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

Rona Reibis1,2, Annett Salzwedel1, Ana Abreu3, Ugo Corra4, Constantinos Davos5, Wolfram Doehner6,7,8, Patrick Doherty9, Ines Frederix10,11,12, Dominique Hansen13, Marie Christine Iliou14, Carlo Vigorito15 and Heinz Völler1,16; for the Secondary Prevention and Rehabilitation Section of the European Association of Preventive Cardiology (EAPC)

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 (VO2 peak) and performed metabolic equivalents (METs). Recent data indicate that the particular minute ventilation (VE/VCO2) slope determined by CPET is of high predictive value in determining RTW rates (VE/VCO2 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 ‘Ludwigshafener 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 (VO2). 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 VO2, German recommendations.

<table>
<thead>
<tr>
<th>Maximum capacity on the ergometer14</th>
<th>Maximum capacity in relation to BW</th>
<th>Endurance capacity on the ergometer</th>
<th>Estimated energy expenditure (METs)*15</th>
<th>Work intensity</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;50 Watts</td>
<td>About 1 Watt/kg BW</td>
<td>Up to 50 Watts</td>
<td>&lt;3.1</td>
<td>Very light</td>
</tr>
<tr>
<td>&gt;50–75 Watts</td>
<td>&gt;1–1.5 Watts/kg BW</td>
<td>&gt;50–75 Watts</td>
<td>&lt;4.3</td>
<td>Light</td>
</tr>
<tr>
<td>&gt;75–125 Watts</td>
<td>&gt;1.5–2 Watts/kg BW</td>
<td>&gt;75–100 Watts</td>
<td>&lt;6.4</td>
<td>Moderate</td>
</tr>
<tr>
<td>125–150 Watts</td>
<td>&gt;2 Watts/kg BW</td>
<td>&gt;100 Watts</td>
<td>&lt;7.4</td>
<td>Heavy</td>
</tr>
</tbody>
</table>

BW: body weight; MET: metabolic equivalent.

*Exemplary for patients with a body weight of 80kg (adapted from Lollgen14 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. 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. Patients experiencing a complication (CABG) showed a more pronounced cognitive decline after intervention. Patients experiencing a complicated ACS (out of hospital cardiac arrest (OHCA), acute aorto-coronary bypass grafting or post-infarctional heart failure) require a complex, multi-modal reintegration concept for improving the RTW rate. A French working group analysed the prevalence and factors associated with RTW in OHCA survivors. 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%. Interestingly, congestive heart failure at admission was unrelated to work resumption, as well as the initial coronary intervention (PCI or CABG). 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.

**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. 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. 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. 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. 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.

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.

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 VO2peak. 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. 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). In particular, the hospital anxiety and depression scale is widely used and lower score values have been shown to increase the probability of RTW. 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).

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

<table>
<thead>
<tr>
<th>Questionnaire</th>
<th>Abbreviation</th>
<th>Focus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospital anxiety and depression scale</td>
<td>HADS</td>
<td>Measurement of anxiety and depression in a general medical population of patients</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Anxiety and depression subscales</td>
</tr>
<tr>
<td>Occupational stress inventory</td>
<td>OSI-R</td>
<td>Measurement of occupational stress, psychological strain and coping resources</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Three sections:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Occupational role questionnaire (ORQ)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Personal strain questionnaire (PSQ)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Personal resources questionnaire (PRQ)</td>
</tr>
<tr>
<td>Obstacles to return to work questionnaire</td>
<td>ORTWQ</td>
<td>Multidimensional, including biopsychosocial and environmental factors</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- 55 Items, grouped into nine subscales</td>
</tr>
<tr>
<td>Patient health questionnaire</td>
<td>PHQ-9</td>
<td>Depression module of PHQ-D to detect depression and assess severity in a somatic medical population of patients</td>
</tr>
<tr>
<td>Return-to-work self-efficacy</td>
<td>RTWSE-19</td>
<td>Self-estimation of the worker’s confidence in meeting job demands and their own ability to return to work</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- 19 Items</td>
</tr>
<tr>
<td>Work ability index</td>
<td>WAI</td>
<td>Own prognosis of their work ability in 2 years’ time</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Work ability in relation to the demands of the job</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Estimated impairment owing to diseases/illnesses or limiting conditions</td>
</tr>
</tbody>
</table>
reintegration of patients with implanted electrical devices (cardiac pacemakers, defibrillators), especially in professions in industry, may be difficult. 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%). 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.

**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 1. Interaction of CR professional for reintegration of ACS patients.](image)

CR and RTW

Comprehensive CR is one of the core treatment components of patients after an acute coronary event. 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. 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. 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.

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. 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 cardiologist, medical examinations, coordination of CR treatments, SCD risk stratification, final cardiological assessment, communication to General Practitioner; psychologist, psycho-social counseling, registration of barriers, QOL questionnaire, cognitive-behavior therapy, short-term psycho-dynamic therapy; social worker, financial support, social support, assistance with the pension application, transport organization, family connections; physiotherapist, nurse, diettian, improvement of aerobic capacity and muscular strength, 6 minute walk test, teaching kitchen for healthy eating, care during the inpatient stay, wound management after CABG; occupational therapist, ICF classification, estimation of work energy expenditure, determination of residual work capacity, final decision on the ability to work, contact to the employer, creating a concept for re-integration.
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\(_{2\text{max}}\) (light work <25% VO\(_{2\text{max}}\), moderate 25–50% VO\(_{2\text{max}}\), heavy and very heavy >50% VO\(_{2\text{max}}\)).\(^{45}\) 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\(_{2\text{max}}\)) 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 3. Selection of the metabolic demands of occupational activities (adapted from Ainsworth et al.\(^{49}\)).

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

METs: metabolic equivalents.

*Estimated.
care after ACS, leading to an improved RTW rate.55

have been successfully implemented for prolonged
try, person-centred care interventions for 6 months
or other official funding institutions. In a Swedish regis-
rehabilitation options are offered by health insurances
the initial medical rehabilitation. By participating in the
exercise programme, health education and nutrition
perform up to 24 additional appointments including an
rehabilitation institution. Patients extra-occupationally
German pension insurance, which is organised by a
IMBORENA: intensified medically and professionally
ationally oriented rehabilitation aftercare;
BERONA: occupa-
tionally 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 pro-
gramme despite the lack of time. Cardiac telerehabilita-
tion 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 telerehabilita-
tion 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 modal-
ities could be used and increase the acceptance of the
aftercare programmes. Further supplementary services
offered include rehabilitation sports in a cardiac rehab
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 par-
tially 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 phys-
ician, the physician of the rehabilitation facility, the
company physician and the service provider. The dom-
inant role is taken by the cardiologist in the rehabilita-
tion 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 per-
formed 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 guide-
lines, 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

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**Table 4. Supportive strategies for professional reintegration during CR.**

- Risk stratification (identification of negative chronic occupa-
tional 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.

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**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 histor-
ically 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 pro-
grammes enables the sustainability of medical rehabili-
tation services and serves as a bridge between temporally limited CR and the everyday lives of reha-
bilitants.54 Across EU nations very few prolonged rehabilitation options are offered by health insurances
or other official funding institutions. In a Swedish regist-
try, 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: occupa-
tionally 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

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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. 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. 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. 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. 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. The Scandinavian countries (Sweden, Finland, Norway, Iceland and Denmark) are characterised by a high scientific output regarding RTW. 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. 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. 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. 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. 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). 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. 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

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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