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The importance of return to work: How to achieve optimal reintegration in ACS patients

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Abstract

The vocational reintegration of patients after an acute coronary syndrome is a crucial step towards complete convalescence from the social as well as the individual point of view. Return to work rates are determined by medical parameters such as left ventricular function, residual ischaemia and heart rhythm stability, as well as by occupational requirement profile such as blue or white collar work, night shifts and the ability to commute (which is, in part, determined by physical fitness). Psychosocial factors including depression, self-perceived health situation and pre-existing cognitive impairment determine the reintegration rate to a significant extent. Patients at risk of poor vocational outcomes should be identified in the early period of rehabilitation to avoid a reintegration failure and to prevent socio-professional exclusion with adverse psychological and financial consequences. A comprehensive healthcare pathway of acute coronary syndrome patients is initiated by cardiac rehabilitation, which includes specific algorithms and assessment tools for risk stratification and occupational restitution. As the first in its kind, this review addresses determinants and legal aspects of reintegration of patients experiencing an acute coronary syndrome, and offers practical advice on reintegration strategies particularly for vulnerable patients. It presents different approaches and scientific findings in the European countries and serves as a recommendation for action.

Keywords

Return to work, acute coronary syndrome, predictors, pension insurance

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Introduction

Coronary artery disease (CAD) including acute coronary syndrome (ACS) is the most common acquired cardiac disease and the leading cause of morbidity and mortality, contributing over 8.75 million deaths in 2015 worldwide.[1] Depending on the country, the mean age of male and female patients indexing with ACS is approximately 51–59 years, of female patients 70–74 years.[2,3] Thus in general CAD is a disease of middle and advanced aged patients, nevertheless a relevant number of patients are at working age. Independent of the initial treatment strategy, return to work (RTW) rates within 12 months after ACS is about 67–93%.[4,5] The mean time delay until RTW is 2–3 months.[6] However, in a nationwide Danish registry, although describing a high initial RTW rate of 91%, after one year 24% of the ACS patients were detached from employment due to cardiac and non-cardiac reasons.[7] Although international comparisons are limited by sociopolitical and cultural differences, the likelihood of returning to work after ACS also appears to be lower for women older than 55 years of age than for men.[8] Cardiac events increase the risk of poorer professional conditions including reduced responsible area, part-time employment, lower salary and discharge from jobs with an exemplary mean productivity loss (for example in Spain) of €9673 per person in the index event year (considering the cost per day not worked at €54.65 as the minimum wage).[9]

Predictors of successful RTW

While the medical estimation of the patient's ability to return to work is largely based on objective data such as cardiac function including left ventricular ejection fraction (LVEF) and exercise capacity as well as existing comorbidities, the patient's self-assessment mainly includes work-related factors (satisfaction with the previous work situation, negative expectations on resuming work) and general wellbeing. Regarding the World Health Organization (WHO) definition of health as 'a state of complete physical, mental and social wellbeing and not merely the absence of disease or infirmity' a multidimensional approach in assessing the patient's performance should be sought.

Cardiac-related factors

The severity of myocardial damage due to ACS depends on the area and the duration of coronary occlusion. LVEF at admission has been described as the most important prognostic clinical parameter and remains largely constant after finished inpatient rehabilitation.[10,11] If a discrepancy between LVEF and exercise capacity spiroergometric exists, cardiopulmonary exercise testing (CPET) can be performed to ascertain the anaerobic threshold, peak oxygen uptake and respiratory efficiency.[12] CPET can be used to correlate peak oxygen consumption ($VO_{2\ peak}$) and performed metabolic equivalents (METs). Recent data indicate that the particular minute ventilation (VE/VCO_2) slope determined by CPET is of high predictive value in determining RTW rates (VE/VCO_2 slope >35 indicates a reduced RTW rate by 15%).[13]

In Germany, a patient's maximum and endurance bicycle exercise capacity is interpreted as absolute value as well as in relation to body weight (see Table 1).[14] This so called 'Ludwigshafen model' is widely used. Furthermore, there are exemplary tables which correlate energy requirements in METs (depending on body weight) with the performed load during cycle ergometry.[15] Although this scheme can be applied in a variety of patients, it has limitations such as not taking into account age and gender differences. Including these parameters CPET is a more objective and reliable method, but there are only limited data for the assignment into work intensity groups using peak oxygen consumption (VO_2). While cycle ergometry is usually sufficient for activities with low or moderate physical load stress, ergometry seems to underestimate the requirements for heavy physical exertion. In this case, an individual correlation of the oxygen uptake

Table 1. Estimation of maximum cardiopulmonary capacity and full-time working capacity on the basis of the achieved peak VO_2, German recommendations.

Maximum capacity on the ergometer[14]	Maximum capacity in relation to BW	Endurance capacity on the ergometer	Estimated energy expenditure (METs)*[15]	Work intensity
<50 Watts	About 1 Watt/kg BW	Up to 50 Watts	<3.1	Very light
>50–75 Watts	>1–1.5 Watts/kg BW	>50–75 Watts	<4.3	Light
>75–125 Watts	>1.5–2 Watts/kg BW	<75–100 Watts	<6.4	Moderate
125–150 Watts	>2 Watts/kg BW	>100 Watts	<7.4	Heavy

BW: body weight; MET: metabolic equivalent.
*Exemplary for patients with a body weight of 80 kg (adapted from Löllgen[14] and Haskell et al.[15]).

with the energy expenditure of the specific workplace conditions is desirable.

A Spanish working group has suggested a short algorithm including revascularisation status, LVEF and stress test for a simplified estimation of work capacity.[16] However, until now there are limited definitive European recommendations on how to execute a stress test for the evaluation of the ability to re-engage in occupation.

Imaging using pharmacological or dynamic stress echocardiography is dispensable to a large extent for the assessment of occupational reintegration. It may be helpful to detect ischaemia, but does not reflect the exercise capacity of the patient. As most work tasks do not involve peak exercise, the risk of ischaemia particularly in revascularised patients after coronary events during work is low.

Rhythm stability is essential particularly for occupational activities, in which short-term arrhythmia-associated consciousness disorders may lead to potentially dangerous situations (professional drivers, roofers, etc.). Treatment/procedural factors are critical for expected recovery as well for instance in comparison to patients treated by percutaneous coronary intervention (PCI), patients after coronary artery bypass grafting (CABG) showed a more pronounced cognitive decline after intervention.[17] Patients experiencing a complicated ACS (out of hospital cardiac arrest (OHCA), acute aorto-coronary bypass grafting or post-infarctional heart failure) require a complex, multimodal reintegration concept for improving the RTW rate. A French work group analysed the prevalence and factors associated with RTW in OHCA survivors.[18] The RTW rate was 62.8%, while patients with a higher level job, and with the OHCA occurring in the workplace, were more likely to be reintegrated. Also, a Danish nationwide cohort study including 30-day OHCA survivors who were employed prior to arrest demonstrated a reintegration rate even after organ replacement therapy during intensive care unit treatment of only 53%.[19] Interestingly, congestive heart failure at admission was unrelated to work resumption, as well as the initial coronary intervention (PCI or CABG).[20] The decisive factor seems to be not the type but the effectiveness of the primary treatment.

Existing comorbidities (diabetes mellitus, renal failure, previous stroke, chronic obstructive pulmonary disease, peripheral arterial disease, etc.) additionally influence the overall estimation of a patient's physical capacity and the RTW rate.[21]

Psychosocial factors

Chronic stress in the workplace results from high requirements and low decision-making potential, or through the combination of high expectations and low professional gratification. Particularly for psychologically vulnerable patients, persistent shift work, night work or overtime hours may aggravate the individual effort–reward imbalance.[22] Objectively, job strain has an important impact on the risk of cardiovascular diseases, for example on the incidence of atrial fibrillation. The meta-analysis of the Swedish Longitudinal Occupational Survey of Health and two other studies demonstrated a pooled hazard ratio of 1.37 (95% confidence interval (CI) 1.13–1.67) for atrial fibrillation in stressful occupational exposures.[23] In women there are mainly familial problems, the double burden of work and family that increases the risk of CAD by a factor of three or four.[24] In a prospective cohort study in The Netherlands, depression (odds ratio (OR) 3.48, 95% CI 1.45–8.37) and anxiety disorders (OR 2.90, 95% CI 1.00–6.38) were significantly correlated with the absence of RTW.[25] Professional reintegration is often limited by the fear of harming oneself because of the work-related physical or emotional stress through occupational physical and mental stress. Thus in the context of non-cardiac factors, the self-assessment of the patient's ability to perform the previous activity adequately has a high prognostic value for reintegration.[26]

A recent multinational review paper found six barriers (job strain, anxiety, depression, comorbidity, older age and low education) and four facilitators (job control, work ability, perceived good health and high socioeconomic status) of RTW for patients with cardiovascular diseases.[27]

However, the lack of correlation between objective and subjective assessment of the performance is not uncommon, because the latter is superimposed on anxiousness and depression, especially in patients with physically demanding jobs. Subjective dyspnoea is poorly correlated with exercise capacity and VO_{2peak}.[28] CPET offers a helpful instrument to differentiate between cardiac, pulmonary and peripheral limitations, thus motivational problems (e.g. persons who desire retirement) can be discovered.

In addition to the medical, psychological and professional factors, the financial situation plays an important role for the patients. The creation of financial work incentives, e.g. by disability insurance has led to a higher RTW rate in some Scandinavian countries.[29] It is essential to ensure access to the official financial resources for the patients in a low-threshold manner, taking into account the situational vulnerability caused by survived ACS. However, prospective data across Europe are rare due to different stakeholders and national laws.

In summary, vocational reintegration of patients after acute myocardial infarction is primarily

determined by psychosocial parameters and less by the underlying cardiac disease. For this reason, the early diagnosis of the mentally conditioned risk of non-RTW by using standardised psychometric questionnaires can be proposed. While the short form (SF)-36 (or SF-12) questionnaire and the European quality of life five dimensions questionnaire (EQ-5D) can be used to assess the general quality of life, more specific psychosocial or vocation-oriented reintegration assessment instruments are available (Table 2).[30,31] In particular, the hospital anxiety and depression scale is widely used and lower score values have been shown to increase the probability of RTW.[32] All these instruments are not cardiac specific and due to limited comparison data none of the questionnaires can be recommended as the superior one. Particularly in CABG patients, often characterised by at least temporary cognitive impairment, the psychological tests should be performed not too soon after admission to cardiac rehabilitation (CR) as an individual case management to allow a restitution of cognitive abilities and to increase the RTW rate.

However, in addition to the largely objectifiable factors, the likelihood of RTW is also determined by individual financial aspects, cultural preferences and intrafamilial decisions. The totality of the limiting barriers can be objectified by the involved professional groups within the scope of the multidisciplinary rehabilitation and correlated for the assessment of the vocational reintegration possibility (Figure 1).

Work-related factors

Working prior to coronary intervention has a high predictive impact for RTW, nevertheless the characteristics of the performed task is important for RTW probability.[12] Work-related factors influencing occupational reintegration include the intensity of physical effort that has to be performed (lifting, carrying and moving heavy objects) as well as specific workplace situations of a physical and chemical nature (toxic fumes, atmospheric high pressure or low pressure, high noise level, fine dust load, heat/cold, electric fields and other) have to be considered. Psychological tasks including shift work and night work, production line work, piecework, or working under time pressure are important professional parameters in the assessment of reintegration ability. Workers in a rotating three shift or permanent night shift schedule demonstrate a modification of their cardiac neurovegetative regulation due to an elevated sympathetic tone both during night time as well as during day time sleep.[33] Limited data are available of the impact on patients with manifest cardiovascular disease employed in the shift or assembly line system; however, the pathophysiological impact on heart function and vascular tonus is obvious.[34] Furthermore, particularly patients with manual and physically demanding work are at risk of poor occupational outcomes.[35] The ability to commute (reach the working place either walking or by the use of a vehicle or public transport) can be a limiting factor for patients with a driving ban. The occupational

Table 2. Overview of commonly used psychometric tests in occupational rehabilitation.

Questionnaire	Abbreviation	Focus
Hospital anxiety and depression scale	HADS	• Measurement of anxiety and depression in a general medical population of patients • Anxiety and depression subscales
Occupational stress inventory	OSI-R	• Measurement of occupational stress, psychological strain and coping resources • Three sections: ○ Occupational role questionnaire (ORQ) ○ Personal strain questionnaire (PSQ) ○ Personal resources questionnaire (PRQ)
Obstacles to return to work questionnaire	ORTWQ	• Multidimensional, including biopsychosocial and environmental factors • 55 Items, grouped into nine subscales
Patient health questionnaire	PHQ-9	• Depression module of PHQ-D to detect depression and assess severity in a somatic medical population of patients
Return-to-work self-efficacy	RTWSE-19	• Self-estimation of the worker's confidence in meeting job demands and their own ability to return to work • 19 Items
Work ability index	WAI	• Own prognosis of their work ability in 2 years' time • Work ability in relation to the demands of the job • Estimated impairment owing to diseases/illnesses or limiting conditions

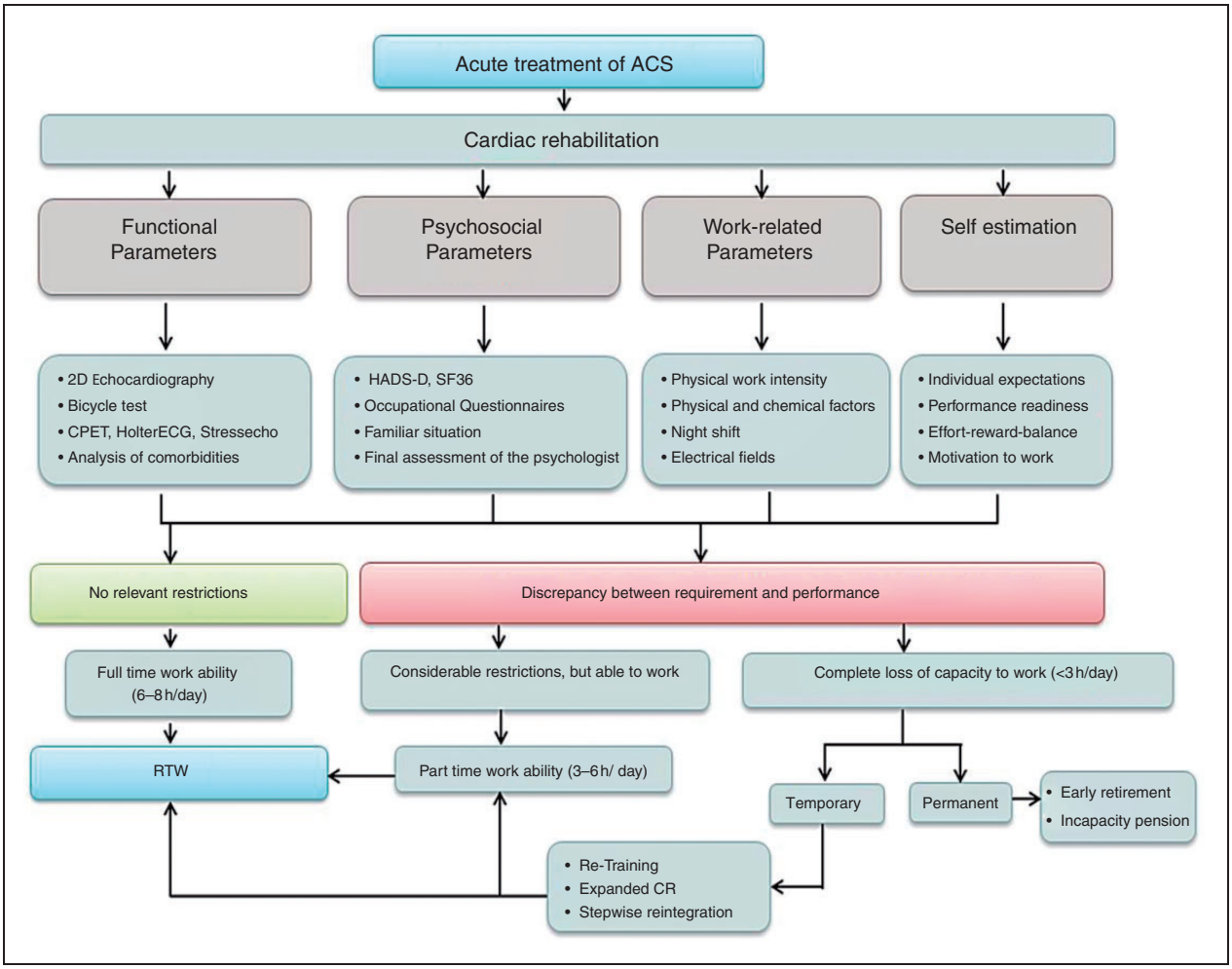

Figure 1. Interaction of CR professional for reintegration of ACS patients.
CR: cardiac rehabilitation; ACS: acute coronary syndrome; SCD: sudden cardiac death; QOL: quality of life; CABG:– coronary artery bypass grafting; ICF: International Classification of Functioning, Disability and Health.

reintegration of patients with implanted electrical devices (cardiac pacemakers, defibrillators), especially in professions in industry, may be difficult.[36] Given a risk of electromagnetic interference, the implanted electrical device may be influenced by electrical fields and might be a contraindication for the resumption of work in certain areas. The actual incidence of relevant malfunctions of the implantable cardioverter defibrillator (ICD) due to electromagnetic fields is low (0.5%).[37] If there is uncertainty about electrical, magnetic or electromagnetic interference, an exact workplace analysis must be performed to identify potential risks. This should be done by the technical facilities of the organisation, the professional association or the Technical Control Board, based on field measurements, and should be coordinated with the representative of the ICD manufacturer. Besides objectively measurable parameters the relationship to the employer must be considered important. Regardless of the disease leading to sickness absence a Dutch working group extracted a trustful employer–employee interdependence as a dominant factor for RTW.[38]

Practical guidance on reintegration strategies

Reintegration of patients after ACS should be considered as an expanded and multicomponent process including initial CR, after-care programmes and expanded socio-medical support. To estimate the employee's suitability for work several aspects have to be considered. A practical model for re-adaptation to work after ACS should integrate human and work-related parameters for final occupational judgement (Figure 2). Thus residual job ability (partial–total/temporary–permanent disability) depends on the existing above-mentioned cardiac, psycho-cognitive and professional barriers.

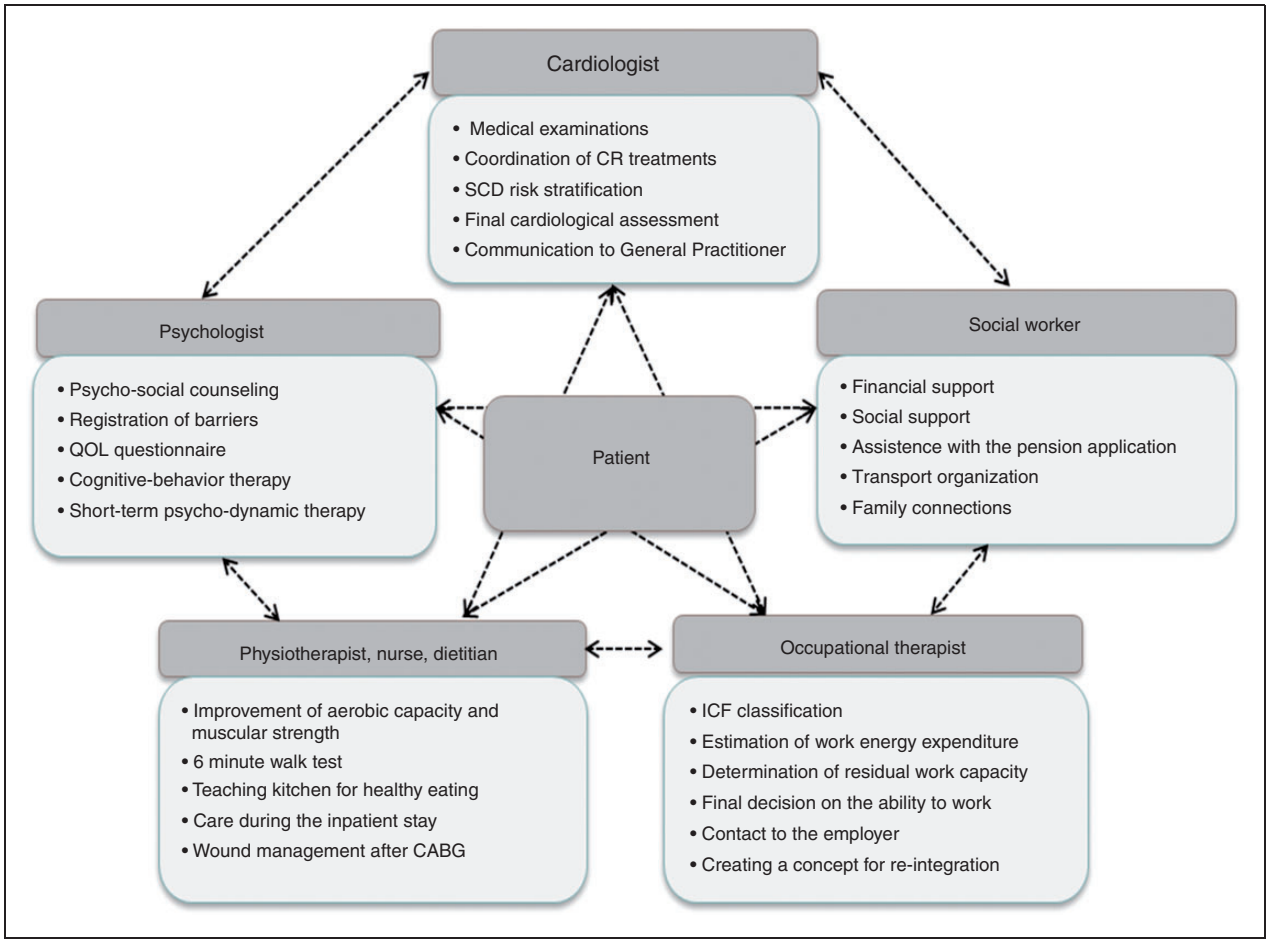

Figure 2. Flow chart for the evaluation of work capacity in patients with acute coronary syndrome.
RTW: return to work; CPET: cardiopulmonary exercise testing; CR: cardiac rehabilitation; HADS-D: hospital anxiety and depression scale; SF-36: short form health survey 36.

CR and RTW

Comprehensive CR is one of the core treatment components of patients after an acute coronary event.[39] Besides clinical stabilisation the organisation of RTW represents a major topic of CR. Occupational recovery and subsequent professional reintegration can be significantly improved by CR due to the time available for the necessary examinations and the institutional infrastructure (dialogue between cardiologists trained in occupational medicine, psychologists and social workers). In comparison to matched controls, CR participants independently of age, gender and former profession had a significantly greater reintegration rate.[40] A recently published meta-analysis of 18 studies focusing on the reintegration rate following an individually delivered psychosocial and vocational intervention demonstrated an improved work rate at 3 months when compared with usual care.[41] After 6–12 months the effect was neutralised, emphasising the impact on desired early reintegration. However, despite robust prognostic impact, across European countries fewer than the half of eligible cardiovascular patients participate in CR.[42]

Patients at risk of poor occupational outcomes should be identified already in the early period of reintegration, optimally during early post-acute CR. Overall, profession-related information is considered to a small extent during CR. A French survey described that advice concerning RTW was completely missing for 44 % of ACS patients and only 53% of information provided was work-related.[43] Thus treatment of the underlying cardiac disease (including physical training, nutrition counselling and optimisation of secondary preventive medication) is given a comparatively high priority, whereas reintegration strategies leave room for optimisation.

Particularly in physically demanding jobs or jobs with specific occupational tasks and risks (heat, in heights, electro-magnetic fields, etc.) the judgement of the company doctor is usually required. For this interface a cooperative approach between participating

Table 3. Selection of the metabolic demands of occupational activities (adapted from Ainsworth et al.[49]).

Codes	METs	Description
11135	1.8	Engineer (e.g. mechanical or electrical)
11125	2.3	Custodial work, light effort (e.g. cleaning sink and toilet, dusting, vacuuming, light cleaning)
11750	2.5	Tailoring, machine sewing
11792	3.5	Walking on job, 3.0 mph, in office, moderate speed, not carrying anything
11126	3.8	Custodial work, moderate effort (e.g. electric buffer, feathering arena floors, mopping, taking out trash, vacuuming)
11070	4.0	Chambermaid, hotel housekeeper, making bed, cleaning bathroom, pushing cart
11793	4.3	Walking on job, 3.5 mph, in office, brisk speed, not carrying anything
11030	6.0*	Building road, driving heavy machinery
11244	6.8	Fire fighter, rescue victim, automobile accident, using pike pole
11145	7.8	Farming, vigorous effort (e.g. baling hay, cleaning barn)
11050	8.0*	Manually carrying heavy loads (e.g. bricks, tools)
11850	8.5	Walking or walk downstairs or standing, carrying objects about 100 pounds or over

METs: metabolic equivalents.
*Estimated.

healthcare professionals (occupational physician, general physician, rehabilitation cardiologist, company doctor) is desirable as well as a trusting relationship between rehabilitant and company doctor. Company doctors have internal knowledge of the in-house structural processes that can be applied for an individualised reintegration process. Nevertheless, such interdisciplinary teams are rare.[44]

Correlation of physical performance and work severity

The assessment of the job and work environment on the one hand and the assessment of the worker's ability on the other are necessary in order to be able to confirm a working ability of the patient, especially in physically demanding occupations. In 1978, the WHO classified the strain at work depending on the performed percentage of estimated VO_{2max} (light work <25% VO_{2max}, moderate 25–50% VO_{2max}, heavy and very heavy >50% VO_{2max}).[45] According to specific tables the work demand can be classified on the basis of METs into four groups (<3 METs very light work, 3–5 METs light work, 5–7 METs moderate work, >7 METs heavy work) as well.[46] One MET corresponds to 3.5 mL oxygen per kilogram of body weight per minute. To convert from Watts into METs and vice versa, standard calculation equations are available.[47] An Italian working group suggests that a person is able to realise for 6–8 hours continuous employment with consumption of oxygen equal to 35–40% of maximum CPET aerobic capacity (VO_2max) with peak values during working which must not exceed two-thirds of the maximal achieved values. RTW may be permitted if the individual functional capacity is at least twice the energy demands of specific work activity.[48] Table 3 demonstrates a selection of MET levels of different professional activities. For example, for a physically demanding job (i.e. chambermaid/hotel housekeeper 4.0 METs full-time corresponding to 14 ml O_2/kg/minute) the patient should achieved 35 ml O_2/kg/minute as the CPET maximum value, for physically light work (i.e. 1.8 METs) an oxygen uptake of 16 ml O_2/kg/minute is sufficient.

The 2011 Compendium of Physical Activities,[49] particularly chapter 11, which correlates specific activities and measured or estimated METs, values can be useful for individual job characteristics.[50] Furthermore, for a detailed job description, the international standard classification of occupations of the International Labour Organization (ILO) can be used.[51] Although the upper workload differs between the groups, the average workload of industrial jobs requires less than three times the resting energy expenditure (<3 METs), thus can mostly be classified as light work.[52] However, frequently the work requirement varies during the day, so in case of uncertainty, the requirement can be objectified directly at the workplace. A controlled field study analysed the objective cardiovascular demands of a small cohort of construction workers by registration of heart rate and oxygen consumption during several work tasks by using portable oxygen uptake and heart rate monitors.[53] In comparison to other on-site field measurements (i.e. field measurements in ICD patients), the approach of continuous registration of physical activity energy expenditure by wearable trackers, ideally over a longer period can be helpful for occupational reintegration.

Table 4. Supportive strategies for professional reintegration during CR.

- Risk stratification (identification of negative chronic occupational conditions)
- Work-related diagnosis (recording the current job characteristics)
- Multiprofessional team meetings (cardiologist, occupational physician, social worker, physiotherapist, psychologist)
- Involvement of family members
- Individual re-entry training (ergonomic interventions)
- Psycho-social counselling
- Contacting the employer, discussion of reintegration strategy
- Contact to the pension insurance, if necessary
- Organisation of financial security
- Exact recommendations in case of reintegration failure

CR: cardiac rehabilitation.

Special occupational problems

The chronic negative occupational conditions include long-term sickness absence, long-term unemployment or permanent functional injuries. Under these basic conditions reintegration attempts are often frustrating. However, it can be concluded that patients have historically had to cope with these conditions on their own. If a problematic judgement of fitness to work is to be feared, various expanded reintegration strategies including prolonged rehabilitation, stepwise integration or retraining are being considered (see Table 4).

Expanded CR/aftercare programmes

Expanded CR including aftercare prevention programmes enables the sustainability of medical rehabilitation services and serves as a bridge between temporally limited CR and the everyday lives of rehabilitants.[54] Across EU nations very few prolonged rehabilitation options are offered by health insurances or other official funding institutions. In a Swedish registry, person-centred care interventions for 6 months have been successfully implemented for prolonged care after ACS, leading to an improved RTW rate.[55] In Germany, several follow-up programmes (IRENA: intensive rehabilitation aftercare; BERONA: occupationally oriented rehabilitation aftercare; IMBORENA: intensified medically and professionally oriented rehabilitation care) have been implemented since 2001. The IRENA is a part-time offer of the German pension insurance, which is organised by a rehabilitation institution. Patients extra-occupationally perform up to 24 additional appointments including an exercise programme, health education and nutrition advice in a period of up to one year after the end of the initial medical rehabilitation. By participating in the IRENA, a positive effect on the reintegration rate was demonstrated (70.2% of the IRENA group vs. 52.6% of the control group within 2 years).[56]

Particularly for professional intensively involved patients, rehabilitation programmes using new digital technologies (web-based, non-presence programmes) may be helpful in continuing the rehabilitation programme despite the lack of time. Cardiac telerehabilitation is a novel CR strategy, which has been proved to be both effective and cost-efficient.[57] As this eHealth based form of CR is delivered remotely, it allows patients to restart working while at the same time engage in ongoing tele-CR. As cardiac telerehabilitation has been proved to induce health benefits also in the long term, this care strategy is a valuable additional mode of CR delivery. Thus existing analogue modalities could be used and increase the acceptance of the aftercare programmes. Further supplementary services offered include rehabilitation sports in a cardiac rehab group and functional training up to 2 years, financed by health insurance companies.

Part-time (stepwise) reintegration

Part-time or stepwise reintegration is aimed at bringing 'work-incapacitated' insured persons who are only partially able to perform their previous activities to 'full-time work'. This model is used in various somatic and neuropsychiatric disorders.[58] The concept is based on a continuous increase in the daily number of hours of work until full-time work, whereby the type of activities can also be modified. It is arranged in agreement between the employee, the employer, the treating physician, the physician of the rehabilitation facility, the company physician and the service provider. The dominant role is taken by the cardiologist in the rehabilitation clinic. This creates a reintegration plan with the patient based on the discharge parameters. Further modifications can be made in the course by the family doctor or the continuing medical specialist.

Stepwise reintegration is predominately an offer of healthcare providers in some EU countries where it has been found to be successfully implemented when performed frequently, but in general it is unusual at a wider European level.

Recommendations on RTW across European countries

Due to the heterogeneity or a lack of national guidelines, existing legislations, funding, health systems and cultures across the 28 members of the European Union (EU) the RTW recommendations differ substantially between the countries. Until now, there are no uniform laws or guidelines for occupational reintegration for

ACS patients at the European level. The European Society of Cardiology (ESC) guidelines for the management of acute coronary syndromes exclusively focus on the clinical aspect of acute care.[59] The European Association of Preventive Cardiology has also not given any comments in this respect. In 2016, the European Agency for Safety and Health at Work published an extensive document regarding the rehabilitation and RTW as an analysis report on EU and Member States policies, strategies and programmes.[60] The European Union of Medical specialists (UEMS, section of specialists in occupational medicine) focuses on the risk of work-related illnesses, but not on scientific research of improved reintegration after illness. The efforts to return to work in the EU was analysed in 2010, comparing 13 European countries, but no recent data are available.[61] The ICF (International Classification of Functioning, Disability and Health) model is rarely used to describe individual impairment and disability as well as the activity and participation domains in the context of environmental factors.[62] Even on a national level for the majority of European countries clear directives are missing. The guidelines produced by the Italian Society of Occupational Medicine and Industrial Hygiene (SIMLII; Società Italiana di Medicina del Lavoro e Igiene Industriale), through the Consortium for Accreditation and Updating in Occupational Medicine focus firstly on the definition of judgement of fitness for a specific job.[63] The Scandinavian countries (Sweden, Finland, Norway, Iceland and Denmark) are characterised by a high scientific output regarding RTW.[64] This is made possible by a specific system of recording of the population (unique identification number for each inhabitant). Demographics and health data are kept in national registers, which can be used scientifically for statistical research purposes.

Recently, a comparison between intervention policies and social security in the case of reduced working capacity in The Netherlands, Finland and Germany has been reported.[65] However, no validated models are yet available on which the RTW probability can be controlled or predicted from the EU. This emphasises the urgent need for the creation of a central European statement and of practical recommendations for occupational cardiologists and all contributors.

Driving ability after ACS: current status in Europe

For the 300 million drivers across the EU, since January 2013 a new European driving licence has been introduced by the European Commission.[66] However, until now, except for the European Heart Rhythm Association (EHRA) task force on ICD and driving there is no uniform driving policy within Europe for patients with cardiovascular diseases.[67] Even so, there are no published reviews and comparisons regarding national concepts, helping to harmonise driving licence regulations in the EU for patients. While the American Heart Association (AHA) and the North American Society for Pacing and Electrophysiology (NASPE) has formulated a scientific statement for personal and public safety issues related to arrhythmias, a common European guideline is urgently needed.[68] The recommendations on driving licences are mainly based on data from prospective non-randomised observational studies. The driving ability of patients after ACS is aligned to the group of driving classes, the remaining left ventricular function and the duration of the arrhythmia-free interval.

In general, a distinction is made between private (cars and motorcycles, group 1) and professional drivers (trucks/lorries, bus driver, pilot, taxi driver group 2).[69, 70] The driving ability of patients with coronary heart disease is primarily aligned to their haemodynamic stability, the duration of the arrhythmia-free interval and the group of driving classes.[71] A substantial UK fitness to drive recommendation has recently been published, covering multiple cardiovascular disorders including ACS. In this guidance, an exercise tolerance testing is required for group 2 drivers (cycling for 10 minutes with 20 W per minute increments, to a total of 200 W or CPX with completed three stages of the standard Bruce protocol or equivalent safely, without of signs of cardiovascular dysfunction).[72] However, until now every European country has published their own statement, which continues to be legally binding.

Call for action

There is a clear need to internationalise the knowledge of a country-specific framework in occupational medicine. Regardless of the political background of the individual European countries a harmonised common approach should be sought. In particular, it is essential to understand whether different systems in Europe are comparable. At the country level this includes factors such as the participation rate in cardiological rehabilitation, objectification of the RTW rate, recording of the respective reintegration strategies (organisational, in-house, financial and medical) and the long-term success rate in professional reintegration. Here, individual subgroups (younger and advanced age, gender, comorbidities, type and treatment of the index event) should be considered differentiated. All national data should be analysed by a European scientific board to create a practical approach to synergise current initiatives. Subsequently, multinational prospective registries can be performed to investigate the enforceability of these strategies. Structures that have objectively emerged as

the most effective have to be adapted to the underlying social, environmental, cultural and economic conditions of the individual countries. In summary, there is a need for action from the national cardiological societies to build the evidence base across countries to address further evidence-based decision-making on a European level.

Conclusion

For patients after ACS RTW requires increased efforts and should preferably be performed without any delay after completion of the post-infarction rehabilitation programme. In addition to cardiological factors, the reintegration of patients is primarily determined by psycho-cognitive and work-related parameters. Throughout European countries a considerable inconsistency regarding the CR process, RTW rate, length of sick leaves and psychosocial support can be determined. Due to the increasing spatial and political fusion of the EU a transnational ESC recommendation for RTW after acute cardiac events including a homogenised driving ability recommendation is very desirable.

Author contribution

RR, AS, PD, AA and HV contributed to the conception and design of the work. All authors contributed to the acquisition, analysis, or interpretation of data for the work. RR drafted the manuscript. All authors critically revised the manuscript. All authors gave final approval and agree to be accountable for all aspects of the work ensuring integrity and accuracy.

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