความเสี่ยงต่อการเกิดภาวะพึ่งพิง และการเสียชีวิตในผู้สูงอายุ ปัจจัยสำคัญที่เกี่ยวข้องกับภาวะมวลกล้ามเนื้อน้อย ได้แก่ ภาวะทุพโภชนาการ การอักเสบเรื้อรัง โรคเรื้อรังร่วม และการมีกิจกรรมทางกายน้อย การติดเชื้อโควิด-19 กระตุ้นภาวะอักเสบ และการสลายของโปรตีนในกล้ามเนื้ออย่างรุนแรง ส่งผลให้การสูญเสียมวลกล้ามเนื้อเกิดขึ้นอย่างรวดเร็ว ในผู้สูงอายุที่มีความสามารถในการปรับตัวทางสรีรวิทยาลดลง ในระยะหลังการติดเชื้อ การนอนพักนาน ความเหนื่อยล้า การลดกิจกรรมทางกายและการได้รับสารอาหารไม่เพียงพอ ล้วนเพิ่มความเสี่ยงต่อการเกิดภาวะมวลกล้ามเนื้อน้อย ผู้สูงอายุที่เคยไร้ที่อยู่อาศัยมีความเปราะบางเป็นพิเศษ เนื่องจากการขาดสารอาหารเรื้อรัง การมีโรคเรื้อรังร่วมหลายโรค และความเปราะบาง แม้ว่าปัจจุบันจะเข้าพักในที่พักอาศัยที่ได้สนับสนุนซึ่งเป็นบริบทที่เอื้อต่อการดูแลและฟื้นฟูสุขภาพ แต่หลักฐานเกี่ยวกับภาวะมวลกล้ามเนื้อน้อยหลังการติดเชื้อโควิด-19 ในผู้สูงอายุที่เคยไร้ที่อยู่อาศัยยังมีอยู่อย่างจำกัด

วัตถุประสงค์ เพื่ออธิบายการเกิดภาวะมวลกล้ามเนื้อน้อยภายหลังการติดเชื้อโควิด-19 และกระบวนการฟื้นฟูสมรรถภาพในผู้สูงอายุที่เคยไร้ที่อยู่อาศัยซึ่งอาศัยอยู่ในสถานคุ้มครองคนไร้ที่พึ่ง โดยเน้นการประเมินทางการแพทย์ การดูแลฟื้นฟู และผลลัพธ์ด้านสมรรถภาพทางกาย

รูปแบบการวิจัย การศึกษานี้เป็นการวิจัยเชิงกรณีศึกษา

วิธีดำเนินการวิจัย กลุ่มตัวอย่างประกอบด้วยกรณีศึกษา 2 ราย รายที่ 1 เป็นเพศชายอายุ 84 ปี เคยไร้ที่อยู่อาศัยและได้เข้าอาศัยอยู่ในสถานคุ้มครองคนไร้ที่พึ่งเป็นเวลา 13 ปี กรณีศึกษารายที่ 2 เป็นเพศชายอายุ 62 ปี เคยไร้ที่อยู่อาศัยและได้เข้าอาศัยอยู่ในสถานคุ้มครองคนไร้ที่พึ่งเดียวกันเป็นเวลา 7 ปี เลือกแบบเฉพาะเจาะจงเพื่อเปรียบเทียบเนื่องจากมีประสบการณ์การติดเชื้อโควิด-19 คล้ายกัน และมีความเสี่ยงต่อภาวะมวลกล้ามเนื้อน้อยในระดับใกล้เคียงกัน หลังจากการฟื้นฟูจากการติดเชื้อโควิด-19

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ได้มีการตรวจคัดกรองหลังการติดเชื้อเป็นส่วนหนึ่งของการติดตามสุขภาพตามปกติ มีการประเมินความเสี่ยงและภาวะมวลกล้ามเนื้อน้อย โดยใช้เกณฑ์การคัดกรองและการวินิจฉัยมาตรฐานที่แนะนำ โดยคณะกรรมการด้านภาวะกล้ามเนื้ออ่อนแอเอเชีย ปี ค.ศ. 2019 การประเมินทางกายภาพบ่งชี้ ประเมินความแข็งแรงของกล้ามเนื้อ และสมรรถภาพทางกาย มีการพัฒนาโปรแกรมฟื้นฟูสมรรถภาพแบบสหสาขาวิชาชีพ โดยประสานงานระหว่างพยาบาล ซึ่งเป็นผู้วิจัยและบุคลากรที่ดูแลผู้ป่วยในที่พักอาศัย การฟื้นฟูสมรรถภาพประกอบด้วย การออกกำลังกายแบบใช้แรงต้านเป็นรายบุคคล การฝึกทรงตัวและการเดิน และการออกกำลังกายเพื่อเพิ่มความคล่องตัว สัปดาห์ละ 3 ครั้ง การจัดการด้านโภชนาการเน้นการได้รับพลังงานอย่างเพียงพอและการเสริมโปรตีน โดยให้รับประทานโปรตีน 1.2 กรัม/กิโลกรัมของน้ำหนักตัว/วัน การดูแลติดตามจากพยาบาลอย่างต่อเนื่องช่วยส่งเสริมความสม่ำเสมอของการปฏิบัติตามโปรแกรม ความปลอดภัย และความต่อเนื่องของการดูแลตลอดระยะเวลาการฟื้นฟูสุขภาพ โดยกรณีศึกษาที่ 1 เข้าร่วมโปรแกรมฟื้นฟู ในขณะที่กรณีศึกษาที่ 2 ไม่ได้เข้าร่วมและดำเนินกิจกรรมประจำวันตามปกติ มีการติดตามตัวชีวิตใน 4 ช่วงเวลา ได้แก่ T1: 3 เดือนหลังการติดเชื้อโควิด-19, T2: การติดตามผลที่ 1 ปี, T3: ก่อนการฟื้นฟูซึ่งดำเนินการ 6 เดือนหลังจาก T2 และ T4: การประเมินหลังการฟื้นฟู ทั้งนี้ได้มีการวิเคราะห์เปรียบเทียบระหว่างกรณี (cross-case analysis) เพื่อศึกษาความเหมือนและความแตกต่างของภาวะมวลกล้ามเนื้อน้อยและผลลัพธ์

ผลการศึกษา ในการติดตามทั้ง 4 ช่วงเวลา กรณีศึกษาที่ 1 มีเส้นรอบน่องเท่ากับ 26.5, 23.5, 25.5 และ 27.0 เซนติเมตร ตามลำดับ; แรงบีบมือเท่ากับ 15.5, 10.85, 11.3 และ 19.5 กิโลกรัม ตามลำดับ; คะแนนสมรรถภาพทางกายเท่ากับ 17.4, 20.91, 12.00 และ 10.71 ตามลำดับ โดยค่าดัชนีมวลกล้ามเนื้อโครงร่างส่วนระยางค์ (Appendicular Skeletal Muscle Index, ASMI) ที่ T1 และ T4 เท่ากับ 6.74 และ 7.56 กิโลกรัม/ม² ตามลำดับ กรณีศึกษาที่ 2 มีเส้นรอบน่องเท่ากับ 28.5, 28.0, 28.5 และ 28.0 เซนติเมตร ตามลำดับ; แรงบีบมือเท่ากับ 16.0, 17.5, 16.0 และ 10.5 กิโลกรัม ตามลำดับ; คะแนนสมรรถภาพทางกายเท่ากับ 19.08, 22.33, 20.55 และ 27.95 ตามลำดับ โดยค่าดัชนีมวลกล้ามเนื้อโครงร่างส่วนระยางค์ ที่ T1 และ T4 เท่ากับ 6.30 และ 5.55 กิโลกรัม/ม² ตามลำดับ

ข้อเสนอแนะ การศึกษาเชิงกรณีศึกษานี้ชี้ให้เห็นถึงความสำคัญของการคัดกรองภาวะมวลกล้ามเนื้อน้อยโดยพยาบาลในระยะเริ่มต้นภายหลังการติดเชื้อโควิด-19 โดยเฉพาะในผู้สูงอายุที่มีความเปราะบางทางสังคม สถานคุ้มครองคนไร้ที่พึ่งสามารถส่งเสริมการฟื้นฟูสมรรถภาพ โดยบูรณาการการออกกำลังกาย การเสริมโภชนาการ และการทำงานร่วมกันของทีมสหสาขาวิชาชีพ การพยาบาลควรมุ่งเน้นการประเมินติดตามอย่างต่อเนื่อง การวางแผนการดูแลฟื้นฟูสุขภาพรายบุคคล และการประเมินสมรรถภาพทางกายเพื่อส่งเสริมการฟื้นฟูสุขภาพและป้องกันการถดถอยในระยะยาว การศึกษาครั้งต่อไปควรมีการศึกษาแนวทางการจัดการภาวะมวลกล้ามเนื้อน้อยหลังการติดเชื้อโควิด-19 อย่างเป็นระบบ ในสถานคุ้มครองคนไร้ที่พึ่ง

Journal of Thailand Nursing and Midwifery Council 2026; 41(2) 332-351

คำสำคัญ ภาวะมวลกล้ามเนื้อน้อย ภายหลังการติดเชื้อโควิด-19 ผู้ที่เคยไร้ที่อยู่อาศัย ผู้สูงอายุ สถานคุ้มครองคนไร้ที่พึ่ง

วันที่ได้รับ 24 ธ.ค. 68 วันที่แก้ไขบทความเสร็จ 15 มี.ค. 69 วันที่รับตีพิมพ์ 24 มี.ค. 69

Introduction

Coronavirus disease 2019 (COVID-19) infection induces a severe inflammatory and catabolic state that adversely affects skeletal muscle health.¹ Elevated levels of inflammatory cytokines, prolonged immobilization,² and hospitalization contribute to accelerated muscle protein breakdown and the development of sarcopenia, particularly in older adults.³⁻⁵ Even short periods of bed rest during acute illness have been shown to result in substantial muscle loss,⁶ while longer hospital stays are strongly associated with malnutrition and functional decline.⁷ During the post-acute phase of COVID-19, many survivors experience persistent malnutrition, reduced physical activity, fatigue, and neuropsychiatric symptoms, all of which further exacerbate muscle loss and impair recovery.^{8,9} Collectively, these post-COVID-19 sequelae place older adults at high risk for prolonged sarcopenia and delayed functional restoration.

Sarcopenia is a progressive geriatric syndrome characterized by declines in skeletal muscle mass, strength, and physical performance,¹⁰ and is associated with functional impairment,¹¹ poor quality of life,¹² and increased mortality.¹³ Older adults are particularly susceptible to sarcopenia due to age-related physiological changes, chronic inflammation, multimorbidity, and reduced physical activity, placing this population at an inherently high baseline risk for muscle loss.¹⁴ Older adults with a history of homelessness represent a particularly vulnerable population with heightened susceptibility

to frailty and muscle loss. Long-term exposure to unstable living conditions, chronic malnutrition, multimorbidity, and limited access to healthcare services contributes to cumulative physiological decline and increased risk of sarcopenia.¹⁴⁻¹⁶

The prevalence of sarcopenia was 38.1% among institutionalized older adults, while systematic reviews indicate that the prevalence in long-term care facilities ranged from 17.7% to 73.3%, reflecting the substantial burden of sarcopenia in institutional settings.^{17,18} Among those with COVID-19, the prevalence of sarcopenia has been reported to be as high as 48.7%, underscoring the substantial impact of SARS-CoV-2 infection on skeletal muscle health.¹⁹ Previous studies conducted among former homeless older adults living in supportive housing have reported that as many as 71.2% had possible sarcopenia, indicating a substantially higher burden of muscle loss in this socially vulnerable population.²⁰ Even after transitioning into institutional supportive housing, many former homeless older adults continue to experience persistent health vulnerabilities, including frailty, physical inactivity, and functional limitations. Institutional living environments may also impose structural constraints on daily physical activity and nutritional autonomy, thereby further exacerbating muscle deterioration.

Moreover, it is essential to consider that supportive housing operates as a closed institutional system, which poses significant challenges to infection prevention. Unlike community settings

where social distancing can be implemented as a fundamental protective measure against COVID-19, such strategies are difficult to achieve within the physical and structural constraints of institutional living environments. Consequently, these conditions substantially increased the risk of COVID-19 transmission among older homeless adults. During the severe COVID-19 outbreak, all older adults of the Home for the Destitute in Nonthaburi Province were infected with COVID-19, further amplifying their risk of post-infectious sarcopenia.

This supportive housing is a closed residential institution with communal living and high population density. The facility comprises seven dormitories including 530 residents, with approximately 25% of residents aged ≥ 50 years. During the COVID-19 situation in 2023, no structured physical activity or exercise programs were implemented, movement between dormitories was restricted, and food access was limited depending limited food budget. These conditions reduce mobility and nutritional adequacy, increasing the risk of physical decline and sarcopenia compared with older adults in the general community.

Despite the heightened risk of COVID-19 transmission within closed institutional settings, supportive housing also provides environments that may facilitate access to care and rehabilitation once acute infection has resolved. However, evidence regarding post-COVID-19 sarcopenia and recovery trajectories in former homeless

older adults remains limited. Given its close association with functional decline and intrinsic capacity, sarcopenia is highly relevant to the Integrated Care for Older People (ICOPE) framework. The Integrated Care for Older People program, developed by the World Health Organization (WHO), aims to promote healthy aging through integrated, person-centered care and has been implemented among community-dwelling older adults in various settings.²¹ Therefore, early identification and appropriate management of sarcopenia in vulnerable older adults are of critical importance. Nurses play a critical role in the early identification and management of sarcopenia in institutional and community care. Nurse-led screening, functional assessment, care coordination, and rehabilitation monitoring can support supportive housing staff in implementing structured exercise and nutritional interventions for older adults at risk of sarcopenia. Standardized screening and diagnostic approaches are therefore essential for early detection and management. The Asian Working Group for Sarcopenia (AWGS) 2019 consensus provides widely accepted criteria for identifying sarcopenia in Asian populations.²²

However, most previous studies have focused on sarcopenia among community-dwelling older adults or nursing home residents. Evidence regarding sarcopenia among former homeless older adults residing in supportive housing remains extremely limited, and to our knowledge, studies describing post-COVID-19 sarcopenia and rehabilitation in this population are scarce in Thailand.

Beyond screening and diagnosis, strategies to delay the progression of sarcopenia, where possible, may reverse muscle decline. Current evidence emphasizes the role of multimodal programs, particularly resistance exercise combined with adequate protein intake and nutritional optimization, in preserving muscle mass, strength, and physical performance among older adults. These programs are especially critical for vulnerable populations, in whom delayed rehabilitation may exacerbate muscle decline. Therefore, a screening and management system was developed in the supportive housing, Nonthaburi Home for Destitute, through multidisciplinary approaches. This study is a part of this newly developed system, with aims to promote rehabilitation from COVID-19 and delay progressions of sarcopenia among older adults residing in this supportive housing.

Objective

To describe the progression of sarcopenia following COVID-19 infection and the rehabilitation in former homeless older adults residing in supportive housing, with emphasis on nursing assessment, rehabilitation care, and functional outcomes.

Conceptual Framework

This case study is conceptually informed by the integration of the Asian Working Group for Sarcopenia (AWGS) 2019²² consensus and the World Health Organization's Integrated Care for Older People (ICOPE) framework. The AWGS criteria were applied to guide the screening and

clinical assessment of sarcopenia, including evaluation of muscle strength, muscle mass, and physical performance. These standardized criteria provide a structured approach for identifying possible sarcopenia and monitoring changes in muscle function among older adults.

The integration of AWGS diagnostic criteria and the ICOPE framework provides a comprehensive approach for early identification, assessment, and management of sarcopenia among vulnerable older adults residing in institutional care settings.

Methodology

Study Design and Setting

This study employed a descriptive case study design guided by the methodological approach of Yin²³ This study was conducted in a public supportive housing facility (Home for the Destitute) in Nonthaburi Province, Thailand, which provides long-term residential care and health support services for socially vulnerable older adults, including those with a history of homelessness. The facility does not have permanently stationed nursing personnel; therefore, health monitoring and rehabilitation activities were implemented through collaboration between supportive housing staff and the research team.

Case Identification and Inclusion Criteria

The cases included in this report were purposively selected from residents living in the supportive housing facility. Selection was based on clinical relevance and the presence of sarcopenia-

related indicators following recovery from COVID-19 infection. The inclusion criteria were as follows: (1) older adults aged ≥ 50 years residing in the supportive housing; (2) history of COVID-19 infection during the institutional outbreak period; (3) evidence of sarcopenia based on screening assessments recommended by the AWGS; (4) availability of follow-up data before and after participation in a structured rehabilitation program.

Potential cases were identified through routine health monitoring conducted by the researchers as part of a health surveillance initiative to screen residents for post-COVID-19 functional decline and sarcopenia risk.

Participant Selection

The two cases were purposively selected to represent contrasting conditions (rehabilitation participation vs. non-participation), consistent with the replication logic of a multiple-case study design. This approach allows comparison of outcomes across cases within a similar contextual environment.

Case 1 was an 84-year-old Thai male with a 13-year residency in supportive housing and a prior history of homelessness. This case was purposively selected as the individual exhibited clinical manifestations of sarcopenia following recovery from COVID-19. The subsequent implementation of a structured rehabilitation program within the supportive housing facility provided a unique opportunity to examine the progression of sarcopenia and the efficacy of functional recovery interventions within an institutional care setting.

Case 2 was a 62-year-old Thai male with a 7-year residency in the same supportive housing facility and a prior history of homelessness. This case was purposively selected for comparison based on similar exposure to COVID-19 infection and comparable baseline risk of sarcopenia, but did not participate in the structured rehabilitation program. The inclusion of this comparison case enabled examination of contrasting clinical trajectories within a similar contextual setting.

Sarcopenia Assessment

Sarcopenia screening and diagnosis were conducted according to the Asian Working Group for Sarcopenia (AWGS) 2019 consensus criteria. Muscle strength was assessed using handgrip strength, with cut-off values of <28 kg for men indicating low muscle strength. Physical performance was evaluated using standardized functional assessments, including gait and chair-stand tests. Muscle mass was estimated using the appendicular skeletal muscle mass index (ASMI). In addition, sarcopenia risk was assessed using the Mini Sarcopenia Risk Assessment (MSRA) questionnaire.²²

To facilitate early detection in community and institutional settings, the AWGS recommends screening tools such as calf circumference (<34 cm for male), the SARC-F questionnaire (score ≥ 4), and the SARC-CalF questionnaire (score ≥ 11). The clinical diagnostic and screening criteria based on the AWGS 2019 consensus are summarized in Table 1.

Table 1. Clinical Diagnostic and Screening Criteria for Sarcopenia Based on the AWGS 2019 Consensus

Consensus group	Main criteria definition	Screening Sarcopenia risk either	Lean muscle mass ASMI:	Muscle function			
				Muscle strength	Physical performance (Screening either)		
Sarcopenia	Low ASMI plus low Physical performance or Muscle strength	No	DXA: $\leq 7.0 \text{ kg/m}^2$ for men $\leq 5.4 \text{ kg/m}^2$ for women BIA: $\leq 7.0 \text{ kg/m}^2$ for men $\leq 5.7 \text{ kg/m}^2$ for women	< 28 kilograms (Kg) for men < 18 kilograms (Kg) for women	Gait speed 6-m walk < 1.0 meter/second for both men and women	SPPB ≤ 9 point for both men and women	5-time chair stand ≥ 12 seconds
Possible sarcopenia (Community vs hospital settings)	Sarcopenia risk and low Physical performance or Muscle strength	1. CC < 34 cm for men < 33 cm for women 2. SARC-F (≥ 4) 3. SARC-CalF (≥ 11)	No	< 28 kilograms (Kg) for men < 18 kilograms (Kg) for women	6-m walk < 1.0 meter/second for both men and women	≤ 9 point for both men and women	≥ 12 seconds

Abbreviations: AWGS = Asian Working Group for Sarcopenia; ASMI = appendicular skeletal muscle mass index; DXA = dual-energy X-ray absorptiometry; BIA = bioelectrical impedance analysis; SPPB = Short Physical Performance Battery; SARC-F = Strength, Assistance in walking, Rising from a chair, Climbing stairs, and Falls; SARC-CalF = SARC-F combined with calf circumference; CC = calf circumference.

Instruments

Several standardized instruments were used to assess sarcopenia risk, muscle strength, physical performance, and muscle mass in accordance with the AWGS 2019 recommendations.

Sarcopenia Screening: Initial screening was performed using calf circumference and the Mini Sarcopenia Risk Assessment-5 (MSRA-5) questionnaire. Calf circumference was measured

at the widest part of the leg using a non-elastic tape with the participant in a seated position and the knee flexed at 90° . According to AWGS 2019, a value of < 34 cm in men indicates an increased risk. The MSRA-5 was further utilized to evaluate nutritional status and clinical history, where lower scores signify a higher risk of sarcopenia

Muscle strength: Muscle strength was quantified using a handgrip dynamometer. The

participants performed the test in a standing position, with the arm fully extended to the side. The assessment consisted of two trials, with a brief rest interval between attempts. The maximal value was recorded, with <28 kg defining low muscle strength in men.

Physical performance: Functional mobility was evaluated using the 6-meter walk test and the 5-time sit-to-stand (5TSTS) test. Impaired performance was defined as a gait speed of <1.0 m/s or a 5TSTS duration of ≥ 12 seconds. All tests were conducted under strict supervision to ensure participant safety.

Muscle Mass Assessment: Skeletal muscle mass (SMM) was estimated using a Bioelectrical Impedance Analysis (BIA) device. The SMM was calculated based on the following validated predictive equation:²²

$$\text{SMM} = [0.401 \times \frac{\text{Height}^2}{\text{Resistance}}] + (3.825 \times \text{gender}) - (0.071 \times \text{Age}) + 5.102$$

(Where Gender = 1 for male, Age is in years, Height in cm, and Resistance in Ω)

Subsequently, the Skeletal Muscle Mass Index (SMI) was derived by normalizing SMM for height: $\text{SMI} = \frac{\text{SMM}}{\text{Height}^2}$. According to the AWGS 2019 criteria, low muscle mass was defined as an SMI of <7.0 kg/m² for men.²²

Data Collection and Clinical Timeline

This case study employed a longitudinal data collection framework, capturing metrics at four

distinct milestones: 3 months post-infection (initial assessment) (T1), 1-year post-infection (interim follow-up) (T2), pre-rehabilitation program (T3), and post-rehabilitation program (following the 3-month rehabilitation) (T4). This multi-point monitoring allowed for a comprehensive analysis of the participant's clinical trajectory. All assessments were performed by trained personnel utilizing standardized protocols to ensure maximum measurement accuracy and longitudinal consistency.

Multidisciplinary Rehabilitation Program

Following the diagnosis of sarcopenia, a structured 3-month multidisciplinary program was implemented, focusing on the synergy between physical stimulus and nutritional support.

Multi-modal Exercise Protocol: The participant engaged in a supervised exercise regimen three times per week. Each 60-minute session followed a Progressive Resistance Training (PRT) model using body weight and resistance bands. The protocol comprised ten specific movements targeting major muscle groups, including the Seated Shoulder Press, Band Pull-Apart, and Seated Row. Each exercise was performed in three sets of 10 repetitions, with a 1–2-minute rest interval between sets to optimize muscle hypertrophy and recovery.

Nutritional Management: To counteract age-related anabolic resistance, a high-protein dietary plan was prescribed. The target protein intake was set at 1.2 g/kg body weight/day. A key

strategy involved the even distribution of protein across three main meals to maximize 24-hour muscle protein synthesis.

Coordination and Safety: The program was overseen by nursing staff in collaboration with supportive housing personnel. This multidisciplinary approach ensured strict adherence to the protocol and participant safety.

Data Analysis

Data analysis was primarily descriptive at the individual level. Clinical indicators measured at four time points, including muscle strength, physical performance, and muscle mass, were examined to illustrate changes over time in the primary case who participated in the rehabilitation program. In the cross-case analysis, data were described to highlight similarities and differences in sarcopenia-related indicators between Case 1, who underwent rehabilitation, and Case 2, who did not.

Ethics Approval and Consent to Participate

Ethical approval for this case study was obtained from the Institutional Review Board of the Faculty of Medicine, Ramathibodi Hospital, Mahidol University (COA. MURA2022/690 and MURA2026/40). Written informed consent for participation and publication was obtained from the participant. All procedures were performed in accordance with the Declaration of Helsinki, and confidentiality was strictly preserved.

Results

Case 1: Rehabilitation Participant Following the occurrence of SARS-CoV-2 infection within the supportive housing setting, an 84-year-old former homeless man had been residing in a supportive housing facility for 13 years. His medical history included hypertension and gout. He had a documented history of COVID-19 infection. After clinical recovery from COVID-19, post-infection screening was newly implemented within the supportive housing facility as part of an initiative to establish systematic health monitoring, including screening for sarcopenia.

The initial post-COVID-19 assessment revealed reduced calf circumference, measuring 26.5 cm, along with decreased muscle strength and physical performance. Handgrip strength was 15.55 kg, the physical performance score was 17.4, and the appendicular skeletal muscle mass index (ASMI) was 6.74 kg/m². Based on these findings, the participant was classified as having possible sarcopenia according to AWGS criteria.

At the 1-year follow-up, calf circumference had decreased to 23.5 cm, handgrip strength declined to 10.5 kg, and the physical performance score was 20.91. According to the AWGS 2019 criteria, the participant continued to be classified as having possible sarcopenia. Due to contextual constraints within the community-based supportive housing setting, advanced body composition assessment

tools available in hospital settings were not feasible for use at this follow-up.

In response to the persistent risk of sarcopenia identified during follow-up, a structured intervention was initiated. Baseline reassessment was conducted prior to the intervention, including evaluation of sarcopenia risk using the Mini Sarcopenia Risk Assessment (MSRA) questionnaire. The MSRA score was 22, indicating a high risk of sarcopenia. At this point, calf circumference had decreased to 25.5 cm, handgrip strength declined to 11.3 kg, and the physical performance score was 12. The prolonged period of physical inactivity was largely attributable to COVID-19-related restrictions, during which organized exercise and routine activities were suspended for over 1 year. Accordingly, an intervention plan was collaboratively developed with relevant stakeholders to maintain muscle function and, where possible, promote recovery from sarcopenia.

Program planning and implementation were conducted in collaboration with stakeholders within the supportive housing facility. As part of the recovery process, daily resistance exercise sessions were introduced, conducted every day from 8:30 to 9:30 a.m. under supervision within the supportive housing setting. The patient subsequently participated in an intensive rehabilitation program for four weeks. The program included mobility training, muscle strengthening, balance training, coordination

exercises, and gait training. In addition, a resistance exercise program specifically recommended for older adults with sarcopenia was implemented. The exercise regimen was performed three times per week, consisting of three sets of 10 repetitions per exercise, with a 120-second rest period between sets and 4 minutes between exercises.

A multidisciplinary approach was adopted through collaboration with supportive housing staff and other stakeholders. Nutritional management focused on optimizing dietary intake and protein supplementation, including protein sources derived from on-site fish farming. Adequate protein intake was emphasized as essential for muscle function, with a target of 1.2 g/kg/day, evenly distributed across all meals.

Following the rehabilitation intervention, the participant demonstrated continuous clinical improvement, including increased muscle strength, improved balance, and full independence in activities of daily living (ADL). Functional assessments showed improvement in physical performance, with a score of 10.71. Handgrip strength increased to 19.5 kg, calf circumference increased to 27 cm, and the appendicular skeletal muscle mass index (ASMI) improved to 7.56 kg/m². The patient continued to engage in regular exercise under staff supervision using a structured resistance exercise program, as illustrated in Figure 1.

*Sarcopenia After COVID-19 Infection and Rehabilitation in Former Homeless Older Adults Residing in Supportive Housing:
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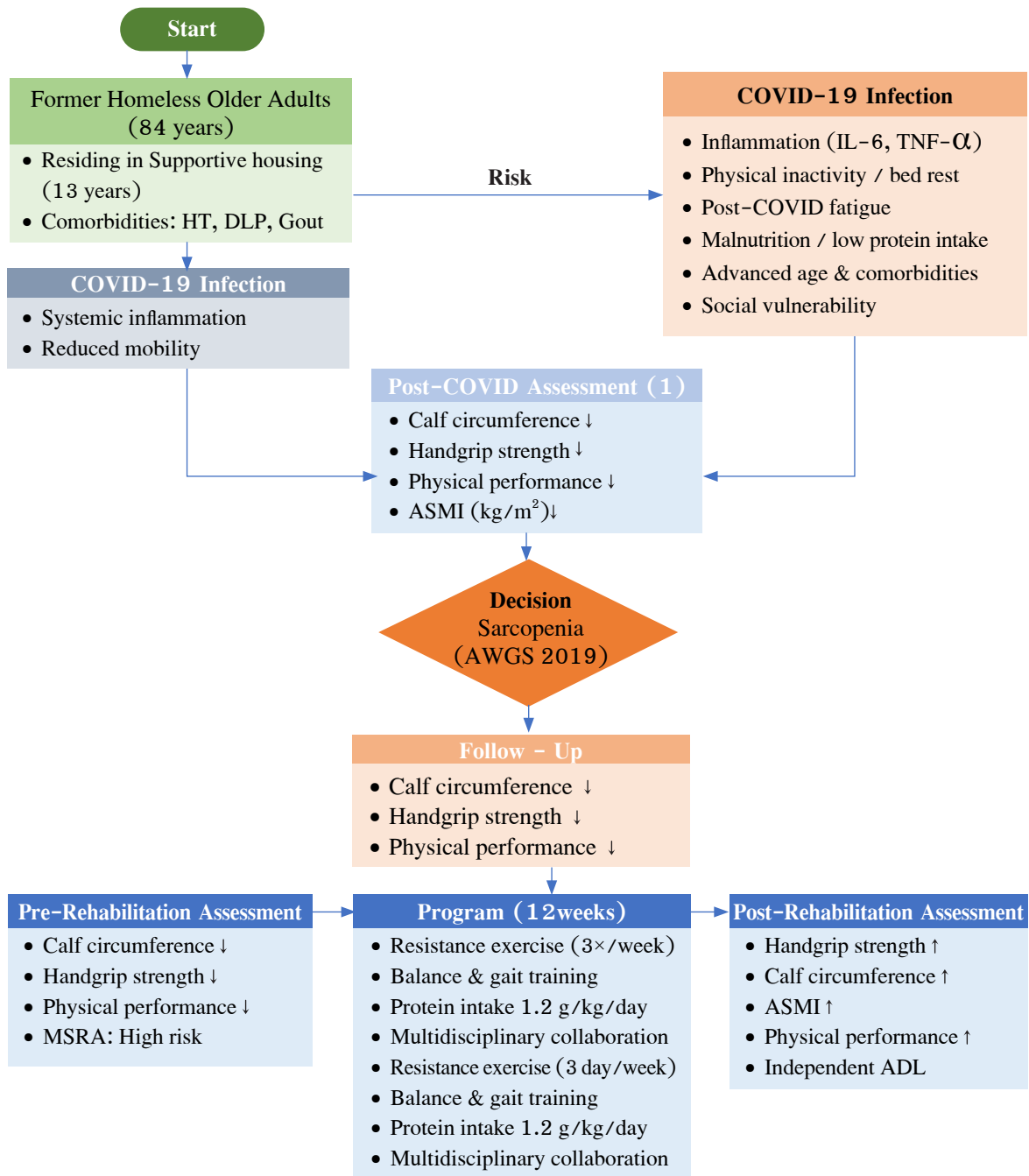


Figure 1 Clinical pathway of post-COVID-19 sarcopenia assessment and rehabilitation in former homeless older adults

Case 2: Non-Participant

A 62-year-old Thai male with a 7-year history of residence in the same supportive housing facility and a prior history of homelessness was included for comparison. He had a confirmed history of COVID-19 infection during the same institutional outbreak period. Initial post-COVID assessment showed a calf circumference of 28.5 cm, handgrip strength of 16 kg, physical performance score of 19.08, and ASMI of 6.30 kg/m². At the 1-year follow-up, calf circumference was 28 cm, handgrip strength was 17.5 kg, and physical performance score increased to 22.33. Prior to the rehabilitation phase, the participant remained at high risk of sarcopenia (MSRA = 22), with calf circumference

of 28.5 cm, handgrip strength of 16 kg, and physical performance score of 20.55. The participant did not engage in the structured rehabilitation program and remained largely sedentary. At the post-rehabilitation time point, handgrip strength was 10.5 kg, physical performance score was 27.95, and ASMI was 5.55 kg/m². The participant became wheelchair-dependent.

Cross-Case Comparison

Both cases had a confirmed history of COVID-19 infection and comparable baseline risk for sarcopenia, as indicated by identical MSRA scores at the pre-rehabilitation assessment. Key contextual and clinical characteristics of both cases are summarized in Table 2.

Table 2 Determinants of Sarcopenia Progression: A Comparative Summary

Comparative Factors	Case 1: Active Rehabilitation	Case 2: Passivity and Inactivity
Age	84 years (Older)	62 years (Younger)
Institutionalization	13 years	7 years
COVID-19 History	Confirmed	Confirmed
Exercise Intervention	Structured Progressive Training	Declined to Participate
Protein Nutrition	Optimized (1.2 g/kg/day)	Optimized (1.2 g/kg/day)
Clinical Progression	Fully Independent	Wheelchair-Dependent

Despite differences in age and duration of institutionalization, both participants were exposed to a similar supportive housing environment. However, differences in participation in the rehabilitation program were observed. Following the program, the two cases demonstrated contrasting clinical trajectories. Case 1, who participated in the structured rehabilitation program combined with adequate protein intake, showed improvement in

muscle strength, physical performance, muscle mass, and functional independence. In contrast, Case 2, who did not participate in the rehabilitation program, exhibited progressive deterioration in sarcopenia-related indicators and became functionally dependent. Detailed changes in sarcopenia indicators across time points for both cases are presented in Table 3.

Table 3. Pre- and Post-Rehabilitation Assessment Outcomes Following COVID-19 Infection:
Comparison of Sarcopenia Indicators Between Two Cases

Time Points / Cases	Parameter	Case 1 (Rehabilitation)	Case 2 (Non Participant)
T1: Post-COVID (3m)	MSRA score	NA	NA
	Calf Circumference (cm)	26.5	28.5
	Handgrip Strength (kg)	15.5	16
	Physical Performance (Score/Time)	17.4	19.08
	ASMI (kg/m ²)	6.74	6.30
T2: Follow-up (1y)	MSRA score	NA	NA
	Calf Circumference (cm)	23.5	28
	Handgrip Strength (kg)	10.85	17.5
	Physical Performance (Score/Time)	20.91	22.33
	ASMI (kg/m ²)	NA	NA
T3: Pre-rehabilitation	MSRA score	22	22
	Calf Circumference (cm)	25.5	28.5
	Handgrip Strength (kg)	11.3	16
	Physical Performance (Score/Time)	12	20.55
	ASMI (kg/m ²)	NA	NA
T4: Post-rehabilitation	MSRA score	22	22
	Calf Circumference (cm)	27	28
	Handgrip Strength (kg)	19.5	10.5
	Physical Performance (Score/Time)	10.71	27.95
	ASMI (kg/m ²)	7.56	5.55

Discussion

This case study describes the onset and progression of sarcopenia following COVID-19 infection in two former homeless older adults residing in supportive housing and highlights differences in functional trajectories between a case that participated in a structured rehabilitation program and a comparison case that did not. The findings underscore the vulnerability of socially disadvantaged older adults to post-COVID-19

sarcopenia and demonstrate the potential role of supportive housing as a setting for recovery and rehabilitation.

COVID-19 infection is known to induce a profound inflammatory and catabolic response,¹ characterized by elevated cytokine levels, prolonged immobilization, and nutritional deterioration,²⁴ all of which contribute to accelerated skeletal muscle loss. In older adults, these effects are further amplified by age-related inflammation and

reduced physiological reserve. Consistent with previous studies, both cases in this study demonstrated sarcopenia-related features following COVID-19 infection, including reduced muscle strength and impaired physical performance. From a pathophysiological perspective, post-COVID-19 sarcopenia may result from a combination of systemic inflammation, prolonged physical inactivity, and inadequate nutritional intake. Persistent inflammatory activation and immobilization can accelerate muscle protein breakdown, while insufficient energy and protein intake may impair muscle protein synthesis and muscle repair. In older adults, these mechanisms occur in the context of age-related anabolic resistance and reduced physiological reserve, increasing susceptibility to rapid declines in muscle strength and functional performance. Previous studies have similarly described post-COVID-19 sarcopenia as a multifactorial condition driven by inflammation, inactivity, and malnutrition among older adults recovering from COVID-19.^{25,26}

Importantly, these cases highlights the multiple constraints inherent to the lived experience of former homeless older adults residing in supportive housing, where daily activities and nutritional intake are largely governed by institutional routines. Despite these limitations, supportive housing served as more than a residential environment, functioning as a practical platform for post-COVID-19 rehabilitation. Collaboration between the multidisciplinary team and supportive housing staff enabled early

identification of sarcopenia, individualized exercise planning, nutritional support, day-to-day supervision of rehabilitation activities, and ongoing monitoring of functional changes within the supportive housing setting. These integrated interventions may help delay disease progression and maintain muscle function in sarcopenia, consistent with previous analyses demonstrating the effectiveness of combined exercise and nutritional strategies.²⁷ In addition, prior evidence suggests that nutritional supplementation, particularly when adequately protein-rich, may further enhance the benefits of exercise-based rehabilitation.²⁸ Such integrated care approaches are highly relevant for formerly homeless older adults, who often experience fragmented healthcare access and delayed rehabilitation.

The more favorable functional trajectory observed in the rehabilitation case may be explained, in part, by the physiological effects of combined resistance exercise and nutritional support. Resistance exercise stimulates neuromuscular activation and muscle protein synthesis, thereby improving muscle strength and physical performance. When combined with adequate protein intake, these interventions may enhance anabolic recovery and support improvements in mobility, balance, and activities of daily living. Recent systematic reviews have consistently reported that resistance-based or multicomponent exercise programs improve muscle strength and functional performance among older adults with sarcopenia, particularly when combined with appropriate nutritional strategies.²⁷ In the present

report, the contrast between the two cases suggests that structured rehabilitation within supportive housing may have contributed to better preservation or recovery of muscle-related function, although causal inference cannot be established from this design.

Existing literature on post-COVID-19 sarcopenia has primarily focused on hospitalized²⁹ or community-dwelling older adults.³⁰ In contrast, evidence regarding sarcopenia recovery trajectories in formerly homeless populations remains scarce. This study adds novel context-specific evidence by suggesting that structured rehabilitation and nutritional support delivered within a supportive housing setting may support functional recovery, even among individuals with longstanding social and health vulnerabilities.

These cases also highlight the importance of clearly defined personnel roles in resource-limited institutional settings. Although no permanently stationed nursing personnel were available within the facility, a practical care model was implemented through collaboration between the research team, supportive housing staff, and other relevant professionals. In this context, nursing expertise contributed to the design of screening procedures, functional assessment, goal setting, care coordination, and rehabilitation monitoring, while supportive housing staff provided daily supervision of exercise activities and monitored functional changes during routine care. Previous studies have emphasized that multidisciplinary collaboration

and rehabilitation-nutrition approaches are essential components of effective sarcopenia management in older adults, particularly in settings with limited healthcare resources.^{27,28}

This study has several limitations. Given the limited number of cases, the findings cannot be generalized. Information on Integrated Care for Older People (ICOPE) assessment was only partially reported. Moreover data on protein intake monitoring were not reported in this study.

Clinical Implications and Policy Insights

The findings of this study provide important clinical and policy insights for the management of sarcopenia in vulnerable older adults residing in institutional or supportive housing environments. Early identification of sarcopenia following COVID-19 infection is critical, as delayed detection may lead to progressive functional decline and loss of independence. Simple screening tools such as handgrip strength, calf circumference, and functional performance assessments may facilitate early detection in resource-limited settings. Integrating routine sarcopenia screening into health monitoring systems within supportive housing facilities may help identify high-risk individuals and support timely rehabilitation interventions.

Future research should examine longitudinal outcomes of post-COVID-19 sarcopenia among institutionalized older adults, particularly those residing in supportive housing or other resource-limited environments. Long-term follow-up studies are

needed to evaluate the sustainability of rehabilitation outcomes and the progression of sarcopenia over time. In addition, future studies should investigate feasible implementation models for routine sarcopenia screening in supportive housing facilities and explore effective rehabilitation strategies that can be delivered in settings with limited healthcare resources.

Acknowledgement

The authors would like to express their sincere gratitude to Prof. Dr. Noppawan Piaseu for her invaluable academic guidance, mentorship, and support throughout the development of this case study. We are also deeply grateful to the participant for generously sharing his experience and for his cooperation throughout the assessment and rehabilitation process.

Declaration Statements

Conflict of Interest: No conflict of interest

Author Contribution: Phatcharaphon Whaikid: Conceptualization, Methodology, Validation, Formal analysis, Investigation, Resources, Data curation, Writing original draft, Writing– review & editing, Visualization, Supervision, Project administration, Funding acquisition; Sukanya Tantiprasoplap, Anita Souza, Jirapa Tantipongsirikul: Conceptualization, Project administration, Validation

AI Use Disclosure: The authors declare that no artificial intelligence tools were used in the conduct of this research. Copilot was used only for editing purposes and NotebookLM was used for graphical abstract.

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