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Methods in Measuring Return to Work: A Comparison of Measures of Return to Work Following Treatment of Coronary Heart Disease

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Abstract *Purpose* Methods of measuring return to work (RTW) following temporary disability are diverse. The purpose of this study was to compare different measures of RTW within a 12-month period using a well-defined population of patients treated with Percutaneous Coronary Intervention (PCI) and weekly administrative data on transfer payments. *Methods* Different RTW measures were defined based on weekly data from 12 months follow-up after PCI and agreement between definitions was expressed as Cohen's kappa. Prognostic factors for RTW were compared using logistic regression. *Results* Among those working before the PCI, 70 % were back to work at 6 months after the PCI and 76 % 1 year after when using cross-sectional measures and excluding those who left the workforce permanently during follow up. When using a time to event measure, 77 % experienced RTW during follow up, while only 60 % experienced RTW without recurrent sick-leave events during the following year. We found moderate to near perfect agreement when comparing the measures, with lowest agreement between the time-

to-event measure without relapses compared to the other measures. When comparing prognostic factors for the different RTW outcomes, we found most associations similar in size, except from the clinical measure left ventricular ejection fraction, possibly related to recurrent sick leave. *Conclusions* Different measures revealed some differences in proportions of RTW. However, high agreement between RTW-definitions was found. Choice of RTW-definitions should depend on study purpose; simple cross-sectional methods are sufficient in prediction of RTW and analysis of risk factors, while methods capturing relapses are recommended when sustainability, prognosis and vulnerability are in focus.

Keywords Return to work · Methods · Definitions · Percutaneous coronary intervention · Recurrent sick leave · Work participation

Introduction

While the term return to work (RTW) is commonly used, a clear, consensual and operational definition of the term is lacking. RTW can be referred to as an intervention, a process and an outcome [1]. In this paper we will refer to RTW as an outcome.

Return to work following temporary work disability is often measured as a dichotomous outcome measured at a specified point in time preceding a specific event, e.g. onset of disability or a specific intervention. However, RTW may also be a time-to-event measure as the workers RTW status can be measured continuously throughout the follow-up period [1, 2]. Employees may furthermore experience one or several recurrences of absence and only gradually recover from their injury or illness [3–5]. The commonly

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used dichotomization of the outcome into “returned yes/no” at a certain follow-up point ignores any information of when the person has returned, and information about subsequent recurrences. A recent study tested the measurement properties of three previously defined RTW outcomes with data on employees sick-listed due to soft tissue injuries in the back, upper or lower extremities, or low back pain, from two studies from two countries (Canada and The Netherlands respectively) [6]. They found that differently defined outcomes yielded similar results in predictive validity of common factors, but seemed to differ when compared to functional status. These differences could possibly be attributed to societal context and possibly a birth cohort effect, as data were collected in two different countries at two different points in time. However they did not analyze agreement between the different RTW measures in their study.

The aim of this study was to compare different measures of RTW within a 12-month period of follow-up using a well-defined population of patients treated with percutaneous coronary intervention (PCI) and weekly national administrative data on social transfer payments.

Materials and Methods

Data

From March 2006 to March 2008, 1,585 patients under the age of 67 years treated with first-time PCI at Aarhus University Hospital, Denmark were enrolled in a cohort. Of these, 994 patients were in the workforce, defined as not receiving any permanent disability benefits or pension in the week prior to PCI. The usual retirement age in Denmark was 67 years in the beginning of the inclusion period, but changed to 65 years during follow-up.

Information on working status were collected from a national register on social transfer payments (DREAM) which includes information on all public transfer payments administered by Danish ministries and municipalities for Danish citizens on a weekly basis since 1991 [7]. The type of transfer payment is recorded for each week if the person has received the benefit for 1 day or more. At present the DREAM database includes 114 different codes for social transfer payments. If no transfer income is registered for a specific week, the person is considered to be self-supporting or on short-term sick-leave (less than 2 weeks). In Denmark a citizen in the workforce (employed as well as unemployed) are entitled to sickness absence compensation (at the time of this study after 2 weeks), and in case the employee receives normal salary during sick leave, the employer receives municipal reimbursement. Data from the DREAM database is increasingly applied in research

and the validity has been compared to other sources of information [7, 8].

Return to Work Outcomes

The patients were coded as RTW, if they did not receive any health related benefit, but was still eligible for work and thus not receiving a pension.

This means that both working and work-related benefits due to unemployment was coded as RTW as opposed to any health-related benefits or pension.

Return to work was analysed in 4 different ways:

1. Dichotomous at 6 and 12 months.
Proportions at 6 respectively 12 months after PCI were defined by looking at the specific week for each patient. Patients who had permanently left the workforce before the time point were excluded.
2. Time to first spell of 4 weeks of RTW
Time to first spell of 4 consecutive weeks of RTW within 12 months after the PCI. The measure was further dichotomized in events/non-events for use in comparisons.
3. Time to first spell of 4 weeks of RTW with no relapses.
Time to first spell of 4 consecutive weeks of RTW within 12 months after the PCI, excluding patients who experienced a new sick listing in the first year after first return to work. The measure was further dichotomized in events/non-events for use in comparisons.
4. “Work Participation Score” within 12 months following RTW, defined as a fraction with numbers of RTW weeks in the numerator and numbers of weeks receiving social transfer payments + numbers of RTW weeks in the denominator. The “Work Participation Score” was dichotomized at tree points (25, 50 and 75 % percentiles) to enable for comparison with the other measures.

Exposure Data

We included information of gender, age, left ventricular ejection fraction (LVEF, a cardiologic measure of the functional status of the heart) and indication of the PCI procedure (acute or elective). Age and gender was derived from the Danish Civil Registration System (CPR). Clinical data (LVEF and indication of the PCI procedure) were collected from the Western Denmark Heart Registry (WDHR) [9].

Analyses

Proportions of return to work in each measure were calculated and agreement between definitions was assessed by

Table 1 Baseline characteristics of patients treated with PCI at Aarhus University Hospital 2006–2008

	Complete cohort n = 1,585	Subcohort of patients in the workforce in the week before PCI n = 994
Age		
≤44	(134) 8.5 %	(120) 12.1 %
45–54	(436) 27.5 %	(375) 37.7 %
55–59	(371) 23.4 %	(297) 29.9 %
60–67	(644) 40.6 %	(202) 20.3 %
Gender		
Female	(329) 20.8 %	(169) 17.0 %
Male	(1,256) 79.2 %	(825) 83.0 %
Working status (week before PCI)		
Self-supporting	(593) 37.4 %	(593) 59.7 %
Labor-market-related benefits	(39) 2.5 %	(39) 3.9 %
Health-related benefits	(362) 22.8 %	(362) 36.4 %
Early retirement	(414) 26.1 %	–
Normal retirement	(175) 11.0 %	–
Not living in DK	(2) 0.1 %	–
Indication		
Acute MI	(502) 31.7 %	(337) 33.9 %
Other	(1,083) 68.3 %	(657) 66.1 %
LVEF (%)		
≤34	(81) 5.1 %	(44) 4.4 %
35–54	(564) 35.6 %	(352) 35.4 %
55+	(828) 52.2 %	(525) 52.8 %
Missing	(112) 7.0 %	(73) 7.3 %

LVEF left ventricular ejection fraction; PCI percutaneous coronary intervention

Complete cohort and sub-cohort in the workforce the week before the PCI

Cohen's kappa. Strength of the association was expressed using the labels suggested by Landis & Koch [10].

Associations between RTW definitions and selected covariates (gender, age, LVEF and indication of PCI procedure), were evaluated in logistic regression models with dichotomized RTW measures entered as the outcomes. The models exposure variables were mutually adjusted. Odds ratios (OR) for not returning to work were calculated for each potential prognostic factor with 95 % confidence intervals.

Finally, we plotted the “Work Participation Score” against the time-to-event measures as well as the two different time-to-event measures (1 and 4 weeks self support) against each other. Data were analyzed in STATA, IC version 12.1 (Stata Corporation, College Station, Texas, USA).

Table 2 The different return-to-work measures after PCI expressed as proportions

Measure	Returned to work n (%)
Cross sectional	
Working 6 months after PCI	659/936 (70.4 %)
Working 1 year after PCI	666/876 (76.0 %)
Time-to-event	
Event: 4 weeks of RTW during first year	769/994 (77.4 %)
Event: 4 weeks of RTW during first year no relapses	603/994 (60.5 %)
Work participation score	
Cut-off 25 %	734/994 (73.8 %)
Cut-off 50 %	678/994 (68.2 %)
Cut-off 75 %	533/994 (53.6 %)

Results

Most patients were male (79.2 %), with almost two-thirds being more than 55 years of age (Table 1). A total of 37.2 % were permanently out of the workforce the week preceding the PCI due to retirement or living outside Denmark, whereas the rest were either working or on temporary transfer benefits related to health or unemployment. Roughly, one-third was admitted due to acute MI, and more than half showed an LVEF of 55 % or more. Patients in the workforce were younger, more often men, but had similar LVEF and indication as the complete cohort.

Using different definition of RTW revealed proportions ranging from 53.6 % (Work Participations Score >75) to 77.4 % (Time-to-event during first year). Time-to-event during the first year was very similar to the cross-sectional measure working 1 year after PCI. The time-to-event measure with no relapses defined only 60.5 % as RTW, opposed to the usual time-to-event during the first year (77.4 %). The different cut-offs of Work Participation Score, allowing different amounts of total sick leave during the first year, were as expected quite different, ranging from 53.6 to 73.8 % Table 2.

The agreements between measures expressed as Cohen's kappa (κ) are presented in Table 3. We found moderate to almost perfect agreement between the different measures on RTW. The time-to-event with no relapses of sickness absence in the following 12 months and the cut-off at 75 % of the Work Participation Score were the measures with the largest deviations from the other measures.

Association between RTW measures and relevant covariates are presented in Table 4. Gender remained a stable prognostic factor of RTW across the seven different RTW measures (Table 4). Odds ratios fluctuated between

Table 3 Comparisons of different RTW definitions, proportion of agreement and Cohen's Kappa (κ)

	Working 6 months after PCI	Working 1 year after PCI	Event: 4 weeks of RTW during first year	Event: 4 weeks of RTW during first year (no relapses)
Cross sectional				
Working 1 year after PCI	89.2 % (κ :0.72)			
Time-to-event				
Event: 4 weeks of RTW during first year	91.1 % (κ :0.77)	94.0 % (κ :0.82)		
Event: 4 weeks of RTW during first year, no relapses	84.5 % (κ :0.66)	86.5 % (κ :0.69)	83.3 % (κ :0.62)	
Work participation score				
Cut-off 25 %	94.2 % (κ :0.85)	92.7 % (κ :0.80)	96.1 % (κ :0.89)	83.4 % (κ :0.63)
Cut-off 50 %	97.2 % (κ :0.93)	90.0 % (κ :0.74)	90.6 % (κ :0.77)	84.2 % (κ :0.66)
Cut-off 75 %	84.0 % (κ :0.67)	78.2 % (κ :0.54)	76.1 % (κ :0.50)	81.3 % (κ :0.62)

Table 4 Associations of different prognostic factors of RTW in different definitions of Return to Work

	Female gender (OR)	LVEF under 55 % (OR)	Age over 55 years (OR)	Acute indication of PCI (OR)
Cross sectional				
RTW at 6 months	3.0 [2.1;4.4]	1.7 [1.3;2.4]	1.0 [0.8;1.4]	0.7 [0.5;1.0]
RTW at 1 year	3.4 [2.3;5.0]	1.8 [1.3;2.6]	1.3 [0.9;1.9]	1.0 [0.7;1.5]
Time-to-event				
Event: 4 weeks of RTW during first year	2.7 [1.9;4.0]	2.1 [1.5;3.0]	1.0 [0.8;1.4]	1.0 [0.7;1.5]
Event: 4 weeks of RTW during first year (+no relapses)	2.7 [1.9;3.9]	1.4 [1.1;1.9]	1.2 [0.9;1.6]	0.8 [0.6;1.1]
Work participation score				
Cut-off 25 %	2.7 [1.8;3.9]	1.9 [1.4;2.7]	0.9 [0.6;1.2]	0.8 [0.6;1.1]
Cut-off 50 %	2.9 [2.0;4.2]	2.0 [1.4;2.7]	0.9 [0.7;1.2]	0.7 [0.5;1.0]
Cut-off 75 %	2.8 [1.9;4.0]	1.8 [1.3;2.3]	1.0 [0.8;1.3]	0.7 [0.5;0.9]

Prognostic factors were mutually adjusted. ORs express the risk of non-RTW

2.7 (work participation score, 25 % cut off) and 3.4 (RTW at 12 months). The Odds ratios for associations between LVEF and RTW measures showed more variation, ranging from 1.4 (4 weeks of RTW during first year, no relapses) to 2.1 (4 weeks of RTW during first year). However, all ORs were statistically significant and in the same direction. With regards to age, all except one measure were insignificant; "RTW at 12 months" reached borderline significance. Findings regarding associations with PCI indication showed no stable pattern, with ORs ranging from 1 to 0.7.

When comparing two time-to-event measures that used 1 week versus 4 weeks spell of self-support to define the event, 57 (5.7 %) of the patients were classified differently. The time deviated for both longer and shorter periods (Fig. 1), mostly due to administrative breaks in payments, which would cause a single week to be coded as RTW,

even if the following week included a health related benefit.

Comparing the two RTW measures "Time to first RTW" and "Work Participation Score" revealed that time to first RTW in many cases reflected the degree of work participation: Those who returned fast, tended to have a high work participation score, whereas those who returned later, tended to also have a low work participation rate. However, as indicated in the lower left quadrant of Fig. 2, a significant proportion seemed to return early according to the measure of time to first RTW, but scored low on work participation score (Fig. 2). This is explained by scenarios where the patient returned to work early in the follow-up period, but left the workforce due to new sick listing or pension during follow-up. Thus, an early RTW may not indicate full recovery.

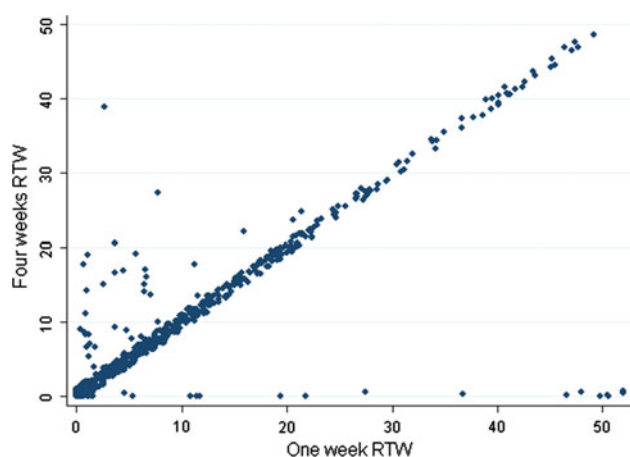


Fig. 1 Plot of weeks to first return to work (1 week spells) on the x-axis and weeks to first return to work (4 week spells) on the y-axis. A jitter of 3 weeks was used to enhance the visual graphics by separation of overlapping points

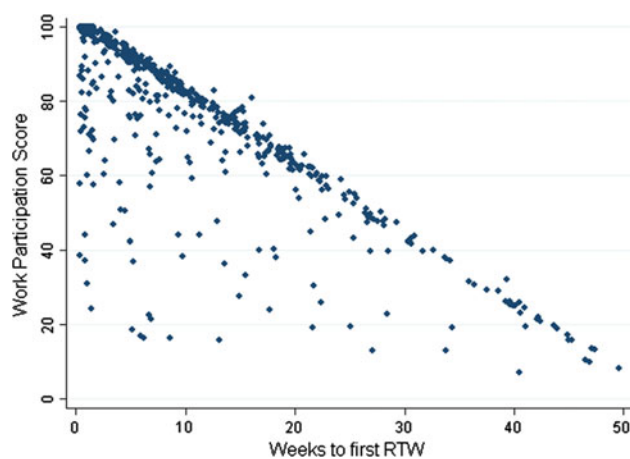


Fig. 2 Comparison of traditional time to first RTW with Work Participation Score. A jitter of 3 weeks was used to enhance the visual graphics by separation of overlapping points

Discussion

Among those working before the PCI, 70 % were back to work 6 months after the PCI and 76 % 1 year after when using cross-sectional measures and excluding those who left the workforce during follow up. When using a time to event measure, 77 % experienced RTW during follow up, but only 60 % experienced RTW without recurrent sick leave events during the following year. We found moderate to near perfect agreement when comparing the measures, with the lowest agreement between the time-to-event measure without relapses compared to the other measures. The cut-off at 75 % of the Work Participation Score did not agree well with the other measures as it did not allow for a long period of sickness absence (Table 3).

This study was based on a well-defined cohort of PCI patients with complete follow-up of working status. We had complete follow-up of weekly working status due to full coverage of registers of social transfer payments including disability compensation benefits in the DREAM database, which is complete for all citizens in Denmark and information is considered valid [8]. A major strength of using the DREAM register in relation to RTW is the ability to establish a measure that captures the RTW dynamically, and not merely time to first RTW or crude cross sectional measures at arbitrary points in time.

The grouping of transfer-payment groups may cause misclassification, if a person on labor market-related benefits, for example unemployment benefits, is not ready to work due to health problems, but fails to report this. However, as this group is small and as receivers of labor market-related benefits are requested to confirm their readiness to work on a weekly basis, this is considered a minor problem. Misclassification of the outcome may occur in persons who are not working, but provided income by their spouse or live as rentiers. In Denmark this is rather uncommon as only 2 % of the population between 40 and 67 years are without personal income [11].

To our knowledge, only one other study has attempted a similar analytical approach [6], despite the fact that previous studies have yielded different results regarding RTW status depending on the RTW measure used [12], and the need for common measures and definitions have been suggested as a main tool to advancing the field of RTW research [2]. The overall finding of good to excellent agreement between the tested RTW measures is in line with the findings by Steenstra and colleagues [6]. However, the two studies can only be compared with regards to the findings of prognostic abilities of common factors, as Steenstra and colleagues did not analyze the association between the different outcomes used in their study. The results from the present study suggest, that the effect of certain prognostic variables vary according to recovery time (for example PCI indication and LVEF), whereas other remains stable throughout the RTW process (for example gender). This illustrates the time dependency of certain prognostic variables, which should be considered when choosing RTW measure.

In conclusion, our findings suggest that defining RTW as 1 or 4 weeks of work following return perform equally. When comparing time-to-event measure to measures that capture subsequent labor market participation, it seems obvious that the simple time-to-event measure failed to capture sustainable RTW, illustrating that time to first RTW is not necessarily a measure of success in terms of sustainable RTW. Overall, if the main research purpose is prediction of RTW or identification of risk factors for non-RTW, simple RTW measures defining RTW as a cross-sectional work status at a specific point of time will often

be sufficient. These are typically easier to obtain than more sophisticated data-heavy RTW measures utilizing a longer period of time in order capture relapses or accumulated work participation. However, the latter types of measure may be appropriate in cases where sustainability, prognosis and vulnerability are the core issues.

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Ethics The study was approved by Danish Data Protection Agency j.no. 2007-41-0991.

Conflict of interest The authors declare that they have no conflict of interest.

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