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Title: Factors Associated with Return to Work Following Myocardial Infarction: A Systematic Review of Observational Studies

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WS and LG conceived and designed the study, and contributed to data searching strategy. WS and KK extracted the data. WS and MH assessed quality of studies. WS analysed the data and drafted the manuscript. LG, LP, KK and MH made critical revisions to the manuscript for important intellectual content. All authors approved the final version to be submitted.

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Factors Associated with Return to Work Following Myocardial Infarction: A Systematic Review of Observational Studies

ABSTRACT

Objectives: To identify and critically synthesise literature on return to work of patients following a myocardial infarction, and to identify factors that are associated with this.

Background: Understanding when patients return to work after myocardial infarction and what factors are associated with this may be helpful in designing person-centred treatment plans to facilitate patients' rehabilitation and return to work.

Design: A narrative systematic review.

Review methods: Six databases, MEDLINE, CINAHL, Academic Search Complete, EMBASE, SCOPUS, and ProQuest Health and Medicine, and the search engine Google were searched to retrieve peer-reviewed articles published in English from January 2008 to January 2020. In total 22,217 papers were sourced and screened, with 18 papers retained for quality appraisal using the Joanna Briggs Institute Critical Appraisal Tools.

Results: The mean time to return to work varied between 46 and 192 days; about half the participants resumed work by three months. Patients who were male, younger, educated, non-manual workers or owned their own business, and those who evaluated their general and mental health highly, had shorter hospitalisation, fewer comorbidities, complications and mental health issues, were more likely to return to work after myocardial infarction.

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Conclusion & relevance to clinical practice: Findings may help nurses detect patients at increased risk of failure to return to work, and provide appropriate support to facilitate this.

Key words: myocardial infarction; return to work; rehabilitation; modifiable factors; nursing.

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What does this paper contribute to the wider global clinical community?

- Return to work is an important outcome from the perspectives of patients, healthcare systems and the wider community.
- It is known that despite advances in the treatment and management of myocardial infarction over the last decades, return to work rates have not changed much for these patients.
- About half of those affected return to work within three months following their myocardial infarction.
- Individual, healthcare and work-related factors associated with return to work post myocardial infarction were identified.

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INTRODUCTION

In 2016, coronary heart disease (CHD) was the leading cause of death on a global scale with a crude death rate of 126 per 100,000 (World Health Organisation, 2018). Myocardial infarction (MI) is the commonest life-threatening manifestation of CHD. Around every 40 seconds a person in the United States (US) develops a MI, and about 14% die as a result within the first year post-MI (Benjamin et al., 2019). In Australia, around 7,300 people lost their lives to MI in 2018: equivalent to an average of 20 deaths each day (Australian Bureau of Statistics, 2019). MI not only results in sudden death, it can also result in disabilities due to the development of functional or cognitive complications, such as arrhythmias, heart failure, depression, and anxiety. These adverse outcomes may negatively affect the health-related quality of life (HRQOL) of survivors and their families.

Return to work (RTW) is an important outcome for patients post-MI but associated complications result in some patients being unable to return to their previous employment, or their RTW process may be delayed. This can impose significant financial burden on individuals and the community, considering that approximately 45% of patients with MI are younger than 65 years old (Babić et al., 2015; Mirmohammadi et al., 2014; Laut et al., 2014; Stendardo et al., 2018). Between 2017 and 2018, around 33,000 patients who developed MI in Australia were under the age of 55 (Australian Bureau of Statistics, 2018).

From a health economic perspective, CHD is associated with significant direct and indirect costs. It imposes a significant economic burden on healthcare systems in many countries. In the United Kingdom (UK), for example, CHD cost the healthcare system about £1.8 billion in 2009 (Townsend et al., 2012); US costs in 2010 were estimated at US$96 billion (Lloyd-Jones et al., 2010), and in Australia in 2008-2009 health expenditure on CHD was estimated at AU$2.03 billion (Australian Institute of Health and Welfare, 2014). CHD also causes productivity losses for industry. In 2009, production losses due to mortality and morbidity associated with CHD cost the UK over £3 billion (Townsend et al., 2012). Within the European Union, around 90 million working days a year were estimated to be lost due to CHD (Leal et al., 2006). In Australia, similar productivity losses amounted to about AU$1.79 billion in 2004 (Zheng, Ehrlich & Amin, 2010). MI was estimated to cost over AU$1.55 billion in total in Australia between 2017 and 2018 (Saunders, 2018). RTW after MI is clearly important from socio-economic perspectives, and attention to this outcome can help reduce costs for the healthcare industry as well as productivity losses generally.

RTW may be important both for younger patients with a career or work-life still ahead of them and for older people who are not ready to retire from work when they experience MI. From patients' perspectives, inability to RTW or extended sickness absence post-MI can

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produce an economic burden for themselves and their families. People of working age who live with chronic disease may not be considered employable (Şahan et al., 2016). Their income may be drastically reduced, and they may face financial difficulties (Şahan et al., 2016). Conversely, having a job may provide an income that covers patients' living expenses and healthcare costs (where applicable) (Waszkowska & Szymczak, 2009). In some countries where patients are charged the full, unsubsidised, cost of medications, those who delay or do not RTW after MI may experience adverse health outcomes as they may not afford medications and further treatment.

MI can negatively affect patients' psychological health. Around 35% of patients who have acute coronary syndrome present with mild to severe depressive symptoms during hospitalisation (Fukuoka et al., 2009). Patients with MI commonly demonstrate low mood, depression, and fear of future cardiac events (Waszkowska & Szymczak, 2009). Poor mental health status is one of the main reasons for failure to RTW despite favourable physical conditions (Mirmohammadi et al., 2014). The inability to RTW because of adverse psychological conditions may aggravate the mental health of MI survivors due to feelings of disability and failure; these may be intensified by financial pressures and social isolation. By contrast, people who resume employment after MI have been found to be five times less likely to develop depression and other mental health issues than those who do not continue working (Waszkowska & Szymczak, 2009). Furthermore, RTW after MI can fulfil individuals' ambitions, enhance self-esteem, positively influence individuals' social position and contribute to high self-assessment (Stendardo et al., 2018; Waszkowska & Szymczak, 2009).

Cardiac rehabilitation is a significant component of the management of patients who survive an MI, to optimise patients' recovery from the associated pathophysiological and psychosocial complications of MI. RTW after MI is frequently considered an important behavioural and functional measure of the effectiveness of cardiac rehabilitation, indicative of patients' recovery and return to normal life (Dreyer et al., 2016; Waszkowska & Szymczak, 2009).

Nonetheless, despite significant advances in the diagnosis and treatment of CHD in recent decades, RTW rates have remained unchanged (Mirmohammadi et al., 2014). Understanding when patients RTW after MI and what factors are associated with patients' RTW can be helpful in designing person-centred treatment plans to help patients resume employment, which in turn may improve their mental health status and HRQOL, and benefit healthcare systems. Consequently, this systematic review aimed to determine when patients

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RTW after MI and what factors are associated with the decision to do this. For the purposes of this review, all study definitions of RTW were accepted.

AIMS

The aims of this review were 1) to identify and critically synthesise literature on return to work of patients following a myocardial infarction, and 2) to identify both facilitating and inhibiting factors that are associated with return to work after myocardial infarction.

METHODS

Design

This was a narrative systematic review, undertaken in line with the Joanna Briggs Institute (JBI) Reviewer's Manual (2017 version) and PRISMA checklist (Moher et al., 2009) (Supplementary file 1). It was registered with the JBI Systematic Review Register and PROSPERO International prospective register of systematic reviews.

Search strategy

In consultation with a health librarian, a search strategy was designed to identify relevant articles that assessed RTW and factors that are related to this in patients post-MI. Electronic databases searched were MEDLINE, CINAHL, Academic Search Complete, EMBASE, SCOPUS, and ProQuest Health and Medicine, and the Google search engine. Search terms were identified using the P and O components of the PICO framework (patient, population or problem, intervention, comparison, and outcome) and MeSH terms, where available. The search terms were: [myocardial infarction* OR myocardial infarct* OR heart attack*] AND [work OR job OR career OR occupation OR employment], searching in the 'title' and 'abstract' only.

Inclusion and exclusion criteria

Searches sought peer-reviewed studies published between January 2008 and January 2020 to ensure that findings reflected contemporary trends of RTW after MI. If the topic of the study focused on acute coronary syndrome, CHD, or ischemic heart disease, the full text was reviewed and only studies that detailed results about RTW in patients with MI were included. Studies did not need to use the phrase 'RTW' specifically, and use of equivalent terms, such as work resumption, work disability, and sickness absence were also accepted. Both quantitative and qualitative studies were included. There were no limitations on the

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follow-up period or type of MI – for example, acute / recurrent MI, or ST segment elevation MI / non-ST segment elevation MI. All definitions of RTW applied in studies were accepted.

Articles published in languages other than English were excluded. Only peer-reviewed primary studies were included; publications such as conference abstracts, discussion papers and letters to the editor were excluded. Reference lists of included studies and excluded reviews were checked for relevant papers. Interventional studies, including randomised controlled trials, that involved medical, pharmacological or psychosocial interventions with RTW as a trial outcome were excluded.

Search outcome

The database searches yielded 22,217 citations of potential relevance, with one additional citation identified searching Google. Duplicated references were removed, leaving 15,133 records for screening. After screening study titles and abstracts for relevance, 160 studies remained. The full text of these papers was reviewed, and review studies, interventional studies, book chapters, conference abstracts, letters to the editor, editorial articles, irrelevant content studies, and non-English language articles were removed. In total, 18 studies conformed to the inclusion criteria (Figure 1).

Quality appraisal

The quality of included studies was appraised by two authors independently using the JBI Critical Appraisal Tools. A third author compared the appraisal results, and any disagreements were discussed between two authors to achieve a consensus. All 18 studies were retained for the review (Table 1 & 2).

Data abstraction

Data abstraction was undertaken independently by two authors, using a pre-developed template which included data on authors, year, country, study design, sample information, factors controlled for, follow-up period, and main findings (Table 3). A third author examined and compared the extracted data, and any differences were resolved by consensus through discussion by two authors.

Data analysis

Due to significant heterogeneity among the studies, including in participants' characteristics, definitions of RTW, and follow-up periods, meta-analysis was not appropriate and data were analysed descriptively. A convergent integrated approach was used to synthesise data based on the JBI Reviewer's Manual (2017 version). The author group developed and

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agreed on a structure based on the research questions to guide the process of summarising findings descriptively. The findings reported included mean and median timings of RTW and RTW at specified follow-up points. Using content analysis text describing the factors related to RTW were categorised into individual, healthcare and work-related factors. Within the individual category, three sub-categories were identified, of socio-demographic, behavioural, and disease and health-related factors. The frequencies with which studies examined and demonstrated significant associations between specific categories and variables with RTW were counted (Popay et al., 2006).

RESULTS

The 18 studies included in this review were conducted across four different continents. Twelve originated from Europe, three from Asia, and one study from North America; two studies were carried out multi-nationally, one in the US and Japan, and the other in the US, Spain, and Australia. Only one study used qualitative design (Şahan et al., 2016). The sample size varied from 12 (Şahan et al., 2016) to 22,394 (Smedegaard et al., 2017) participants. In the qualitative study (Şahan et al., 2016), the mean age of participants was younger than 45 years. Two studies recruited only male participants (Şahan et al., 2016; Waszkowska & Szymczak, 2009), and only one recruited more female than male participants (Dreyer et al., 2016).

Nine studies provided a definition for RTW. In five studies 'work' was considered to refer to full-time or part-time working, or working hours were identified (Attarchi et al., 2012; Fukuoka et al., 2009; Jiang et al., 2018; Laut et al., 2014; Warraich et al., 2018). One study considered participants engaged in paid work (Dreyer et al., 2016). RTW was variously defined: as no social benefit payments received from the Denmark government for four consecutive weeks or at least one week (Laut et al., 2014; Smedegaard et al., 2017), respectively; as "employment status resumption" without further explanation (Stendardo et al., 2018, p. 3). Long-term sickness absence post-MI was defined as > 90 gross days of sick days taken by the individuals recorded by the Social Insurance Agency of Sweden (Wang et al., 2019).

Mean and median timing of RTW post-MI

Six studies reported the mean time to RTW post-MI, ranging from 46 days (SD=4.12) in Iran (Mirmohammadi et al., 2014) to 192 days (SD=17.7) in Spain (Tella et al., 2017). With a follow-up period of 12 months, Stendardo et al. (2018) reported the median time to RTW post-MI of 44 (IQR 33 to 88) days in Italy; Tella et al. (2017), following up participants until

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their first RTW, death or the end of the study, reported median 131 (range 102.1 to 159.9) days in Spain.

RTW at specified follow-up points

Five studies reported the percentage of participants who RTW within a one month follow-up period, which varied from 21.5% to 41.7%, with the lowest and highest proportions of patients to RTW in Italy and Denmark, respectively (Attarchi et al., 2012; Laut et al., 2014; Mirmohammadi et al., 2014; Smedegaard et al., 2017; Stendardo et al., 2018). Three studies reported the percentage of patients who RTW within two months of follow-up, at 53.1%, 59.2% and 60% of participants (Attarchi et al., 2012; Stendardo et al., 2018; Mirmohammadi et al., 2014), respectively. Two studies reported the percentage of patients who RTW within three months of follow-up, at 46.2% and 62.5% of participants (de Jonge et al., 2014; Attarchi et al., 2012), respectively. However, Attarchi et al. (2012) only recruited patients who experienced first time MI, but de Jonge et al. (2014) did not apply any such restriction. Three studies reported the percentage of patients who RTW within six months of follow-up: all were above 70% (Attarchi et al., 2012; Brink et al., 2008; Fukuoka et al., 2009).

Of eight studies that followed participants for 12 months, seven reported the percentage of patients who RTW exceeding 70% (de Jonge et al., 2014; Dreyer et al., 2016; Laut et al., 2014; Mirmohammadi et al., 2014; Smedegaard et al., 2017; Stendardo et al., 2018; Warraich et al., 2018) with the remaining study at 55.9% of patients (Jiang et al., 2018). In three of these eight studies that examined this, the proportion of patients who RTW at one year follow-up reached 90% (Warraich et al., 2018; Smedegaard et al., 2017; Stendardo et al., 2018).

Factors associated with RTW post-MI

Studies focused on identifying factors that influenced RTW among MI patients, and these were categorised as individual, healthcare, and work-related factors (Table 4).

Individual factors

Significant individual factors were presented under the sub-categories of socio-demographic, behavioural, and disease and health-related factors.

Socio-demographic factors

Consistently, a link was demonstrated between older age and lesser likelihood of RTW. Seven studies that investigated this demonstrated strong associations between age and RTW, all of which linked increasing age with reducing proportions of patients who RTW

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(Attarchi et al., 2012; Brink et al., 2008; de Jonge et al., 2014; Isaaz et al., 2010; Jiang et al., 2018; Laut et al., 2014; Waszkowska & Szymczak, 2009).

Male gender was strongly associated with greater RTW in seven of the eight studies that examined this (Dreyer et al., 2016; Duijts et al., 2017; Isaaz et al., 2010; Jiang et al., 2018; Şahan et al., 2016; Smedegaard et al., 2017; Warraich et al., 2018). The remaining study reported men as less likely to RTW than women after controlling for confounding factors (Laut et al., 2014). This Scandinavian population study extracted data from the national payment database and recruited relatively more females than many other studies (Laut et al., 2014). Wang et al. (2019) reported women were more likely to experience long-term sickness absence post-MI, which may have contributed to deterred or delayed RTW.

Seven papers examined the relationship between patients' educational level and RTW; six suggested that patients with higher educational qualifications such as a university degree, were more likely to RTW than those less educated (de Jonge et al., 2014; Dreyer et al., 2016; Jiang et al., 2018; Smedegaard et al., 2017; Stendardo et al., 2018; Waszkowska & Szymczak, 2009). Similarly, lower educational levels were associated with higher rates of long-term sickness absence among patients with MI (Wang et al., 2019).

All three studies that examined social support or isolation found that patients with more social support were more likely to RTW (Dreyer et al., 2016; Şahan et al., 2016; Waszkowska & Szymczak, 2009). The association between patients' marital status and their RTW was examined in six studies, with two studies finding marriage favoured RTW (Dreyer et al., 2016; Isaaz et al., 2010). In the other four studies, most participants were married which may have led to the non-significant findings between marital status and RTW (Attarchi et al., 2012; Jiang et al., 2018; de Jonge et al., 2014; Laut et al., 2014).

Dreyer et al. (2016) assessed the association between patients' financial strain and RTW in three developed countries of the US, Spain and Australia, and found that financial hardship may be linked with reduced likelihood of RTW. However, the qualitative study from a developing nation, Turkey, showed the converse, with financial stress a factor linked to RTW (Şahan et al., 2016).

Behavioural factors

Cigarette smoking was significantly linked to poorer RTW in all four studies that considered this, irrespective of whether the patients were current smokers (Attarchi et al., 2012; Dreyer et al., 2016; Warraich et al., 2018), or had a smoking history (Jiang et al., 2018). Sedentary lifestyles were similarly linked with lower work resumption, with walking more steps on a daily basis before MI significantly and positively associated with RTW (Brink et al., 2008).

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Disease and health-related factors

Four studies examined links between myocardial wall damage and patients' RTW. Two found a strong association between the location of MI and RTW, with patients who experienced anterior heart wall damage more likely to RTW (de Jonge et al., 2014; Jiang et al., 2018) compared with damage in other locations, but the other two studies found no such association (Attarchi et al., 2012; Isaaz et al., 2010). Four of six studies that assessed the relationship between left ventricular ejection fraction (LVEF) and RTW found LVEF strongly linked to RTW (Attarchi et al., 2012; de Jonge et al., 2014; Dreyer et al., 2016; Mirmohammadi et al., 2014). In these studies, patients who maintained an LVEF ≥ 40% were more likely to RTW than those with lower LVEF (Attarchi et al., 2012; de Jonge et al., 2014; Dreyer et al., 2016; Mirmohammadi et al., 2014). One study reported that patients who suffered chest pain and experienced their MI during the daytime had a lower probability of RTW than those who experienced chest pain after seven o'clock at night (Isaaz et al., 2010).

Four of five studies that examined associations between diabetes and RTW found that it was significantly linked with poorer RTW (Attarchi et al., 2012; Dreyer et al., 2016; Smedegaard et al., 2017; Warraich et al., 2018). Four studies that studied associations between proportions of patients with hypertension and patients who RTW post-MI all reported consistent negative associations (Attarchi et al., 2012; Dreyer et al., 2016; Jiang et al., 2018; Warraich et al., 2018). Likewise, participants with hypertension were more likely to have taken sickness absence exceeding 90 days post-MI (Wang et al., 2019). These results are consistent with those of Dreyer et al. (2016), who reported that patients with fewer rather than greater co-morbid disease risk factors in total were more likely to RTW. However, these findings were contradicted by Isaaz et al. (2010), who reported patients who RTW with more risk factors than those who did not.

All three studies that examined relationships between perceived general health and RTW post-MI found that better self-perceived general health significantly predicted greater likelihood of RTW (Brink et al., 2008; Duijts et al., 2017; Waszkowska & Szymczak, 2009). Two of these studies also found better self-reported physical health attended by higher probability of RTW (Brink et al., 2008; Waszkowska & Szymczak, 2009). In the qualitative study by Şahan et al. (2016), seven of 12 participants felt physically weaker after MI, and wanted to leave the labour market permanently.

Depression was negatively related to RTW in all five studies that examined this (de Jonge et al., 2014; Dreyer et al., 2016; Stendardo et al., 2018; Warraich et al., 2018; Waszkowska & Szymczak, 2009). Three of these studies also examined relationships between anxiety and RTW: two of which found that those who were less anxious were significantly more likely to

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RTW (Stendardo et al., 2018; Waszkowska & Szymczak, 2009). Wang et al. (2019) found that participants with depression and anxiety reported greater likelihood to delay their RTW. One study examined the association between stress and RTW, and found that participants who perceived less stress were more likely to RTW (Dreyer et al., 2016). In three studies (Duijts et al., 2017; Jiang et al., 2018; Mirmohammadi et al., 2013), the patient's preference to not RTW was a reason for not resuming work after MI.

Healthcare factors

Four studies evaluated relationships between the duration of hospital stay and RTW, with three studies finding shorter hospital stay post-MI predicted significantly greater likelihood of RTW (Attarchi et al., 2012; Dreyer et al., 2016; Jiang et al., 2018). The relationship between the time taken before calling an ambulance following the experience of chest pain and RTW was reported in only one study (Isaaz et al., 2010), which found that patients with a longer wait time before calling were more likely to RTW. Health care system delay, defined as the time from the first call for emergency service to receiving percutaneous coronary intervention (PCI), was significantly linked with work resumption after MI, with a higher proportion of patients with delay ≤ 120 minutes achieving RTW than those with system delay > 120 minutes (Laut et al., 2014).

Two studies examined the effects of coronary artery bypass graft (CABG) on RTW post-MI. The grafted group reported significantly higher rates of RTW than patients who did not undergo CABG (Attarchi et al., 2012). Participants who received CABG were also significantly more likely to take sick leave > 90 days than those who received PCI (Wang et al., 2019). Three other studies compared RTW rates between patients who had and had not undergone PCI, none of which found a significant difference in RTW rates (Jiang et al., 2018; Smedegaard et al., 2017; Warraich et al., 2018). However, one study found a significantly higher proportion of patients RTW if they received PCI with drug-eluting compared to plain stents (Warraich et al., 2018).

Three studies compared the rates of RTW between patients who participated in a CR program and those who did not, two of which failed to show a statistically significant difference between groups (Babić et al., 2015; Isaaz et al., 2010). However, Dreyer et al. (2016) reported that participants who completed CR were significantly more likely to RTW than those who did not. Lastly, the advice that patients received from their doctors about RTW seemed to positively or negatively affect their decision about resuming work (Mirmohammadi et al., 2013; Şahan et al., 2016).

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Work-related factors

Five studies evaluated the relationship between patients' work types and their RTW status, with results consistently showing that professional and non-manual office workers were significantly more likely to RTW than those working in physically demanding occupations (Attarchi et al., 2012; de Jonge et al., 2014; Dreyer et al., 2016; Isaaz et al., 2010; Stendardo et al., 2018). Similarly, Jiang et al. (2018) found that agricultural workers were most likely to fail to RTW. In addition, self-employed business people took the shortest duration sick leave (Babić et al., 2015; Jiang et al., 2018; Stendardo et al., 2018). Income also appeared to be linked to patients' decisions to RTW; three of four studies that examined this found that salary was a statistically significant factor for RTW. Patients with low paid jobs were less likely to RTW, or more likely to extend their sick leave compared to those with higher salaries (Babić et al., 2015; Jiang et al., 2018; Smedegaard et al., 2017). Additionally, those with high job satisfaction were significantly more likely to RTW than those with low and moderate job satisfaction (Mirmohammadi et al., 2014). In Sahan et al.'s (2016) qualitative study, half of the participants who described their job as stressful, and attributed their MI to the stress of their job, wanted to change their job to prevent recurrent MI. Lastly, job loss was reported as a reason not to RTW after MI (Babić et al., 2015; Dreyer et al., 2016; Mirmohammadi et al., 2014; Warraich et al., 2018).

DISCUSSION

This review found that the mean RTW time varied between 46 and 192 days, and about half the participants resumed work by three months. One study from Spain reported longer sick leave taken by patients with MI than apparently similar patients in studies from other countries (Tella et al., 2017), which warrants investigation.

At one month and one year follow-up, rates of RTW in patients post-MI were highest in the study from Denmark (Smedegaard et al., 2017). This study used data from the national database which comprised all details of weekly benefit payments from the Danish government. As this database was comprised of routinely collected government data, loss to follow-up was less likely, which may partially explain the higher RTW rates. The study definition of RTW (participants who had no benefit payment for one week) may be another reason for the higher RTW rates in this study (Smedegaard et al., 2017). Further, Danish policies for paid sick leave and welfare benefits might also contribute to the higher rates of RTW (Smedegaard et al., 2017).

At one year, the RTW rate was lowest in the study from China. Jiang et al. (2018) proposed that the relatively poor quantity and quality of CR services in China may explain this lower

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rate of RTW. The coercive age-based retirement policy in China, long working hours, and low pay might further discourage RTW.

In summary, exploring factors that are related to RTW, review findings suggest that patients who are male, younger, better educated, non-manual workers or owners of their own business and who highly evaluate their general and mental health, tend to have shorter hospitalisations, fewer comorbidities, complications and mental health issues, and are more likely to RTW after MI.

Review findings indicated that MI has a greater impact on the working abilities of older patients, with, for example, older patients likely to develop heart failure after MI (Shih et al., 2019). Older patients may also be more financially able to take retirement after experiencing a serious disease (Babić et al., 2015; Şahan et al., 2016). However, further research is needed to clarify if age remains a factor in RTW when other factors are controlled.

Female patients were consistently less likely to RTW compared to their male counterparts. This finding links with previous research in which women demonstrated worse physical and mental health outcomes after MI, perhaps because they were more likely to receive sub-optimal care, be older at the time of MI occurrence, and have more comorbidities compared to men (Cenko et al., 2018; Shih et al., 2019). Women might also receive less social support after MI, have greater responsibilities for provision of family care, and undertake more domestic work (Dreyer et al., 2016). Women with a career have been reported as experiencing worse work security, job control, contractual conditions, and self-perceived physical and mental health compared to men (Jiang et al., 2018). Furthermore, women were more likely to attribute the cause of their heart disease to stress (Bennett et al., 2016), and may therefore be reluctant to resume work in order to avoid work-related stressors. Significant gender differences have been seen in recovery goals post-MI. Compared to females, more males had rehabilitation goals of RTW, decreasing job strain, and improving physical function post-MI (Grande & Romppel, 2011). Additionally, although women are increasingly in employment worldwide, males still predominantly assume responsibility for families' economic well-being, as was evident in the study by Şahan et al. (2016), where men felt pressured to resume work to support themselves and their family financially.

Lower educational levels were associated with worse RTW outcomes post-MI, but future studies are needed to examine if education is independently predictive of RTW. Those with lower educational levels were more likely to work in manual sectors of the labour-market (Attarchi et al., 2012; de Jonge et al., 2014) as such work does not usually require higher education, and this could be a factor underpinning lower RTW after MI. As self-perceived poor physical health is common among those who experienced MI (Mollon & Bhattacharjee,

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2017), this may also explain the lower rates of RTW in patients with a physically demanding occupation such as farming. Further, highly educated patients may have better understanding of their disease, risk factors, and MI prognosis, while less educated patients may be more likely to attribute their MI to stress (Gholizadeh et al., 2009), which may affect their decision to resume work.

Self-employment was significantly associated with RTW. Patients who were self-employed might not be able to afford an extended period of unemployment (Stendardo et al., 2018), or for those who own businesses, absence from work for long periods (Babić et al., 2015). Self-employed patients may also have more flexibility in adjusting their workload to their health condition (Stendardo et al., 2018).

Many factors related to RTW may reflect patients' severity of injury from their MI. For example, diabetes, hypertension, and lower LVEF after MI were linked with lower work resumption, but each may be a marker of disease severity. Diabetes in patients with MI has been linked with higher mortality and greater risks of further cardiac events than experienced by those without diabetes (Murcia et al., 2004). Patients who experience MI with subsequent LVEF < 40% have been reported with worse HRQOL and self-evaluated general health, and higher probability of sudden death and overall mortality than those with LVEF ≥ 40% (Pettersen et al., 2008; Shiga et al., 2008). These factors may also indicate poorer physical health status after MI, also negatively linked with CHD outcomes such as higher hospital readmission and mortality rates (Wang, Jiang & Lee, 2016). Similarly, patients who self-rated their general and physical health as poor had lower rates of RTW than those who self-evaluated their physical and general health favourably. Clinical features such as longer hospitalisation may imply greater severity of injury and/or in-hospital complications, also associated with decreased functional capacity, adverse outcomes, and higher mortality in MI survivors (Agarwal et al., 2015; Saczynski et al., 2010).

As in this review, smokers were shown to have adverse long-term MI outcomes, such as worse HRQOL, higher mortality, and higher probability of developing heart failure and other adverse cardiac events than those without a smoking history (Buchanan et al., 2015; Haig et al., 2019). Smoking has also been associated with shorter life expectancy and greater numbers of life-years lost after MI (Bucholz et al., 2016).

This review also revealed links between failure to RTW and common mental disorders such as depression and anxiety. Within the wider literature, poorer mental health status predicts worse recovery outcomes, such as an increased risk of recurrent cardiovascular events or death (Li et al., 2019). Further research is needed to explore the link between mental health status and CHD outcomes as there remains uncertainty to what extent poorer mental health

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drives worse cardiovascular outcomes, or vice versa. The immediate contact with the ambulance service after experiencing chest pain may also reflect patients' psychological status of anxiety in the study of Isaaz et al. (2010), and this mental state may obstruct patients' work resumption. The association between depression and adverse cardiovascular events can be at least partially explained in relation to behavioural factors, particularly physical inactivity (Whooley et al., 2008). Social withdrawal and lack of engagement with physical activity are common in patients with depression (Hallgren et al., 2017), which also affects their RTW and overall cardiovascular outcomes.

Research findings on the relationships between the cumulative effects of risk factors and RTW were complex. Patients with no CVD risk factors were more likely to RTW (Dreyer et al., 2016). However, such patients commonly attributed their MI solely to their jobs, often after experiencing chest pain while they were working (Isaaz et al., 2010). Where this occurred, Isaaz et al. (2010) postulated that this was why many participants who suffered from chest pain during the day were less likely to RTW. Although more research is needed to investigate how these factors affect patients' RTW post-MI, previous studies have shown correlations between stress, including work stress, and patients' outcomes post-MI. Patients with high stress, in general, had higher risk of experiencing angina and poor general health at one year post-MI, and higher mortality at two years post-MI (Arnold et al., 2012). Patients who perceived high job strain or effort-reward imbalance (considered as a source of job strain) had a higher likelihood of experiencing cardiac death and recurrent MI or other CHD than those with low work stress (Aboa-Éboulé et al. 2011; László et al., 2010).

Another factor that appeared to affect patients' RTW after MI was the recommendation received from doctors, in that patients who were advised by their doctors not to RTW were more likely to quit their job. Conversely, an optimistic view of the patients' health condition from the cardiologist or family doctor was linked with shorter sick leave duration post-MI (Perk, 2007). Many patients fail to RTW because they lack confidence that they can work safely (Haennel & Tomczak, 2009). The degree to which doctors are trusted may influence patients' decisions whether to take their doctors' advice (Şahan et al., 2016). National and local welfare policies, or the lack of these, may also affect patients' response to their doctors in relation to RTW. This can be contrasted in the studies from Turkey, where patients reported needing to RTW for financial reasons (Şahan et al., 2016), and the Scandinavian studies where people who did not RTW received government benefits (Smedegaard et al., 2017; Wang et al., 2019).

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Future research

Included studies make it clear that further research on RTW is required. Studies are needed to better explore the relationships between gender and RTW post-MI, adjusting the gender imbalance identified in current studies. Larger sample sizes and more sophisticated analyses are required for future studies to adequately reflect the predictive power of variables for RTW. Further, more comprehensive investigation and reportage is required of factors such as smoking, exercise, self-evaluated physical and general health and other CVD risk factors not widely reported by current studies. Finally, a consensus definition could be established of RTW, and alternative methods should be explored, such as government records including welfare department data, to demonstrate patients' RTW status.

Review limitations

This review has a number of limitations. Firstly, observational studies cannot establish cause and effect relationships between factors and RTW, and only associations can be demonstrated. Exclusion of interventional studies and inclusion of articles only written in English may have meant relevant data were missed. Included studies did not always measure the effects of all potential factors for RTW, and studies did not always fully explain their methods, including details of treatments received by non-CABG and non-PCI comparative groups. The use of self-reported measures could affect the accuracy of data. Gender distribution was not balanced in most studies, with considerably higher proportions of male participants. Some studies did not justify their sample size, and small sample sizes in some studies may have affected the detection of statistically significant differences between groups. Due to heterogeneity among included studies, meta-analysis was not possible.

CONCLUSION AND RELEVANCE TO CLINICAL PRACTICE

This review reported the proportions of patients who RTW within different timeframes after MI. Findings can be used by healthcare providers as a guide when considering appropriate RTW time for their patients post-MI. They can also be used as a benchmark in development and review of rehabilitation services.

This review examined patients' work status post-MI, and identified factors that were associated with patients' RTW from the individual, healthcare, and work-related aspects. The results of the review may help healthcare professionals including nurses to detect early, while they are still hospitalised, if their patients display characteristics that tend to deter or delay RTW. They may then provide or refer patients to appropriate healthcare services to facilitate RTW, focusing on modifiable factors that meet patients' individual needs. This

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review provides new information about RTW post-MI which can inform nurses' and healthcare providers' preparation of such patients for discharge and their educatation of these patients about factors related to RTW post-MI. Findings can inform development of evidence-based clinical guidelines to assist healthcare policy-makers and providers to minimise the effects of modifiable factors negatively linked with RTW and to support RTW for patients recovering from MI.

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Table 1 Quality appraisal content derived from relevant JBI Critical Appraisal Tools (JBI 2017)

	Qualitative studies	Case control studies	Cross sectional studies	Cohort studies
Q 1	Congruity between stated philosophical perspective & research methodology	Comparable groups	Clear inclusion criteria	The two similar groups / recruited from the same population
Q 2	Congruity between research methodology & research question / objectives	Cases & controls appropriately matched	Detailed subjects & the setting	Similar exposure measurement in both groups
Q 3	Congruity between research methodology & methods used to collect data	Same criteria used for identification of cases & control	Valid & reliable measurement on the exposure	Valid & reliable exposure measurements
Q 4	Congruity between research methodology & representation & analysis of data	Valid & reliable exposure measurements	Objective & standard criteria for measurements	Confounding factors identified
Q 5	Congruity between research methodology & interpretation of results	Same exposure measurements for cases & controls	Confounding factors identified	Strategies to deal with confounders stated
Q 6	A statement locating the researcher culturally / theoretically	Confounding factors identified	Strategies to deal with confounders stated	Groups / participants free of the outcomes at the start
Q 7	Influence of researcher on research / vice-versa addressed	Strategies to deal with confounders stated	Valid & reliable outcome measurements	Valid & reliable outcome measurements
Q 8	Participants & their voices adequately represented	Standard, valid & reliable outcome measurements for cases & controls	Appropriate statistical analysis	Follow-up time reported & long enough
Q 9	Research ethical according to current criteria / recent studies & approved by an appropriate body	Long enough exposure period		Follow-up completed & loss of follow-up described

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Q 10	Conclusions drawn from the analysis / interpretation of the data	Appropriate statistical analysis		Strategies to address incomplete follow-up applied
Q 11				Appropriate statistical analysis

Abbreviations: JBI: Joanna Briggs Institute.

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Table 2 Quality appraisal of the included studies

Critical appraisal questions are based on Table 1.

Quality appraisal table for qualitative research												
Authors (Year)	**Q 1**	**Q 2**	**Q 3**	**Q 4**	**Q 5**	**Q 6**	**Q 7**	**Q 8**	**Q 9**	**Q 10**	**Overall appraisal**	
Şahan et al. (2016)	N	Y	Y	Y	Y	N	N	Y	Y	Y	INC	
Quality appraisal table for case control studies												
Authors (Year)	**Q 1**	**Q 2**	**Q 3**	**Q 4**	**Q 5**	**Q 6**	**Q 7**	**Q 8**	**Q 9**	**Q 10**	**Overall appraisal**	
Waszkowska & Szymczak (2009)	Y	Y	Y	N	N	N	N	Y	Y	Y	INC	
Quality appraisal table for cross sectional studies												
Authors (Year)	**Q 1**	**Q 2**	**Q 3**	**Q 4**	**Q 5**	**Q 6**	**Q 7**	**Q8**	**Overall Appraisal**			
Dreyer et al. (2016)	Y	Y	Y	Y	Y	Y	Y	Y	INC			
Quality appraisal table for cohort research												
Authors (Year)	**Q 1**	**Q 2**	**Q 3**	**Q 4**	**Q 5**	**Q 6**	**Q 7**	**Q 8**	**Q 9**	**Q 10**	**Q 11**	**Overall appraisal**
Attarchi et al. (2012)	Y	Y	Y	Y	Y	Y	Y	Y	Y	U	Y	INC
Babić et al.	N/A	N/A	Y	N	N	Y	Y	Y	Y	U	Y	INC

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(2015)												
Brink et al. (2008)	Y	Y	Y	Y	Y	Y	Y	Y	Y	N/A	Y	INC
de Jonge, Zuidersma & Bültmann (2014)	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	INC
Duijts et al. (2017)	Y	Y	N	Y	Y	Y	Y	Y	Y	N/A	Y	INC
Fukuoka et al. (2009)	Y	Y	Y	Y	Y	Y	Y	Y	Y	U	Y	INC
Isaaz et al. (2010)	Y	Y	Y	Y	Y	Y	N	Y	Y	N	Y	INC
Jiang et al. (2018)	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	INC
Laut et al. (2014)	Y	Y	Y	Y	Y	Y	Y	Y	Y	U	Y	INC
Mirmohammadi et al. (2014)	Y	Y	Y	N	N	Y	Y	Y	Y	N	Y	INC
Smedegaard et al. (2017)	Y	Y	Y	Y	Y	Y	Y	Y	Y	U	Y	INC
Stendardo et al. (2018)	N	N	Y	Y	Y	Y	Y	Y	Y	U	Y	INC
Tella et al. (2017)	Y	Y	Y	Y	Y	Y	N	Y	Y	U	Y	INC

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Wang et al. (2019)	Y	Y	Y	Y	Y	Y	Y	Y	U	U	Y	INC
Warraich et al. (2018)	N/A	N/A	Y	Y	Y	Y	Y	Y	Y	U	Y	INC

Abbreviations: Q: Question; **Y:** Yes; **N:** No; **N/A:** Not applicable; **U:** Unclear; **INC:** Include.

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Table 3 Characteristics of included studies

Authors (Year), Countries	Study Design	Sample Information (Age, Gender, Setting)	Factors Controlled For	Follow-up Period	Main Results
Attarchi et al. (2012), Iran	Quantitative, observational, longitudinal, survey	N = 384, Mean age: 52 years old (SD: N/A), Males: 372 (97%), Setting: a general hospital in Tehran	Age, DM, duration of hospitalisation, angina post-MI, CABG, LVEF	7 months post-MI	**79%** RTW at 7 months after MI: **68.8% vs. 10.2%** returned to full-time jobs and part-time jobs respectively. **Average days of RTW after MI:** 2.2 months. **Inhibiting factors:** older age (p<0.05), smoking (p<0.05), longer duration of hospitalisation (p<0.001), development of angina in hospital (p<0.001), history of IHD (p<0.002), hypertension (p=0.028), CABG (p<0.001), and DM (p=0.045). **Facilitating factors:** LVEF >40% (p<0.001), white-collar (p<0.001), and light work (p<0.001). **Facilitating factors in MVA:** younger age (p<0.001), shorter duration of hospitalisation (p<0.001), DM (p=0.013), no development of angina in hospital (p=0.01), no CABG (p=0.012), and LVEF >40% (p<0.001).
Babić et al. (2015), Croatia	Prospective, single-centre, open trial involving the blinded	N = 145, Mean age: 53.17 years old (SD: 7.29), Males: 128 (88.3%), Setting: Sestre Milosrdnice University	Age, lipoproteinemia, educational level	24 months post PPCI	**The average days of RTW for pts with PPCI after STEMI:** 125.83±125.04 days. **35.2%** took extended sick leave: median 17.1±6.2 vs. 3.9±2.5 days due to cardiac and non-cardiac causes respectively.

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	evaluation of the end points	Hospital Centre at Zagreb in Croatia			**Factors affected sick leave duration:** salary before (p=0.007) and after (p=0.005), STEMI, and self-evaluated QoL post STEMI (p=0.017). **Factors affecting permanent job leave:** age (p=0.009). **Facilitating factors:** white-collar or self-employed business (p=0.001). **Inhibiting factors in MVA:** older age (p<0.001), hyperlipoproteinemia (p<0.05), and lower education (p<0.05).
Brink et al. (2008), Sweden	Quantitative, longitudinal	N = 88, Mean age: 57 years old (SD: 7), Males: 65 (74%), Setting: a rural hospital in Sweden	Age, PCS, footsteps per day	4 and 6 months post-MI	**80% vs. 55%** RTW in pts who were employed before MI and all pts respectively. **Inhibiting factors:** older age (p=0.005), and more physical health issues (SHCQ) (e.g. pain (p=0.005), bodily pain (p=0.005), and fatigue (p=0.011)). **Facilitating factors:** greater physical health (SHCQ) (p=0.000). **Facilitating factors in MVA:** higher PCS (p=0.011), and more daily footsteps (p=0.033).
de Jonge, Zuidersma & Bültmann (2014), Netherlands	Prospective, cohort	N = 200, RTW group = 133, NRTW group = 40, no data on RTW = 27, Mean age: RTW group: 49.7 years old (SD: 6.7), NRTW group: 53.7 years old (SD: 9.5),	Age, gender, LVEF, depression	3 and 12 months post-MI	**46.2% vs. 76.9%** RTW at three and 12 months post-MI respectively. **Facilitating factors at three months:** higher educational degree (p<0.01), white-collar (p<0.05), and light work (p<0.01). **Facilitating factors at 12 months:** younger age (p<0.01), LVEF ≥40% (p<0.01), higher Killip Class

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		Males: RTW group: 122 (91.7%), NRTW group: 35 (87.5%), Setting: 4 hospitals north Netherlands			(p<0.05), and anterior MI (p<0.05). **Depression** (p=0.013) during the first three months post-MI significantly affected pts to not RTW at 12 months post-MI.
Dreyer et al. (2016), USA, Spain & Australia	Quantitative, observational, longitudinal	N = 1,680, Mean age: males: 48 years old (IQR: 8.0), females: 48 years old (IQR: 8.0), Males: 718 (42.7%), Setting: 103 USA, 24 Spanish, and 3 Australian hospitals	Age, gender, ethnicity, marital status, children, educational level, country, insurance, job changes, working hours per week, work type, depression, stress, social support, financial hardship, physical health, hypertension, DM, dyslipidaemia, smoking, previous CHD, BMI, STEMI, LVEF, CR, duration of hospitalisation	12 months post-MI	**86%** RTW at 12-month follow-up: **85% vs. 89%** of male and female pts respectively (p=0.02). **Facilitating factors at 12 months post-MI:** male gender (p=0.02), being married (p<0.001), higher education (p<0.001), insurance (p<0.001), not changing jobs frequently (p=0.025), working more hours (p=0.044), white-collar (p<0.0010), fewer risk factors (no DM (p=0.019), no smoking (p=0.001), LVEF ≥40% (p=0.024), and CR (p=0.007)), less depression (p<0.001), less stress (p<0.001), more social support (p=0.131), and less financial stress (p<0.001). **Facilitating factors at 12 months post-MI in MVA:** being married, white-collar, greater physical health (SF-12), and no history of CAD and hypertension.
Duijts et al. (2017), UK	Population-based, prospective,	N = 537, Diagnosed as MI = 191, Males: 157 (82.2%), Setting:	Gender, expectation of being at work after	24 months post-MI	**Inhibiting factors:** female gender (p=0.094). **Facilitating factors:** greater general health (GHQ) (p=0.042), and higher expectation of being at work

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	cohort	England	certain age		(*p*=0.074). **Facilitating in MVA:** male gender (*p*=0.018), and higher expectation of being at work (*p*=0.033).
Fukuoka et al. (2009), USA & Japan	Quantitative, prospective, longitudinal	N = 212, Diagnosed as STEMI = 121, Mean age: 53 years old (SD: 9.3), Males: 180 (84.5%), Setting: 3 hospitals in USA, 5 in Japan	Age, gender, educational level, job strain before ACS, BDI-II score, DASI	2 and 6 months post hospital admission	**86.8%** RTW post-MI.
Isaaz et al. (2010), France	Quantitative, observational, longitudinal	N = 200, Mean age: 48 years old (SD: 7), Males: 184 (92%), Setting: University Hospital of Saint-Étienne	Age, gender, chest pain onset during day time, blue collar professions, time to call ambulance service, marital status, number of risk factors, multiple vessel disease, period of hospitalisation, CR	Median 3 and half years post-MI	**76%** RTW during the follow-up. **The mean days of RTW:** 134 days (range: 7 – 990 days) after MI. **Facilitating factors:** male gender (*p*=0.025), and shorter time to call ambulance after chest pain (*p*=0.016). **Inhibiting factors:** female gender (*p*=0.025), CR (*p*<0.001), older age (*p*<0.001), onset of chest pain from seven to 19 o'clock (*p*=0.011), fewer risk factors (*p*=0.002), shorter time to call ambulance after chest pain (*p*=0.016), and blue collar (*p*=0.025). **Inhibiting in MVA:** older age (*p*=0.0001), not being married (*p*=0.046), onset of chest pain from seven to 19 o'clock (*p*=0.025), blue collar (*p*=0.026), shorter time to call ambulance after chest pain (*p*=0.031), and fewer risk factors (*p*=0.06).

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					Among pts RTW, factors affected pts' late RTW in MVA: CR (p=0.0011), blue collar (p=0.01), duration of hospitalisation (p=0.015), and TIMI flow grade 3 (p=0.022). **Factors affected pts' RTW within three months after MI (early return):** less anterior STEMI (p=0.0077), no CR (p=0.001), LVEF ≥40% (p=0.0143), and shorter duration of hospitalisation (p=0.0164).
Jiang et al. (2018), China	Quantitative, prospective, cohort	N = 1,566, Mean age: 52.2 (SD: 9.7), Males: 1,436 (91.7%), Setting: 53 hospitals in China	N/A	12 months post discharge	**55.9%** RTW within 12 months after MI: **41.5%** did not have the capacity to work, or did not want to go back to work due to MI; **19.0%** retired directly due to MI. **Inhibiting factors:** older age (p<0.001), female gender (p<0.001), farmers (p<0.001), hypertension (p=0.03), development of stroke (p=0.13), AF (p=0.47), angina (p=0.008), and infection (p=0.04) in hospital, recurrence of angina post-MI (p=0.03), lower education (p<0.001), lower salary before MI (p<0.001), longer duration of hospitalisation (p=0.04), smoking, and dyslipidaemia. **Facilitating factors:** higher education, T2DM, and anterior MI
Laut et al. (2014), Denmark	Quantitative, population-based, historical,	N = 4,061, HCSD ≤120 mins group = 2305, HCSD >120 mins group = 1756, Mean age:	HCSD >120 mins, age, gender, marriage, comorbidity,	8 years post PPCI	**29% vs. 25%** RTW in no HCSD and HCSD groups respectively at one month post PPCI. **96% vs. 94%** returned full-time jobs in no HCSD and HCSD groups respectively at one month post PPCI.

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	cohort	HCSD ≤120 mins group: 54 years old (SD: N/A), HCSD >120 mins group: 55 years old (SD: N/A), Males: HCSD ≤120 mins group: 1971 (85.5%), HCSD >120 mins group: 1465 (83.4%), Setting: Danish National Register on Public Transfer Payments	smoker, year		**87% vs. 83%** RTW in no HCSD and HCSD groups respectively at one year follow-up. **93% vs. 89%** RTW in no HCSD and HCSD groups respectively at four years follow-up. **Mean sick leave length:** 10 weeks vs. 12 weeks in no HCSD and HCSD groups respectively. **Inhibiting factors in MVA:** male gender (p<0.001), HCSD (p<0.001), and older age (p<0.05).
Mirmohammadi et al. (2014), Iran	Quantitative, observational, longitudinal	N = 174.	N/A	12 months post-MI	**30% vs. 60% vs. 77%** RTW during 40 days after MI, 50 days after MI, and at one year after MI respectively. **Mean days of RTW:** 46 ± 4.12 days. **Facilitating factors:** higher job satisfaction (p=0.35), and LVEF ≥40% (p=0.007). **Inhibiting factors:** patients' own decision (45%), Drs' advice (22.5%), and retirement (10%).
Şahan et al. (2016), Turkey	Qualitative	N = 12, Mean age: 43.9 years old, Males: 12 (100%), Setting: a university hospital coronary care unit	N/A	N/A	Most pts worked at the same job, but for less hours than before MI. **Facilitating factors:** financial stress, and male gender. **Inhibiting factors:** less social support, worse mental health, work stress, worse physical health, and Drs'

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					advice.
Smedegaard et al. (2017), Denmark	Quantitative, nationwide, retrospective, cohort	N = 22,394, Mean age: 55 years old (IQR: 49–59), Males: 18,120 (80.9%), Setting: Danish National Register on Public Transfer Payments	Age, gender, living alone, baseline income, education level, HF, arrhythmia, DM, CVA, CKD, COPD, depression, stress, coronary angiography, PPCI, CABG, period of hospitalisation	12 months post admission	**41.7% vs. 86.4% vs. 91.1%** RTW at one month after MI, three months after MI and after one year of MI respectively. **Inhibiting factors:** female gender, HF, arrhythmia, DM, CVA, and CKD. **Facilitating factors:** male gender, higher education, and higher salary.
Stendardo et al. (2018), Italy	Quantitative, prospective	N = 102, Median age: 56 years old (IQR: 50–60), Males: 90 (88.24%), Setting: The University Hospital of Ferrara	High school, university degree, METs physical performance, self-employed, HADS-D score	12 months post-MI	**21.5% vs. 59.2% vs. 92.7%** RTW at one month follow-up, two months follow-up, and after one year MI respectively. **The median days of RTW post-MI:** 44 days (IQR: 33–88). **Facilitating factors:** higher education (p=0.026), self-employed business (p<0.001), white-collar (p=0.02), lower HADS-D scores (p=0.008) and lower HADS-A scores (p=0.009). **Facilitating factors in MVA:** higher education, self-employed business, and lower HADS-D score.
Tella et al. (2017), Spain	Quantitative, observational, retrospective,	N = 497, Diagnosed as MI = 295, Mean age: 53 years old (SD: 7.4),	Age, gender, diagnosis, meds taken within one	Follow-up until the first RTW, death, or the	**The estimated mean days of RTW post-MI:** 192 days (p=0.002).

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	longitudinal	Males: 491 (90.7%), Setting: the primary care clinical records of the Lleida health region	year post-MI	end of the study 31/12/2012	
Wang et al. (2019), Sweden	Quantitative, observational, longitudinal, Prospective, cohort	N = 8,199, Males: 6,658 (81.2%), Setting: the Micro-data for analyses of social insurance (MiDAS) register	Age, gender, education level, country of birth, type of living area, family situation, previous SA and unemployment, in- and specialised outpatient care due to CMDs and other mental disorders, antidepressants, anxiolytics, sedatives, type of infarction, MSDs, DM, renal insufficiency, hypertension, stroke, cancer and other somatic disorders	3 years post-MI	**Inhibiting factors:** female gender, lower education, previous SA, previous unemployment (>180 days), MSDs, hypertension, cancer, other somatic disorders, CMDs, antidepressants, sedatives, anxiolytics, and CABG. **Inhibiting factors in MVA:** female gender, lower education, previous SA, previous unemployment (>180 days), STEMI, MSDs, hypertension, cancer, other somatic disorders, CMDs, antidepressants, sedatives, anxiolytics, and CABG.
Warraich et al.	Quantitative,	N = 9,319, Mean age:	Age, gender, race,	6 weeks, and 6,	**10%** had a worse employment condition at one year

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(2018), USA	observational, longitudinal,	55.8 years old (SD: 9.2), Males: 6780 (72.7%), Setting: 2333 hospitals in USA	BMI, STEMI, prior MI, DM, hypertension, smoker, number of unplanned rehospitalisation within one year post discharge, post discharge bleeding, within one year, meds taken within year post discharge, baseline EQ5D VAS, and baseline PHQ2	12 and 15 months post discharge	post discharge: **7%** no longer worked; and **3%** worked less. **Inhibiting factors:** female gender (p=0.002), smoking (p=0.025), DM (p=0.012), hypertension (p=0.0003), no drug-eluting stent (p=0.01), recurrent MI (p<0.001), revascularisation (p<0.001), stroke (p=0.039), development of post-discharge bleeding (p<0.001), readmissions (p<0.001), PHQ2 score >3 (p<0.042), and lower EQ5D VAS (p<0.013). **Inhibiting factors in MVA:** readmissions (p=0.0003), smoking (p=0.0215), hypertension (p=0.0076), and development of post-discharge bleeding (p=0.0022).
Waszkowska & Szymczak (2009), Poland	Quantitative, observational, longitudinal, retrospective	N = 168, Mean age: 53.7 years old (age range: 39–65 years), Males: 168 (100%), Setting: cardiology dept	N/A	N/A	**Facilitating factors:** younger age (p<0.01), higher education (p<0.01), light work (p<0.01), great self-evaluated general health (p<0.01), and higher QoL (NHP). **Inhibiting factors:** less energy (p=0.01), bodily pain (p=0.01), depression (p=0.01), social isolation (p=0.01), and reduced mobility (p=0.01).

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Abbreviations: ACS: acute coronary syndrome; **AF:** atrial fibrillation; **ANOVA:** analysis of covariance; **BDI-II:** Beck Depression Inventory-II; **BMI:** body mass index; **CABG:** coronary artery bypass grafting; **CAD:** coronary artery disease; **CHD:** coronary heart disease; **CKD:** chronic kidney disease; **CMD:** common mental disorder; **COPD:** chronic obstructive pulmonary disease; **CR:** cardiac rehabilitation; **CVA:** cerebrovascular disease; **DASI:** Duke Activity Status Index; **Dept:** department; **DM:** diabetes mellitus; **Dr:** doctor; **EQ5D:** EuroQoL-5 Dimensions; **GHQ:** General Health Questionnaire; **HADS-A:** anxiety subscale of the Hospital Anxiety and Depression Scale; **HADS-D:** depression subscale of the Hospital Anxiety and Depression Scale; **HCSD:** health care system delay; **HF:** heart failure; **IHD:** ischaemic heart disease; **IQR:** interquartile range; **LVEF:** left ventricular ejection fraction; **Meds:** medications; **MET:** metabolic equivalent; **MI:** myocardial infarction; **Mins:** minutes; **MSD:** musculoskeletal disorder; **MVA:** multivariable analysis; **N/A:** not applicable; **NHP:** Nottingham Health Profile; **NRTW:** not return to work; **PCS:** physical component score; **PHQ:** Patient Health Questionnaire; **PPCI:** primary percutaneous coronary intervention; **Pts:** patients; **QoL:** quality of life; **RTW:** return to work; **SA:** sickness absence; **SD:** standard deviation; **SF-12:** Short-form 12; **SHCQ:** Somatic Health Complaints Questionnaire; **STEMI:** ST-elevation myocardial infarction; **T2DM:** type 2 diabetes mellitus; **TIMI:** thrombolysis in myocardial infarction; **UK:** United Kingdom; **USA:** United States of America; **VAS:** visual analog scale.

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Table 4 Summary of factors that were related to patients' RTW post-MI

Individual factors
Sociodemographic factors:
Age: Attarchi et al. 2012; Brink et al. 2008; de Jonge, Zuidersma & Bültmann 2014; Isaaz et al. 2010; Jiang et al. 2018; Laut et al. 2014; Waszkowska & Szymczak 2009.
Gender: Dreyer et al. 2016; Duijts et al. 2017; Isaaz et al. 2010; Jiang et al. 2018; Laut et al. 2014; Şahan et al. 2016; Smedegaard et al. 2017; Wang et al. 2019; Warraich et al. 2018.
Educational level: de Jonge, Zuidersma & Bültmann 2014; Dreyer et al. 2016; Jiang et al. 2018; Smedegaard et al. 2017; Stendardo et al. 2018; Wang et al. 2019; Waszkowska & Szymczak 2009.
Marriage status: Dreyer et al. 2016; Isaaz et al. 2010.
Life insurance: Dreyer et al. 2016.
Financial stress: Dreyer et al. 2016; Şahan et al. 2016.
Social support / isolation: Dreyer et al. 2016; Şahan et al. 2016; Waszkowska & Szymczak 2009.
Behavioural factors:
Smoking: Attarchi et al. 2012; Dreyer et al. 2016; Jiang et al. 2018; Warraich et al. 2018.
Daily footsteps: Brink et al. 2008.
Disease and health-related factors:
ST-elevation myocardial infarction: Wang et al. 2019.
Location of myocardial infarction: de Jonge, Zuidersma & Bültmann 2014; Isaaz et al. 2010; Jiang et al. 2018.
The time of chest pain onset: Isaaz et al. 2010.
Diabetes mellitus: Attarchi et al. 2012; Dreyer et al. 2016; Jiang et al. 2018; Smedegaard et al. 2017; Warraich et al. 2018.
Hypertension: Attarchi et al. 2012; Dreyer et al. 2016; Jiang et al. 2018; Wang et al. 2019; Warraich et al. 2018.
Hyperlipoproteinemia: Babić et al. 2015.
Number of risk factors: Dreyer et al. 2016; Isaaz et al. 2010.
Ischaemic heart disease / coronary artery disease: Attarchi et al. 2012; Dreyer et al. 2016.
Arrhythmia: Smedegaard et al. 2017.
Chronic kidney disease: Smedegaard et al. 2017.
Cerebrovascular disease: Smedegaard et al. 2017.
Musculoskeletal disorders: Wang et al. 2019.
Cancer: Wang et al. 2019
Heart failure: Smedegaard et al. 2017; de Jonge, Zuidersma & Bültmann 2014.
Left ventricular ejection fraction: Attarchi et al. 2012; de Jonge, Zuidersma & Bültmann 2014; Dreyer et al. 2016; Isaaz et al. 2010; Mirmohammadi et al. 2014.
Angina: Attarchi et al. 2012; Jiang et al. 2018.

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Infection: Jiang et al. 2018.

Atrial fibrillation: Jiang et al. 2018.

Recurrent myocardial infarction: Warraich et al. 2018.

Post-discharge bleeding: Warraich et al. 2018.

Stroke: Jiang et al. 2018; Warraich et al. 2018.

Readmissions: Warraich et al. 2018.

General health: Brink et al. 2008; Duijts et al. 2017; Waszkowska & Szymczak 2009.

Physical health: Brink et al. 2008; Dreyer et al. 2016; Şahan et al. 2016.

Bodily pain: Brink et al. 2008; Waszkowska & Szymczak 2009.

Fatigue / energy: Brink et al. 2008; Waszkowska & Szymczak 2009.

Mobility: Waszkowska & Szymczak 2009.

Depression: de Jonge, Zuidersma & Bültmann 2014; Dreyer et al. 2016; Stendardo et al. 2018; Warraich et al. 2018; Wang et al. 2019; Waszkowska & Szymczak 2009.

Anxiety: Stendardo et al. 2018; Wang et al. 2019; Waszkowska & Szymczak 2009.

Stress: Dreyer et al. 2016.

Patients' own decision: Jiang et al. 2018; Mirmohammadi et al. 2014.

Healthcare factors

Duration of hospitalisation: Attarchi et al. 2012; Dreyer et al. 2016; Isaaz et al. 2010; Jiang et al. 2018.

Time to call ambulance after chest pain: Isaaz et al. 2010.

Expectation of being at work: Duijts et al. 2017.

Health care system delay: Laut et al. 2014.

Coronary artery bypass graft: Attarchi et al. 2012; Wang et al. 2019.

Drug-eluting stent: Warraich et al. 2018.

Thrombolysis in myocardial infarction flow grade 3: Isaaz et al. 2010.

Revascularisation: Warraich et al. 2018.

Cardiac rehabilitation: Dreyer et al. 2016; Isaaz et al. 2010.

Doctor's advice: Mirmohammadi et al. 2014; Şahan et al. 2016.

Work-related factors

Work classification: Attarchi et al. 2012; Babić et al. 2015; de Jonge, Zuidersma & Bültmann 2014; Dreyer et al. 2016; Isaaz et al. 2010; Jiang et al. 2018; Stendardo et al. 2018.

Work energy requirement: Attarchi et al. 2012; de Jonge, Zuidersma & Bültmann 2014; Waszkowska & Szymczak 2009.

Salary: Babić et al. 2015; Jiang et al. 2018; Smedegaard et al. 2017.

Job stress / satisfaction: Şahan et al. 2016; Mirmohammadi et al. 2014.

Work change: Dreyer et al. 2016.

Work hours: Dreyer et al. 2016.

Being fired: Babić et al. 2015; Dreyer et al. 2016; Mirmohammadi et al. 2014; Warraich et al.'s 2018.

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Previous sickness absence: Wang et al. 2019.

Previous unemployment: Wang et al. 2019.

Abbreviations: MI: myocardial infarction; **RTW:** return to work.

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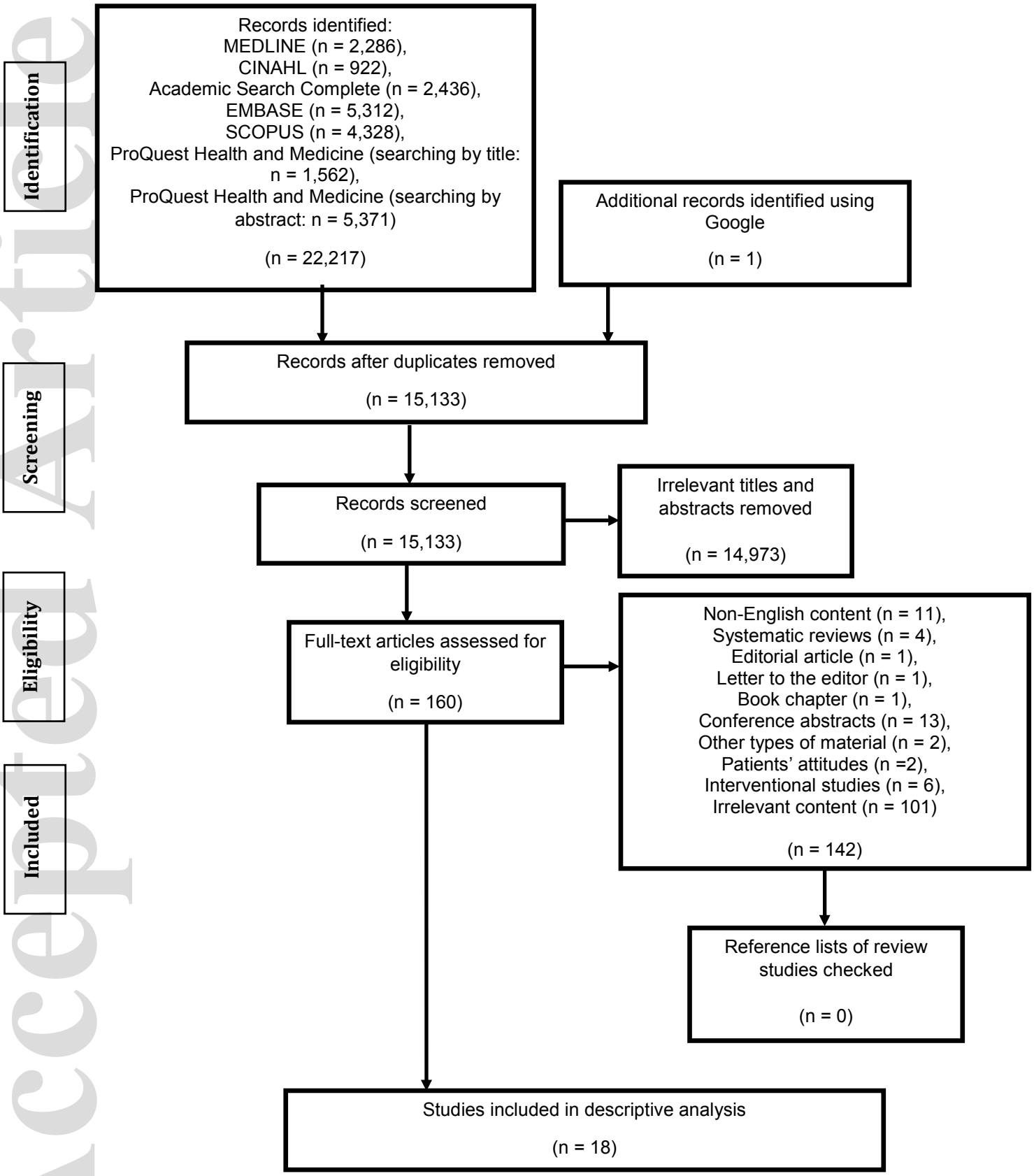

Figure 1 The process of study selection

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