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Review Article

The Role of Inspiratory Muscle Training for Enhancing Functional Capacity in Post-Heart Valve Surgery Patients: A Scoping Review

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Abstract

Valvular Heart Disease (VHD), particularly Rheumatic Heart Disease (RHD), is a major health burden in Indonesia, often requiring heart valve surgery. Post-operative respiratory muscle dysfunction and reduced functional capacity hinder recovery. Inspiratory Muscle Training (IMT) is a non-invasive intervention that improves respiratory muscle strength and functional outcomes. This scoping review evaluates the role of IMT in enhancing functional capacity among patients after heart valve surgery. A systematic search of PubMed and Scopus identified Randomized Controlled Trials (RCTs) and cohort studies involving adult patients who underwent IMT interventions after heart valve surgery. The search strategy combined controlled vocabulary (Medical Subject Headings [MeSH]) Key terms included: ("heart valve surgery" OR "valve replacement" OR "valvular heart disease") AND ("inspiratory muscle training" OR "respiratory muscle training") AND ("functional capacity" OR "exercise capacity" OR "respiratory muscle strength" OR "pulmonary function"). Outcomes included functional capacity, respiratory muscle strength, pulmonary function, Post-operative Pulmonary Complications (PPCs), and hospital Length of Stay (LOS). Data were synthesized narratively. Four RCTs (273 patients) showed IMT significantly improved Maximal Inspiratory Pressure (MIP), Six-Minute Walk Distance (6MWD), and pulmonary function [Forced Vital Capacity (FVC), Forced Expiratory Volume in 1 second (FEV_1)]. Interventions of 4–12 weeks reduced PPCs and LOS. Optimal benefits were observed with 8–12-week protocols. IMT enhances functional capacity, respiratory muscle strength, and pulmonary function post-heart valve surgery, with the potential to reduce complications and costs. Its integration into rehabilitation programs is recommended, particularly in regions with high RHD prevalence, such as Indonesia. Further studies should standardize protocols and assess long-term outcomes.

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Keywords: Cardiac Rehabilitation, Functional Capacity, Heart Valve Surgery, Inspiratory Muscle Training, Pulmonary Function.

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Introduction

Valvular Heart Disease (VHD) poses a substantial global health challenge, impacting over 40 million individuals, with a particularly high prevalence in Low and Middle-Income Countries (LMICs) like Indonesia, where Rheumatic Heart Disease (RHD) accounts for approximately 94% of mitral valve pathologies.[1-2] RHD, resulting from untreated streptococcal infections, causes progressive valve damage, often necessitating surgical interventions such as valve repair or replacement to restore cardiac function and alleviate symptoms like dyspnea, fatigue, and heart failure.[3] In Indonesia, RHD remains a leading cause of VHD, particularly among younger populations, highlighting the critical need for effective post-operative rehabilitation strategies to optimize recovery and reduce long-term morbidity.[2]

Heart valve surgery, while essential, introduces significant physiological challenges. The median sternotomy approach disrupts chest wall mechanics, leading to reduced Functional Residual Capacity (FRC) and inspiratory muscle weakness.[4-5] Prolonged mechanical ventilation and post-operative immobilization further exacerbate respiratory muscle dysfunction, increasing the risk of Post-operative Pulmonary Complications (PPCs) such as atelectasis, pneumonia, and pleural effusion.[6-7] These complications impair functional capacity, defined as the ability to perform daily physical activities, and negatively affect Quality of Life (QoL).[8] Patients with comorbidities like heart failure or Chronic Obstructive Pulmonary Disease (COPD), common in VHD populations, face amplified risks, as these conditions exacerbate respiratory and cardiovascular limitations.[9] Inspiratory Muscle Training (IMT) is a non-invasive rehabilitation technique that employs resistive load devices to strengthen the diaphragm and intercostal muscles, enhancing ventilatory efficiency and reducing dyspnea.[10] By targeting inspiratory muscle weakness, IMT improves Maximal Inspiratory Pressure (MIP), exercise capacity (e.g., Six-Minute Walk Distance [6MWD]), and pulmonary function parameters (e.g., Forced Vital Capacity [FVC], Forced Expiratory Volume in 1 second [FEV_1]).[11-12] Although IMT has shown promise in populations undergoing Coronary Artery Bypass Grafting (CABG) and managing chronic heart failure, its specific application in post-heart valve surgery patients remains underexplored.[13-14] This gap is particularly significant in RHD-prevalent settings like Indonesia, where cost-effective, scalable interventions are essential to address resource constraints.[2]

This scoping review aims to synthesize evidence on IMT's role in enhancing functional capacity in post-heart-valve-surgery patients, focusing on outcomes such as respiratory muscle strength, exercise capacity, pulmonary function, PPCs, and hospital Length of Stay (LOS). By addressing the novelty of IMT as a targeted intervention for this population, the study seeks to inform clinical practice and guide future research in cardiopulmonary rehabilitation, with particular relevance for LMICs facing high RHD burdens.

Methods

This scoping review adhered to the Joanna Briggs Institute (JBI) methodology and the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) guidelines to ensure methodological rigor and transparency.[15] A systematic literature search was conducted on May 2, 2025. PubMed and Scopus were selected for their comprehensive coverage of biomedical and rehabilitation literature, and to maintain feasibility, given the scope of this scoping review. We acknowledge that supplementing the search with other databases, such as Embase or Cochrane Library, could have identified additional records. However, the selected databases were deemed sufficient to capture the core relevant literature. The restriction to English-language publications may have introduced language and publication bias, particularly by omitting relevant studies from LMICs in non-English-speaking regions. The search strategy combined controlled vocabulary (Medical Subject Headings [MeSH]) and free-text terms to enhance sensitivity and specificity. Key terms included: ("heart valve surgery" OR "valve replacement" OR "valvular heart disease") AND ("inspiratory muscle training" OR "IMT" OR "respiratory muscle training") AND ("functional capacity" OR "exercise capacity" OR "respiratory muscle strength" OR "pulmonary function"). Boolean operators (AND, OR) were used to structure queries, and filters were applied to restrict results to human studies and English-language publications. Manual screening of the reference lists of included studies and relevant reviews was conducted to identify additional articles. The detailed search strategy, including database-specific queries, is provided in Table 1 to support reproducibility.

Table 1. Search strategy.

Database	Search Query	Results (n)
PubMed	(Heart valve [MeSH] OR "Heart Surgical Procedure" [MeSH] OR "Surgical Procedure" [Title/Abstract] OR "Cardiac Surgical Procedure" [Title/Abstract] OR "Heart Valve" [Title/Abstract] OR "Cardiac Valves" [Title/Abstract]) AND ("Inspiratory Muscle Training" [Title/Abstract]) AND ("Respiratory function test" [MeSH] OR "Respiratory Function Test" [Title/Abstract] OR "Lung Function Test" [Title/Abstract] OR "Pulmonary Function Test" [Title/Abstract])	33
Scopus	(heart valve [Title/Abstract] OR "Heart Surgical Procedure" [Title/Abstract] OR "Surgical Procedure" [Title/Abstract] OR "Cardiac Surgical Procedure" [Title/Abstract] OR "Heart Valve" [Title/Abstract] OR "Cardiac Valves" [Title/Abstract]) AND ("Inspiratory Muscle Training" [Title/Abstract]) AND ("Respiratory function test" [Title/Abstract] OR "Respiratory Function Tests" [Title/Abstract] OR "Lung Function Test" [Title/Abstract] OR "Pulmonary Function Test" [Title/Abstract])	62

Search Date: May 2, 2025
Filters Applied: English language, Human studies, No publication years restriction.

Eligibility Criteria

Stringent inclusion and exclusion criteria were established to ensure alignment with the review's objectives. Studies were included if they: (1) were randomized controlled trials (RCTs) or cohort studies involving adult post heart valve surgery patients (e.g., aortic or mitral valve repair/replacement); (2) evaluated IMT interventions using resistive load devices (e.g., POWERbreathe®, Threshold IMT); (3) reported outcomes related to functional capacity (e.g., 6MWD), respiratory muscle strength (e.g., MIP), pulmonary function (e.g., FVC, FEV_1), PPCs, or LOS; and (4) were published in English with full-text availability. A comprehensive list of eligibility criteria is available in Table 2.

Study Selection and Data Extraction

The search retrieved 95 records (PubMed: 33, Scopus: 62), which were imported into EndNote for deduplication, yielding 86 unique records. Two reviewers (HW, DMS) independently screened titles and abstracts using Rayyan.ai, a systematic review platform, to identify eligible studies. Discrepancies were resolved through discussion, with a third reviewer (MLD) and a fourth reviewer (FA) consulted for unresolved conflicts. Twelve articles underwent full-text review. Although cohort studies were eligible for inclusion, none met all eligibility criteria upon full-text assessment. Consequently, only four RCTs were included in this review. The selection process is illustrated in a PRISMA flow diagram (Figure1). Data were extracted using a standardized

Table 2. Eligibility criteria.

Criteria	Inclusion	Exclusion
Study Design	Randomized Controlled Trials (RCTs), cohort studies	Systematic reviews
Population	Adult Patient with post heart valve surgery (e.g., aortic or mitral valve repair/replacement)	Patients who did not undergo heart valve surgery, no specific comorbidities were excluded
Intervention	Inspiratory Muscle Training (IMT) using resistive load devices (e.g., POWERbreathe®, Threshold IMT)	
Outcomes	Functional capacity (e.g., 6MWD), respiratory muscle strength (e.g., MIP), pulmonary function (e.g., FVC, FEV1), PPCs, LOS	
Language		Non-English publications
Access		Full-text not available

RCTs: Randomized Controlled Trials, IMT: Inspiratory Muscle Training, 6MWD: Six-Minute Walk Distanc, MIP: Maximal Inspiratory Pressure, FVC: Forced Vital Capacity, FEV_1: Forced Expiratory Volume in 1 Second, PPCs: Post-Operative Pulmonary Complications, LOS: Length of Stay.

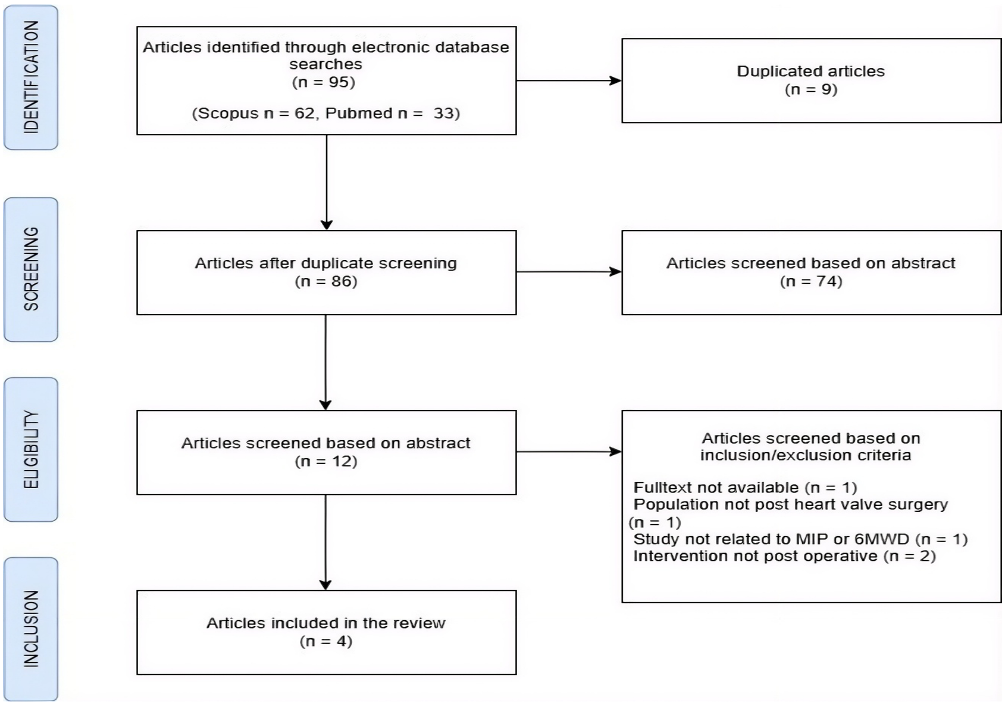

Figure 1. PRISMA flow diagram.

Table 3. Study characteristics.

Study	Country	Design	Sample Size	Mean age (years)	Male (%)	Population
Cargnin *et al.* (2019)	Brazil	Double-blind RCT	25 (IMT: 13, Control: 12)	61.3	56.5	Post-elective heart valve replacement, no complications
Kodric *et al.* (2013)	Slovenia	Double-blind RCT	52 (IMT: 36, Control: 16)	68	75	Post-major cardiac surgery with diaphragmatic paralysis
Xu *et al.* (2023)	China	Double-blind RCT	96 (IMT+CR: 48, CR: 48)	78.8	50	Post-transcatheter aortic valve replacement (TAVR)
Hegazy *et al.* (2021)	Egypt	Double-blind RCT	100 (IMT: 50, Control: 50)	45.7	41	Post-mitral valve replacement

RCT: Randomized Controlled Trial, IMT: Inspiratory Muscle Training, CR: Cardiac Rehabilitation, COPD: Chronic Obstructive Pulmonary Disease.

template that captured study characteristics (e.g., author, year, country), participant demographics (e.g., age, sex, comorbidities), intervention details (e.g., IMT device, intensity, duration), and outcomes. Extraction was performed by HW and verified by DMS, MLD, and FA to ensure accuracy. The extracted data are summarized in Table 3, and the intervention protocols are detailed in Table 4. The authors screened the search results by first reviewing article titles and then abstracts. Articles with titles and abstracts aligned with the study objectives underwent full-text review; included articles were further explored to meet and enrich the review's purpose.

Results

Study and Participant Characteristics

Four RCTs involving 273 post-heart-valve-surgery patients were included and were conducted in Brazil, Slovenia, China, and Egypt. Sample sizes ranged from 25 to 100 participants, reflecting variability in study scope. Participants had a mean age of 63,4 years, with 60–80% male, consistent with the global epidemiology of VHD.[1] Surgical procedures primarily involved aortic or mitral valve replacement, though one study included CABG patients due to similar post-operative respiratory challenges.[16] Comorbidities such as heart

Table 4. Intervention details.

Study	IMT Device	Intensity	Duration	Frequency	Control Group
Cargnin *et al.* (2019)	POWERbreathe® Kinetic KH1	30–40% MIP, adjusted weekly	4 weeks	2 sessions/day, 7 days/week	Sham IMT (minimal resistance)
Kodric *et al.* (2013)	Threshold IMT	Adjusted based on % MIP, progressive	12 months	1–2 sessions/day, 5–7 days/week	Standard care (deep breathing exercises)
Xu *et al.* (2023)	Threshold IMT	30–50% MIP, increased 5–10% weekly	During LOS	1–2 sessions/day, 5–7 days/week	Cardiac rehabilitation (CR) alone
Hegazy *et al.* (2021)	Threshold IMT	40–80% MIP, increased progressively	8 weeks	1–2 sessions/day, 5–7 days/week	Standard care (early mobilization)

MIP: Maximal Inspiratory Pressure, LOS: Length of Stay. Intensity was typically set as a percentage of baseline MIP, with progressive increases based on patient tolerance. Control groups varied, with sham IMT or standard care (e.g., deep breathing, mobilization) used to ensure valid comparisons. Xu et al. integrated IMT with cardiac rehabilitation, including aerobic and resistance exercises.

failure, COPD, and hypertension were prevalent, influencing baseline functional capacity and recovery.[17-18] The geographic diversity of the studies underscores IMT's global applicability, while the male predominance highlights a need for research on female patients. Study characteristics, including participant demographics and surgical details, are provided in Table 3.

Study and Participant Characteristics

IMT interventions used threshold-based resistive devices (e.g., POWERbreathe®, Threshold IMT) that provide precise control of inspiratory resistance.[16-18] Initial intensities were set at 30–40% of baseline MIP, with progressive increases of 5–10% weekly based on patient tolerance. Intervention durations ranged from 4 to 12 weeks, with sessions lasting 20–30 minutes, conducted 1–2 times daily, 2–7 days per week. Two studies integrated IMT into Cardiac Rehabilitation (CR) programs, incorporating endurance or resistance exercises to enhance overall recovery.[18-19] Control groups received sham IMT (minimal resistance) or standard care, such as deep-breathing exercises and early mobilization, thereby ensuring valid comparisons. The heterogeneity in protocols reflects the absence of standardized IMT guidelines for this population, a critical area for future research. Intervention details are summarized in Table 4.

Outcomes

Exercises Capacity

All studies reported significant improvements in 6MWD, a reliable measure of exercise capacity, in IMT groups compared to controls. Cargnin et al. observed a 6MWD of 447.2 ± 96.6 m in the IMT group versus 314.7 ± 94.1 m in controls after 4 weeks ($p = 0.019$), indicating rapid functional gains. Xu et al. reported a 41.51 m increase in 6MWD at 1 month in the IMT plus CR group versus CR alone ($p=0.041$), highlighting synergistic effects.[18] Hegazy et al. reported a 6MWD of 509.5 ± 16.6 m in the IMT group versus 410.9 ± 10.3 m in controls after 8 weeks ($p < 0.001$), suggesting greater benefits with longer interventions.[19] These improvements likely stem from enhanced ventilatory efficiency and delayed respiratory metaboreflex, reducing peripheral muscle fatigue.[20]

Respiratory Muscle Strength

Significant increases in MIP were reported across all studies.[16–19] Kodric et al. reported a 77.78% improvement in diaphragmatic mobility and significant gains in MIP ($p<0.001$) after 12 months, indicating sustained benefits.[17] Hegazy et al. reported an MIP of 89.78 ± 5.1 cmH_2O in the IMT group versus 72.16 ± 5.5 cmH_2O in controls after 8 weeks ($p<0.001$), reflecting rapid strength gains.[19] These findings suggest IMT promotes inspiratory muscle hypertrophy and oxidative capacity, critical for post-operative recovery.[21]

Pulmonary Function

Three studies reported improved FVC and FEV_1 with IMT.[16,18-19] Hegazy et al. observed significant increases in FVC, FEV_1, and FEV_1/FVC ratio ($p<0.001$) after 8 weeks, indicating enhanced lung expansion.[19] Xu et al. reported a 0.21 L FEV_1 increase at 1 month in the IMT plus CR group ($p=0.034$), suggesting early benefits.[18] These improvements likely result from stronger inspiratory muscles facilitating greater lung volumes and reducing atelectasis.[22]

Post-Operative Pulmonary Complications (PPCs)

Xu et al. reported a lower PPC rate in the IMT plus CR group (6.9% vs. 20%, p=0.028), likely due to enhanced cough effectiveness and alveolar recruitment.[18] This highlights IMT's preventive potential in high-risk patients.

Length of Stay (LOS)

Xu et al. found a shorter LOS in the IMT plus CR group (11 vs. 12.5 days; p=0.016), attributable to fewer PPCs and faster recovery.[18] This underscores IMT's economic benefits.

Quality of Life (QoL)

Limited QoL data showed improved dyspnea scores with IMT, but intergroup differences were inconsistent, possibly due to variable measurement tools and short follow-ups.[17,19] Outcome details are summarized in Table 5.

Discussion

This scoping review confirms that IMT significantly enhances functional capacity, respiratory muscle strength, and pulmonary function in patients post-heart valve surgery. The findings demonstrate 15–30% increases in the 6MWD and 15–33% improvements in Maximal Inspiratory Pressure (MIP), indicating substantial gains in physical endurance and respiratory efficiency.[16-17,19] These improvements are particularly crucial in addressing common post-operative complications, such as respiratory muscle weakness, reduced lung volumes, and impaired gas exchange, which are frequently exacerbated by median sternotomy and prolonged mechanical ventilation.[4-5] Furthermore, the observed reductions in PPCs and LOS underscore the clinical and economic value of IMT, particularly in LMICs like Indonesia. RHD contributes to a high burden of VHD. [2,19]

Table 5. Outcome measures and results.

Study	Outcome Measures	Result
Cargnin et al. (2019)	6MWD, MIP, FVC, FEV_1, PEF	IMT group: Restored MIP and pulmonary function to pre-operative levels after 4 weeks; 6MWD = 447.2 ± 96.6 m vs. 314.7 ± 94.1 m (control, p = 0.019); MIP correlated with 6MWD (r = 0.45, p = 0.025) and spirometry (r = 0.40–0.51, p<0.05).
Kodric et al. (2013)	MIP, diaphragmatic mobility, VC, MRC dyspnea score, MRADL	IMT group: 77.78% improved diaphragmatic mobility (p<0.001); MIP increased (p<0.001); VC increased from 70.8% ± 16.5% to 86.0% ± 17.1% (p<0.001); improved MRC and MRADL scores (p<0.001). Control: 87.5% no improvement.
Xu et al. (2023)	6MWD, MIP, FVC, FEV1, PPCs, LOS	IMT+CR group: 6MWD increased by 41.51 m at 1 month (p = 0.041); MIP increased by 7.76 cmH_2O at 1 month (p = 0.017); FEV_1 increased by 0.21 L (p = 0.034); PPCs 6.9% vs. 20% (p = 0.016); LOS 11 vs. 12.5 days (p = 0.016).
Hegazy et al. (2021)	6MWD, MIP, FVC, FEV1, FEV1/FVC	IMT group: Significant increases in FVC, FEV_1, FEV^1/FVC (p<0.001); MIP = 89.78 ± 5.1 cmH_2O vs. 72.16 ± 5.5 cmH2O (p<0.001); 6MWD = 509.5 ± 16.6 m vs. 410.9 ± 10.3 m (p<0.001); benefits sustained at 6 months.

6MWD: Six-Minute Walk Distance, MIP: Maximal Inspiratory Pressure, FVC: Forced Vital Capacity, FEV_1 = Forced Expiratory Volume in 1 Second, PEF: Peak Expiratory Flow, VC: Vital Capacity, PPCs: Post-Operative Pulmonary Complications, LOS: Length of Stay, MRC: Medical Research Council, MRADL: Manchester Respiratory Activities of Daily Living.

IMT works by strengthening the diaphragm and intercostal muscles, thereby improving ventilatory efficiency and reducing the work of breathing[10] This physiological adaptation helps delay the onset of the respiratory metaboreflex, a phenomenon in which respiratory fatigue limits oxygen delivery to peripheral muscles during exertion.[20] By enhancing respiratory endurance, IMT allows patients to sustain physical activity for longer durations, directly contributing to improved functional capacity. Additionally, the observed increases in FVC and FEV_1 suggest that IMT promotes lung expansion and reduces atelectasis, both of which are critical to preventing PPCs such as pneumonia and pleural effusions.[22] Collectively, these benefits enhance patients' ability to perform Activities of Daily Living (ADLs), ultimately leading to better QoL, a particularly important outcome in RHD-affected populations, where chronic disability is a major concern.[2,8]

In Indonesia, where healthcare resources are often constrained, IMT presents a cost-effective and scalable intervention. Its low cost, portability, and ease of use make it highly suitable for home-based rehabilitation, reducing dependence on specialized facilities.[23] Given that shorter hospital stays directly translate to lower healthcare costs, IMT could play a pivotal role in optimizing post-surgical recovery in LMICs.[18] Moreover, integrating IMT with CR programs, as demonstrated in two included studies, may amplify its benefits, suggesting that a multimodal rehabilitation approach could further enhance recovery outcomes.[18-19]

Despite these promising findings, several limitations must be acknowledged. First, the small number of included studies (n=4) and their modest sample sizes (25–100 participants) limit the generalizability of the results. Furthermore, the male predominance (60–80%) across the included studies limits the generalizability of our findings to female patients. Women exhibit distinct cardiopulmonary physiology, including generally smaller lung volumes and a more curved diaphragm, which may influence their baseline respiratory muscle strength and their response to IMT. While research on sex-specific responses to IMT in cardiac populations is limited, studies in other fields suggest that training adaptations can differ between sexes. Therefore, the efficacy and optimal protocol of IMT for women post-heart valve surgery remain unclear and warrant dedicated investigation in future trials with adequate female representation to ensure equitable and effective rehabilitation. Additional limitations include clinical and methodological heterogeneity in the included trials. The IMT protocols varied in duration (4–12 weeks) and intensity (30–60% MIP), hindering the establishment of a standardized regimen. The short follow-up periods (up to 3 months) in these studies restrict insights into the long-term sustainability of IMT benefits. Furthermore, one study included patients undergoing Transcatheter Aortic Valve Replacement (TAVR), a less invasive procedure than conventional open-heart surgery, which may influence postoperative recovery trajectories. The concomitant interventions also differed: two studies integrated IMT into comprehensive cardiac rehabilitation programs, whereas others did not, potentially confounding the assessment of IMT's isolated effects.[16,18-19] To address these gaps, future research should prioritize larger multicenter Randomized Controlled Trials (RCTs) with diverse patient populations, including more women, older adults, and individuals undergoing various surgical approaches, particularly conventional open-heart surgery. Studies should directly compare the effects of IMT alone versus IMT combined with comprehensive CR to determine the optimal rehabilitative strategy. Standardizing IMT protocols, such as adopting an 8–12 week training period at 30–60% of maximal inspiratory pressure (MIP), would enhance comparability across studies and facilitate the development of evidence-based clinical guidelines. Additionally, exploring telerehabilitation models could improve accessibility for patients in rural and remote areas, where healthcare infrastructure is limited.[24] Another promising avenue is the combination of IMT with Expiratory Muscle Training (EMT), which may further optimize respiratory and functional outcomes by addressing both inspiratory and expiratory muscle weakness.[25]

Conclusion

IMT has emerged as a highly effective, evidence-based intervention for significantly improving functional capacity, respiratory muscle strength, and pulmonary function in patients recovering from heart valve surgery. This scoping review synthesizes preliminary but compelling evidence indicating that IMT is a promising, low-cost therapeutic adjunct for enhancing functional capacity, respiratory muscle strength, and pulmonary function in patients following heart valve surgery. Its demonstrated potential to mitigate postoperative pulmonary complications and reduce hospitalization duration underscores its significant clinical utility and economic value, particularly in resource-constrained healthcare systems endemic for RHD.

To consolidate these findings and facilitate their integration into standard clinical practice, subsequent research must be directed toward the development and validation of standardized IMT protocols. There is a critical need for larger, methodologically rigorous trials with extended follow-up periods to assess long-term sustainability. Such studies must prioritize inclusive recruitment strategies to ensure adequate representation of female patients and should specifically target under-researched geographical regions, notably Southeast Asia. Addressing these evidence gaps will be instrumental in establishing IMT as a fundamental component of post-operative cardiopulmonary rehabilitation, ultimately aiming to improve patient-centered outcomes and alleviate global healthcare burdens.

List of Abbreviations

6MWD	Six-Minute Walk Distance
ADLs	Activities of Daily Living
CABG	Coronary Artery Bypass Grafting
COPD	Chronic Obstructive Pulmonary Disease
CR	Cardiac Rehabilitation
EMT	Expiratory Muscle Training
FEV	Forced Expiratory Volume
FRC	Functional Residual Capacity
FVC	Forced Vital Capacity
IMT	Inspiratory Muscle Training
JBI	Joanna Briggs Institute
LMICs	Low and Middle-Income Countries
LOS	Length of Stay
MeSH	Medical Subject Headings
MIP	Maximal Inspiratory Pressure
MRC	Medical Research Council
MRADL	Manchester Respiratory Activities of Daily Living
PEF	Peak Expiratory Flow
PPCs	Post-operative Pulmonary Complications
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
QoL	Quality of Life
RCTs	Randomized Controlled Trials
RHD	Rheumatic Heart Disease
TAVR	Transcatheter Aortic Valve Replacement
VHD	Valvular Heart Disease

Ethical Clearance

Not Applicable.

Publication Approval

All authors consent to the publication of this manuscript.

Authors Contributions

All authors contributed substantially to this manuscript. They were involved in the conception and design of the study, drafting the article, critical revision for important intellectual content, and final approval of the version to be published. All authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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Conflict of Interest

None.

Availability of Data and Materials

Not applicable.

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Not applicable.

Generative AI and AI-Assisted Technologies in the Writing Process

Authors acknowledge that artificial intelligence (AI) tools were only used to assist in language editing and did not generate or alter the scientific content, analyses, or conclusions presented in this manuscript

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