การพัฒนาแนวทางการประเมินกลับเข้าทำงานในผู้ป่วยโรคหัวใจด้วยวิธีเดลฟายประยุกต์

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บทคัดย่อ

เมื่อพิจารณาการประเมินการกลับเข้าทำงานในผู้ป่วยโรคหัวใจ การประเมินตัวโรคและความปลอดภัยในขณะทำงานเป็นสิ่งที่มีความซับซ้อนและมีความสำคัญ ซึ่งยังไม่มีแนวทางในประเทศไทยมากนัก ดังนั้นการศึกษานี้มีวัตถุประสงค์เพื่อพัฒนาแนวทางแบบประเมินกลับเข้าทำงานของผู้ป่วยโรคหัวใจสำหรับแพทย์ที่มีส่วนเกี่ยวข้อง โดยใช้วิธีเดลฟายประยุกต์เพื่อรวบรวมความเห็นของผู้เชี่ยวชาญในประเด็นองค์ประกอบที่จำเป็นสำหรับแบบประเมินกลับเข้าทำงานของผู้ป่วยโรคหัวใจ ขั้นตอนที่หนึ่ง ประกอบด้วย การสร้างแบบสอบถามและการสรรหาผู้เชี่ยวชาญ ขั้นตอนที่สอง ผู้เชี่ยวชาญตอบแบบสอบถามรอบที่หนึ่งเพื่อออกระดับความเห็นประเด็นองค์ประกอบที่จำเป็นในแบบประเมินกลับเข้าทำงานในผู้ป่วยโรคหัวใจ ขั้นตอนที่สาม ผู้เชี่ยวชาญตอบแบบสอบถามรอบที่สองในข้อคำถามที่เหลือจากรอบที่หนึ่ง ซึ่งทีมผู้วิจัยได้เพิ่มเติมข้อมูลในข้อคำถามที่เหลือขั้นตอนที่สี่ ผู้วิจัยทำการสรุปฉันทามติคำตอบที่เป็นองค์ประกอบที่จำเป็นในแบบประเมินกลับเข้าทำงานของผู้ป่วยโรคหัวใจ ผลการศึกษาพบว่าประเด็นที่ผ่านฉันทามติ ได้แก่ การซักประวัติ การตรวจร่างกาย การตรวจสืบค้นทางโรคหัวใจ ข้อมูลการรักษา การประเมินระดับพลังงานที่ใช้เคลื่อนไหวทางกายของผู้ป่วยและจากประวัติอาชีพ กรณีผู้ป่วยที่มีอาชีพใช้พลังงานเคลื่อนไหวทางกายไม่หนัก สามารประเมินกลับเข้าทำงานได้โดยไม่ต้องใช้ผลการทดสอบสมรรถภาพของหัวใจและปอด ในกลุ่มโรคกล้ามเนื้อหัวใจขาดเลือด ผู้ที่ได้รับการผ่าตัดเปิดหัวใจ โรคหัวใจเต้นผิดจังหวะ ยกเว้นกลุ่มโรคหัวใจล้มเหลว กรณีที่มีประวัติอาชีพเป็นงานเสี่ยงอันตราย ควรได้รับการประเมินกลับเข้าทำงานโดยแพทย์สหสาขาวิชาชีพทั้งในกลุ่มได้รับการผ่าตัดเปิดหัวใจ โรคหัวใจเต้นผิดจังหวะ และโรคหัวใจล้มเหลว โดยสรุปการประเมินกลับเข้าทำงานที่ไม่ต้องออกกำลังกายเพื่อทดสอบสมรรถภาพของหัวใจและปอด โดยใช้การประเมินระดับความรุนแรงของภาวะหัวใจล้มเหลว ตามการจำแนกของสมาคมโรคหัวใจแห่งนิวยอร์ค (New York Heart Association) สามารถทำได้ในกลุ่มผู้ป่วยประวัติอาชีพที่ใช้พลังงานเคลื่อนไหวทางกายไม่หนัก ยกเว้นกรณีโรคหัวใจล้มเหลว ขณะที่ผู้ป่วยที่อาชีพมีงานเสี่ยงอันตราย ควรได้รับการประเมินกลับเข้าทำงานโดยแพทย์สหสาขาวิชาชีพ

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Development of a medical assessment guide for cardiac disease patients when returning to work using a modified Delphi technique

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Abstract

When considering the return-to-work (RTW) of patients with cardiac diseases, it is essential to take into account the intricacies of their conditions and workplace safety. While a few evidence-based standard guidelines exist in developing countries, they are not well-established. This study aims to develop a medical assessment guide for physicians involved in RTW evaluation. A Modified Delphi technique was utilized to gather the necessary components for the medical evaluation of workers with cardiac diseases returning to work. The process involved constructing a questionnaire and recruiting experts, followed by expert agreement on the completed questionnaire regarding the essential components of the RTW guide. Subsequently, a second round of expert agreement was conducted to address additional information and questions. Consensus was reached on the essential components of the RTW guide. After two rounds of agreement, the necessary components included history taking, physical examination, cardiac investigation, management information, and evaluation of metabolic equivalents (METs) for the patient and their physical work demands. For instance, in the case of non-strenuous work, RTW can be conducted without a cardiorespiratory fitness (CRF) test to calculate METs in patients with ischemic heart disease, post-open-heart surgery, and some types of cardiac arrhythmia, though there was no consensus on heart failure patients in non-strenuous work. For patients engaged in safety-sensitive work, a multidisciplinary team (MDT) assessment was suggested for those with post-open-heart surgery, cardiac arrhythmia, or heart failure. In conclusion, return-to-work evaluation could be conducted by predicting non-exercise cardiorespiratory fitness based on the New York Heart Association classification for non-strenuous work, except in patients with heart failure. MDT assessment is recommended for patients involved in safety-sensitive work.

Keywords: cardiac disease; occupational cardiology; return-to-work

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Introduction

Ischemic heart disease is a cause of death globally[1]. In the United States of America, the top five leading causes of death in 2020 due to cardiovascular disease are coronary heart disease, stroke, other cardiovascular diseases, high blood pressure and heart failure[2]. In Thailand, cardiovascular disease ranks among the four major noncommunicable diseases, contributing to the disability of approximately 400,000 people annually. Half of these cases occurred in individuals aged between 30 and 70 years. The economic burden analysis of noncommunicable diseases in Thailand accounts for 9.7% of the Gross Domestic Product (GDP), and the absenteeism of Thai workers due to these conditions amounts to 74,000 people per day[3]. The burden of cardiovascular disease in the working-age population has significant implications for the evaluation of returning to work. Considering the complexity of cardiovascular disease and several other factors is crucial when planning to return to work. These predictors include cardiac-related factors, functional capacity, psychological and work-related factors[4]. Assessing post-morbid working capacity in patients with cardiac disease for different occupations is complex and involves evaluation objectives, special considerations for specific jobs, and assessment guidelines[5].

A previous study found that occupational history was taken into account, but it was not incorporated in the decision-making process[6]. Cardiovascular disease guidelines exist for certain professions such as commercial drivers, pilots and aircrews, firefighters, divers and offshore workers. However, these guidelines have not been generalized for use in organizations or countries[7-14]. Thailand lacks specific cardiovascular guidelines for different occupations during the return-to-work (RTW) process which is exacerbated by a shortage of occupational physicians. A 2023 survey reported that there are 268 occupational physicians in Thailand[15], therefore, RTW evaluations are predominantly conducted by attending physicians relying on individual judgment. Occupational and environmental physicians should assess a person's ability to perform strenuous or safety-sensitive work after a cardiac event (such as myocardial infarction, stent/angioplasty, arrhythmia, placement of pacemaker or implantable cardioverter defibrillator, coronary artery bypass graft surgery) and the risk of sudden or gradual impairment or incapacitation due to the cardiac condition[16]. A well-executed medical certificate should outline a patient's job capacity by specifying restrictions and limitations to optimize benefits for the patient and reduce potential threats to both the person and public safety[17].

Cardiovascular disease patients thus require a multidisciplinary team (MDT) to enhance treatment, recommend rehabilitation programs, and assess occupational risk factors[18]. Additionally, cardiopulmonary exercise tests (CPET) to evaluate accurate cardiorespiratory fitness (CRF)[4] are the gold

standard, however many Thai medical institutes do not employ them. Thus, this study developed a Modified Delphi technique to aggregate expert opinions to construct a RTW medical assessment guide for individuals with cardiac diseases.

Material and Methods

A modified Delphi technique was used to construct a medical assessment guide for RTW. The following four methodology steps were used: 1) questionnaire construction and expert recruitment, 2) first-round agreement of experts in the necessary components of the RTW guide, 3) second-round agreement of experts in the necessary components of the RTW guide and 4) consensus of the necessary components of the RTW guide (Figure 1).

Step 1. Questionnaire construction and expert recruitment

The researcher performed a literature review of RTW in patients with cardiac disease by focusing on clinical evaluation and occupational information. Next, a 5-point Likert scale questionnaire was developed and divided into four categories of cardiac disease patients including ischemic heart disease, post-open-heart surgery, cardiac arrhythmia and heart failure[19]. The total number of questions in the first-round questionnaire was 85, with 75 questions on clinical evaluation and 10 in seven clinical case scenarios. There were 75 questions related to clinical evaluation in the component domain. The domain included history-taking, physical examination, cardiac investigation, management information and metabolic equivalent (METs) evaluation. Seven questions within seven clinical case scenarios were assessed using a CRF test and job physical demands between patients with strenuous work who refer to vigorous activity that requires more than 6.0 METs[20] and non-strenuous work patients. Another three questions within seven clinical case scenarios were assessed in consideration of MDT assessment consisting of attending physicians and occupational physicians in case of safety-sensitive work which refers to jobs where an impairment could cause a major incident affecting health and public safety[21].

The questionnaire validity test was performed by four validators: a cardiologist, a cardiothoracic surgeon, an occupational physician and a physical therapist. The item objective congruence (IOC) was used to assess content validity. If the index of the IOC is between 0.5 and 1.00, it suggests that the question is acceptable[22]. The open suggestions were included in the questionnaire. Next, a pre-test questionnaire was administered with seven samples. According to expert recruitment, four validators established inclusion criteria for experts with the target number of experts for this study being more than 17 to minimize errors[23,24]. Each specialty of experts was invited to have approximately 6-10 experts in order to reduce the dominance of any single specialty. The 28 experts were recruited by the researcher and four validators consisting of six cardiologists, six cardiothoracic

surgeons, seven occupational physicians and nine physiatrists/physical therapists.

Inclusion criteria

1. Cardiologists and cardiothoracic surgeons must have at least ten years of professional experience. They must also have performed at least 20 RTW evaluations annually.

2. Occupational physicians must have at least five years of experience in RTW cases. A diploma from Thai Board of Preventive Medicine (Occupational Medicine) or at least 10 years of experience in RTW cases with a Thai Certificate Board of Preventive Medicine (Occupational Medicine). They must also have performed at least 20 cardiac fit-to-work evaluations, periodic examinations, and RTW evaluations annually.

3. Physiatrists/physical therapists must have at least 5 years of professional experience. They must have rehabilitated at least 20 cases annually in patients with cardiac disease.

Step 2. First-round agreement of experts on the necessary components of the RTW guide.

The experts completed the questionnaire and agreed on the necessary components of the RTW guide. Some also provided open suggestions for the questionnaire. The questions were analyzed using more than 80% certain level of agreement technique which means that the sum of the proportions of Levels 4 and 5 reached at least 80%[25].

Step 3. Second-round agreement of experts on the necessary components of the RTW guide.

The researcher reviewed the 12 remaining questions where the sum of the proportions of Levels 4 and 5 did not reach 80% and open suggestions. The research team terminated two remaining questions. Another ten remaining questions were rephrased or provided additional information. After the second-round questionnaire was sent and completed, the ten remaining questions were reanalyzed using more than 80% certain level of agreement technique.

Step 4. Consensus on the necessary component of RTW guide

After two rounds of agreement, all domain questions that reached a consensus were concluded to construct the medical assessment guide for RTW patients with cardiac disease. The clinical case scenario questions that reached a consensus were concluded by considering the use of CRF tests and job physical demands for patients with strenuous and non-strenuous work. In addition, the use of MDT assessments in patients with safety-sensitive work was considered.

After the experts had been recruited and registered online via Google form, the questionnaire was sent to the experts via E-mail or letter. The experts' information and answers to the questionnaire were collected and analyzed using Microsoft Excel. Ethical approval for this study (HE651403) was obtained from the Ethics Committee of Khon Kaen University.

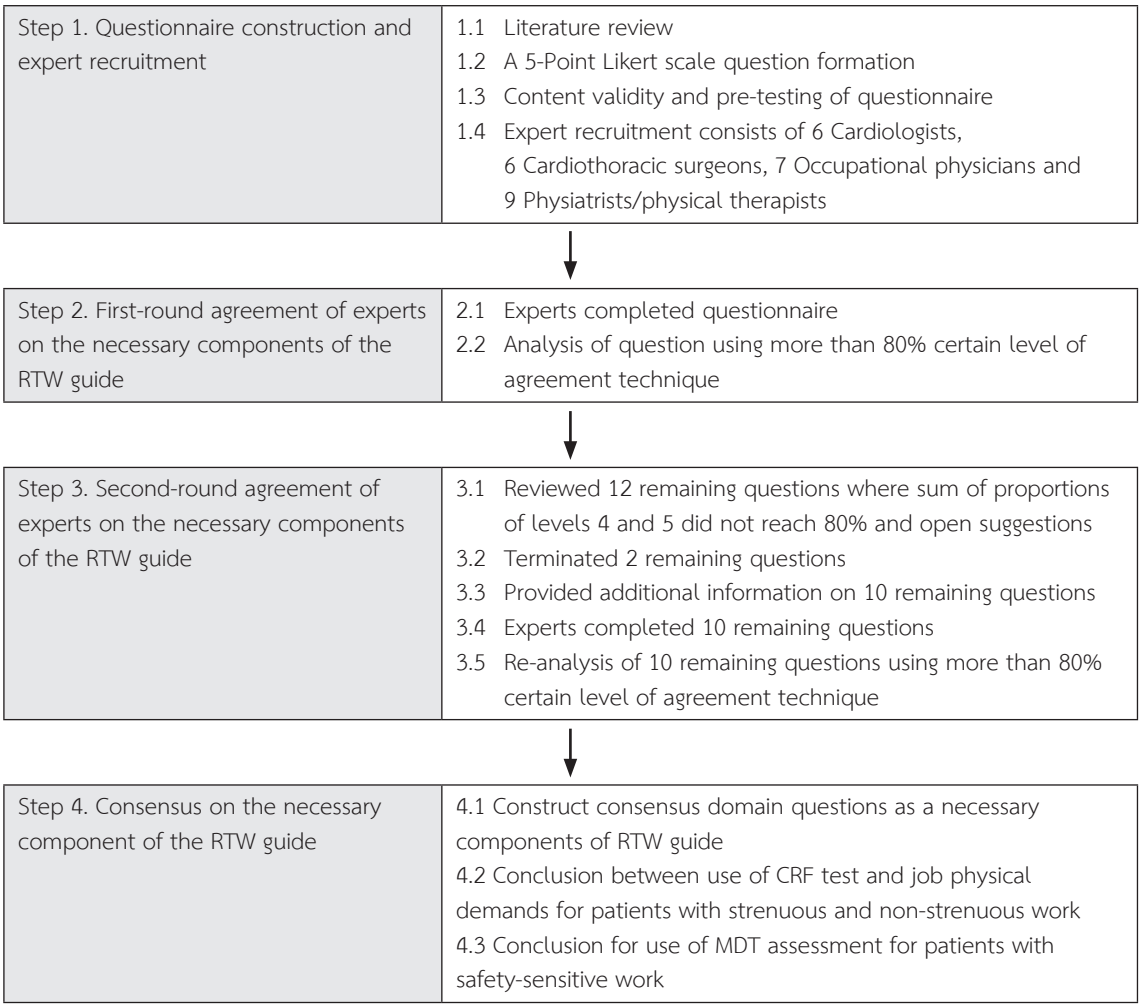

Figure 1 The modified Delphi method used in this study

Result

The results comprised the demographic data of experts, the first and second rounds of agreement of experts on the necessary components of the RTW guide, and consensus on the necessary components for the RTW guide.

Demographic data of experts

Twenty-eight experts met the inclusion criteria and were recruited for the study. The number of specialized experts ranged between 6 and 9. Six cardiologists worked equally in the heart center of university hospital and the excellent center hospital. Two-thirds of physiatrists/physical therapists worked in the heart center of university hospital. Mostly cardiothoracic surgeons worked in the heart center of university hospitals and all occupational physicians worked in the excellent center hospital. Cardiologists had the highest median age of 48.5 years (range

42-58 years) and median years of experience of 18 years. Physiatrists/physical therapists had the highest median number of cases evaluated per year, with 200 assessed cases per year (range 36-500 cases evaluated per year). However, one cardiologist and cardiothoracic surgeon did not respond to the second-round questionnaire. The demographic responses are presented in Table 1.

Table 1 Demographic data of the experts

Job title	Number of experts	Workplace of expert		Median and range of age (years)	Median years of experience	Median and range number of cases evaluated per year
		Heart center of university hospital	Excellent center hospital			
Cardiologists	6	3	3	48.5 (42-58)	18	50 (20-100)
Cardiothoracic surgeons	6	5	1	42.5 (40-58)	13.08	96 (20-100)
Occupational physicians	7	0	7	35 (34-64)	5.83	30 (20-40)
Physiatrists/ physical therapists	9	6	3	38 (32-48)	13.79	200 (36-500)

First and second rounds of agreement of experts in the necessary component of the RTW guide

In the first-round agreement, experts completed the questionnaire for four patient categories: ischemic heart disease, post-open-heart surgery, cardiac arrhythmia, and heart failure. In the second-round agreement, the experts completed the 10 remaining questions. The results for the 4 patient categories are presented below.

Category 1. Ischemic heart disease patient

Experts gave their opinions on the components of the domain including history taking, physical examination, cardiac investigation, management information and METs evaluation. More than 80% certain level of agreement was reached within the first round, with a range of 82.1% to 100% except for the latest chest X ray (question 1.8) which was reached in the second round. In Scenario 1, RTW evaluation for light work without using a CRF test reached more than 80% certain level of agreement within the first round (the sum of the proportions of Levels 4 and 5 was 85.7%). In Scenario 2, an agreement was achieved on the CRF test evaluation for strenuous work after rephrasing the question and providing more information in the second round of review (the sum of the proportions of Levels 4 and 5 was 100%). The sum of the proportions of Levels 4 and 5 on questions of ischemic heart disease after the completion of two rounds of agreement was presented in Table 2.

Category 2. Post-open-heart surgery patient

Experts gave their opinions on the components of the domain including history taking, physical examination, cardiac investigation, management information and METs evaluation which more than 80% certain level of agreement was reached on all the questions within the first round, with a range of 82.1% to 100%. In Scenario 3, a consensus was obtained for the RTW evaluation for light work when the question was restated and more details were given in the second round. The evaluation was agreed upon without using the CRF test (the sum of the proportions of Levels 4 and 5 was 96.1%). In Scenario 4, consensus was achieved on RTW evaluation for strenuous work after rephrasing the question and providing additional information in the second round, using the CRF test (the sum of the proportions of Levels 4 and 5 was 88.4%). Regarding safety-sensitive work, a consensus was reached within the first round regarding using the MDT assessment for RTW evaluation (the sum of the proportions of Levels 4 and 5 was 85.7%). The sum of the proportions of Levels 4 and 5 on questions of post-open-heart-surgery after the completion of two rounds of agreement was presented in Table 3.

Category 3. Cardiac arrhythmia patient

Experts gave their opinion on the components of the domain including history taking, physical examination, cardiac investigation, management information and METs evaluation. More than 80% certain level of agreement was reached within the first round, with a range of 82.1% to 100% except for the questions on Canadian Cardiovascular Society (CCS) angina grade and the latest chest X-ray did not reach more than 80% certain level of agreement in the first round. The researcher terminated the CCS angina grade while the latest chest X-ray was concluded as a component of the medical assessment guide (question 3.1 and 3.10). The questions of METs estimation from job demand and METs report from CRF testing reached consensus in the second round after additional information was provided (questions 3.19 and 3.21). In Scenario 5, consensus was achieved for RTW evaluation for medium work after rephrasing a question and providing additional information in the second round. The decision was made to proceed with the RTW evaluation without using the CRF test (the sum of the proportions of Levels 4 and 5 was 84.6%). Regarding safety-sensitive work, consensus was reached within the first round of using the MDT assessment for RTW evaluation (the sum of the proportions of Levels 4 and 5 was 85.7%). The sum of the proportions of Levels 4 and 5 on questions of cardiac arrhythmia after the completion of two rounds of agreement was presented in Table 4.

Category 4. Heart failure patient

Experts gave their opinions on the components of the domain including history taking, physical examination, cardiac investigation, management information and METs evaluation. More than 80% certain level of agreement was reached within the first round, with a range of 82.1% to 100% except

for the questions of METs reported from CRF (question 4.19) which was reached in the second round. In Scenario 6, involved evaluating the RTW for light work. Despite rephrasing the question and providing more details in the second round, a consensus was still not achieved for the RTW evaluation without using the CRF test (the sum of the proportions of Levels 4 and 5 was 65.3%). In Scenario 7, a consensus was obtained on RTW evaluation for strenuous work after the question was restated and more details were given in the second round, using the CRF test (the sum of the proportions of Levels 4 and 5 was 100%). In safety sensitive work, consensus was reached within the first round of MDT assessment for RTW evaluation (level of agreement 92.86%). The sum of the proportions of Levels 4 and 5 on questions of heart failure after the completion of two rounds of agreement was presented in Table 5.

Table 2 Sum of proportions of Levels 4 and 5 on questions of ischemic heart disease

Question	Sum of proportions of Levels 4 and 5	
	1st round	2nd round
Domain 1.1 History taking and physical examination		
1.1 CCS angina grade	89.2	N/A
1.2 New York Heart Association (NYHA) classification	92.8	N/A
1.3 History of cardiac syncope	100	N/A
1.4 Current vital signs	92.8	N/A
1.5 Details of Abnormal Cardiovascular Physical Examination	100	N/A
1.6 Patient needs to return to their previous work	89.2	N/A
Domain 1.2 Cardiac investigation and management information		
1.7 Latest EKG	92.8	N/A
1.8 Latest chest X ray	78.5	84.6
1.9 Echocardiogram report	96.4	N/A
1.10 Coronary angiography (CAG) and revascularization report	92.8	N/A
1.11 List of current medication	96.4	N/A
1.12 CRF testing report (if available)	82.1	N/A
Domain 1.3 METs evaluation		
1.13 METs estimation from job demand	85.7	N/A
1.14 METs estimation from NYHA classification	96.4	N/A
1.15 METs report from CRF testing (if available)	85.7	N/A
Scenario 1. 55-year-old male bank manager diagnosed with acute myocardial infarction		
1.16 RTW evaluation for light work and using a CRF test	85.7 (without CRF testing)	N/A
Scenario 2. 45-year-old male marathon runner diagnosed with acute myocardial infarction		
1.17 RTW evaluation for strenuous work and using a CRF test	14.2 (without CRF testing)	100 (with CRF testing)

N/A: Not applicable due to reaching more than 80% certain level of agreement in the first round

Table 3 Sum of proportions of Levels 4 and 5 on questions of post-open-heart surgery

Question	Sum of proportions of Levels 4 and 5	
	1st round	2nd round
Domain 2.1 History taking and physical examination		
2.1 CCS angina grade	92.8	N/A
2.2 NYHA classification	100	N/A
2.3 History of cardiac syncope	100	N/A
2.4 European Heart Rhythm Association (EHRA) score	89.2	N/A
2.5 Current vital signs	92.8	N/A
2.6 Details of Abnormal Cardiovascular Physical Examination	92.8	N/A
2.7 Patient needs to return to their previous work	92.8	N/A
Domain 2.2 Cardiac investigation and management information		
2.8 Latest EKG	92.8	N/A
2.9 Latest chest X ray	82.1	N/A
2.10 Echocardiogram report	92.8	N/A
2.11 Coronary angiography (CAG) and revascularization report (if clinically indicated)	82.1	N/A
2.12 Date and type of cardiac operation	92.8	N/A
2.13 List of current medication	94.6	N/A
2.14 List of current oral anticoagulants (if clinically indicated)	92.8	N/A
2.15 The duration of activities is restricted such as heavy lifting, driving etc.	92.8	N/A
2.16 Type of prosthetic valve in case of valve replacement	85.7	N/A
2.17 Specified postoperative complications if present such as surgical wound infection, postoperative stroke	96.4	N/A
Domain 2.3 METs evaluation		
2.18 METs estimation from job demand	89.2	N/A
2.19 METs estimation from NYHA classification	92.8	N/A
2.20 METs report from CRF testing (if available)	89.2	N/A
Scenario 3. 30-year-old female registered nurse diagnosed with Atrial septal defect (ASD) S/P median sternotomy to ASD closure		
2.21 RTW evaluation for light work and using a CRF test	78.5 (without CRF testing)	96.1 (without CRF testing)
Scenario 4. 37-year-old male construction worker diagnosed with infective endocarditis with severe aortic valve regurgitation S/P median sternotomy to mechanical aortic valve replacement		
2.22 RTW evaluation for strenuous work and using a CRF test	32.1 (without CRF testing)	88.4 (with CRF testing)
2.23 Safety sensitive work and using MDT assessment for RTW	85.7 (with MDT)	N/A

N/A: Not applicable due to reaching more than 80% certain level of agreement in the first round

Table 4 Sum of proportions of Levels 4 and 5 on questions of cardiac arrhythmia

Question	Sum of proportions of Levels 4 and 5	
	1st round	2nd round
Domain 3.1 History taking and physical examination		
3.1 CCS angina grade	78.5	(terminated)
3.2 NYHA classification	92.8	N/A
3.3 History of cardiac syncope	100	N/A
3.4 EHRA score	96.4	N/A
3.5 Current vital signs	92.8	N/A
3.6 Details of Abnormal Cardiovascular Physical Examination	92.8	N/A
3.7 Patient needs to return to their previous work	92.8	N/A
Domain 3.2 Cardiac investigation and management information		
3.8 First EKG that diagnosed cardiac arrhythmia	100	N/A
3.9 Latest EKG	100	N/A
3.10 Latest chest X ray	75	(terminated)
3.11 Echocardiogram report	85.7	N/A
3.12 Coronary angiography (CAG) and revascularization report (if clinically indicated)	82.1	N/A
3.13 Date and result of radiofrequency ablation (if undergone)	100	N/A
3.14 Date, type, mode and result of cardiac implantable electronic device (CIED) insertion (if undergone)	100	N/A
3.15 Time duration of activities restriction in patient who has CIED	96.4	N/A
3.16 Report of cardiac monitoring device such as cardiac event monitor or Holter monitor (if undergone)	96.4	N/A
3.17 List of current medication	100	N/A
3.18 List of current oral anticoagulants (if clinically indicated)	100	N/A
Domain 3.3 METs evaluation		
3.19 METs estimation from job demand	78.5	88.4
3.20 METs estimation from NYHA classification	85.7	N/A
3.21 METs report from CRF testing (if available)	78.5	96.1
Scenario 5. 50-year-old male electrician wears a safety harness while climbing scaffolds diagnosed with SVT type AVNRT S/P radiofrequency ablation		
3.22 RTW evaluation for medium work and using a CRF test	71.4 (without CRF testing)	84.6 (without CRF testing)
3.23 Safety-sensitive work and using MDT assessment	85.7 (with MDT)	N/A

N/A: Not applicable due to reaching more than 80% certain level of agreement in the first round

Table 5 Sum of proportions of Levels 4 and 5 on questions of heart failure

Question	Sum of proportions of Levels 4 and 5	
	1st round	2nd round
Domain 4.1 History taking and physical examination		
4.1 CCS angina grade	85.7	N/A
4.2 NYHA classification	100	N/A
4.3 History of cardiac syncope	92.2	N/A
4.4 EHRA score	85.7	N/A
4.5 Current vital signs	100	N/A
4.6 Details of Abnormal Cardiovascular Physical Examination	96.4	N/A
4.7 Current BP (mmHg) in supine, sitting and standing position	82.1	N/A
4.8 Patient needs to return to their previous work	92.8	N/A
Domain 4.2 Cardiac investigation and management information		
4.9 First EKG that diagnosed heart failure	85.7	N/A
4.10 Latest EKG	89.2	N/A
4.11 First chest x ray that diagnosed heart failure	92.8	N/A
4.12 Latest chest x ray PA upright	96.4	N/A
4.13 Echocardiogram report	100	N/A
4.14 Coronary angiography (CAG) and revascularization report (if clinically indicated)	92.8	N/A
4.15 List of current medication	100	N/A
4.16 List of current oral anticoagulants (if clinically indicated)	100	N/A
Domain 4.3 METs evaluation		
4.17 METs estimation from job demand	92.8	N/A
4.18 METs estimation from NYHA classification	96.4	N/A
4.19 METs report from CRF testing (if available)	78.5	96.1
Scenario 6. 50-year-old male engineer diagnosed with ischemic cardiomyopathy (NYHA class II)		
4.20 RTW evaluation for light work and using a CRF test	75 (without CRF testing)	65.3 (without CRF testing)
Scenario 7. 55-year-old male factory security officer diagnosed with ischemic cardiomyopathy (NYHA class II)		
4.21 RTW evaluation for strenuous work and using a CRF test	32.1 (without CRF testing)	100 (with CRF testing)
4.22 Safety-sensitive work and using MDT assessment	92.8 (with MDT)	N/A

N/A: Not applicable due to reaching more than 80% certain level of agreement in the first round

Consensus on the necessary components for the RTW guide

The domain, consisting of history taking, physical examination, cardiac investigation, management information, and METs evaluation, was determined to be a part of the medical assessment guide after two rounds of consensus. For patients with non-strenuous work, RTW evaluation can be conducted without CRF testing for ischemic

heart disease, post-open-heart surgery and some specific types of cardiac arrhythmia. However, there was no consensus regarding patients with heart failure. CRF testing was essential for RTW evaluation in patients performing strenuous work. Moreover, MDT assessment was crucial in evaluating RTW in patients with safety-sensitive work. A summary of the medical assessment guideline for RTW in patients with cardiac disease was presented in Table 6.

Table 6 Summary of medical assessment guide for the RTW of cardiac disease patient

Domains for RTW evaluation	Patient category			
	IHD	Post-open-heart surgery	Cardiac arrhythmia	Heart failure (NYHA class II)
History taking and physical examination	Yes	Yes	Yes	Yes
Cardiac investigation	Yes	Yes	Yes	Yes
Management information	Yes	Yes	Yes	Yes
METs evaluation of the patient	Yes	Yes	Yes	Yes
METs evaluation of job physical demands Can conduct RTW evaluation without CRF testing?				
Non-strenuous work	Yes	Yes	Yes (some type)	No consensus
Strenuous work	No	No	N/A	No
MDT assessment for safety-sensitive work	N/A	Yes	Yes	Yes

Note: Non-strenuous work: physical activity requiring including sedentary (1.0-1.5 METs), light (1.6-2.9 METs) and moderate (3.0-5.9 METs). Strenuous work: vigorous activity requiring more than 6.0 METs[20]. Safety-sensitive work: Jobs in which a person's impairment can result in a significant incident affecting the health or safety of individuals, the public, property, or the environment[21]. Some type of cardiac arrhythmia such as sinus arrhythmia, single premature atrial complex (PAC) or premature junctional complex (PJC), single premature ventricular complex (PVC)[26].

Abbreviations: RTW, return-to-work; IHD, ischemic heart disease; METs, metabolic equivalent; CRF, cardiorespiratory fitness; MDT, multidisciplinary team; N/A: the author did not conduct the question.

Discussion

The researcher opted for the Modified Delphi technique and gathered expert consensus to perform RTW evaluation differently due to limited availability of CPET in Thai medical centers. By predicting non-exercise CRF based on the NYHA classification could become an alternative approach. The researcher used a consensus measurement with more than 80% to conform with established cardiovascular criteria for RTW evaluation. A CRF test was used to assess various occupational physical demands. This study also addressed safety-sensitive employment, showing the need of occupational physicians working with attending physicians in RTW evaluation after clarifying occupational history.

According to the necessary component of the RTW guide, although there were a few differences in the number of experts in each specialty, the majority agreed on the same trend. The results demonstrated that following history taking, physical examination, cardiac investigation, management information and evaluation of METs for the patient and job physical demands, the consensus of expert agreement was in agreement with standard cardiovascular guidelines[27-38]. Most of the questions reached an 80% certain level of agreement within the first round. In addition, the questions were reached consensus in the second round including questions 1.8, 3.19, 3.21 and 4.19, the sum of the proportions of Levels 4 and 5 in all these questions was 78.5% in the first round that nearly 80% agreement might lead experts to agree in the second round. The research team decided to eliminated question 3.1, which asked about the necessity of CCS angina grade for RTW evaluation because it was used to evaluate chest pain caused by coronary artery disease[39,40], except in cases where there was concomitant cardiac arrhythmia with coronary artery disease[41]. Question 3.10, which asked about the necessity of the latest chest x ray for RTW evaluation was also eliminated because information on chest x ray was necessary when the patient was diagnosed with cardiac arrhythmia to assess the organic heart condition or for post-procedural assessment, such as radiofrequency ablation and cardiac device insertion[42-44].

In the first round of Scenario 1, consensus was readily reached on the RTW evaluation without CRF testing. This conclusion was made based on the individual's occupation's sedentary physical demands, which suggested a higher possibility of success than occupations with high physical demands[45]. However, the CRF test aids in prescribing physical activity during working hours and other activities, such as exercise[46]. Scenarios 3 and 5, a consensus was reached on RTW evaluation without CRF testing in the second round after the researcher provided additional information because the registered nurse task required non-strenuous physical demand and a good prognosis of atrial septal defect (ASD) after surgical repair for Scenario 3.[47,48]. Moreover, a good prognosis and no current evidence of limited physical activity after treatment for SVT AVNRT type could reach a consensus in Scenario 5[49]. For strenuous work, consensus was reached on RTW evaluation with the CRF test used in the second round after the researcher provided additional information in Scenarios 2, 4 and 7. This was due to the high levels of occupational physical activity, which increased the risk of major adverse cardiovascular events and common sudden cardiac death in athletes[50,51]. However, no consensus was reached for patients with non-strenuous work who had heart failure in Scenario 6. This was because patients with mild heart failure exhibited similar self-perception between NYHA classes I and II. However, there was discordance between the NYHA classification and CRF test results,

indicating poor ability to discriminate whether the patient was better or worse than the NYHA classification assessment[52,53].

All questions reached on consensus within the first round for the case scenario question, which was assessed using the MDT assessment for safety-sensitive work. In Scenario 4, two experts expressed concerns about bleeding complications from oral anticoagulants due to the common incidence of sharp contact injuries among construction workers[54]. In Scenario 5, the patient used a safety harness. Suspension trauma may occur, which can lead to hemodynamic compromise, might occur[55]. In Scenario 6, a security officer needs high CRF to prepare for emergencies. This issue emphasized the need for clarification in the job description because working conditions might affect patient or public safety.

According to several cardiac diseases and varying degrees of severity, the limitations of this study include case scenarios that do not represent other cardiac conditions such as valvular heart disease, pericardial disease, aortic disease and pulmonary hypertension. In addition, this study did not include many physically demanding or safety-sensitive tasks. Although the current guidelines compile a list of safety-sensitive work and physically demanding tasks[56-58], the priority is the individual evaluation of cardiac disease. Further research should focus on studying the validity and reliability of assessing the level of physical demand in occupational history by evaluating the objective assessment of METs in patients and the outcome achievement in their job tasks.

Conclusion and recommendations

Return-to-work evaluation could be conducted by predicting non-exercise cardiorespiratory fitness based on the New York Heart Association classification for non-strenuous work, except in patients with heart failure. Multidisciplinary team assessment is recommended for patients involved in safety-sensitive work.

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