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Work participation in Q-fever patients and patients with Legionnaires' disease: A 12-month cohort study

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ABSTRACT

Aims: The aim of the study was to assess long-term work participation of Q-fever patients and patients with Legionnaires' disease, and to identify which factors are associated with a reduced work participation in Q-fever patients. Methods: Q-fever patients participated at four time points until 12 months after onset of illness, patients with Legionnaires' disease only at 12 months. Data were self-reported using questionnaires on the amount of hours that patients worked, and on socio-demographic, medical, psychosocial and lifestyle aspects. Results: Our study included 336 Q-fever patients and 190 patients with Legionnaires' disease. There was a decrease in the proportion of Q-fever patients with reduced work participation over time, from 45% at 3 months to 19% at 12 months (versus 15% of patients with Legionnaires' disease at 12 months). Factors associated with reduced work participation of Q-fever patients in a multivariate model were having symptoms, a higher level of sorrow, being a former smoker (compared to never smoking), not consuming any alcohol and following additional treatment for the long-term health effects of Q-fever. Conclusions: Despite an increase in work participation of Q-fever patients over time, almost one in five Q-fever patients and one in six patients with Legionnaires' disease still suffer from reduced work participation at 12 months. Occupational and insurance physicians need to be aware of the long-term impact of these diseases on work participation.

INTRODUCTION

Q-fever is a zoonosis caused by the intracellular bacterium *Coxiella burnetii*. Apart from symptoms and conditions that are commonly reported during the acute phase of the disease, which include fever, pneumonia, hepatitis and neurological symptoms such as headache [1], many patients also report long-term health problems. Several studies have shown that a large proportion of Q-fever patients suffer from long-term fatigue [2–9], even up to 10 years after onset of illness [4]. Although this has never been assessed in Q-fever patients, it is also possible that Q-fever has a psychosocial impact, due to patients being confronted with many experiences of loss (e.g. health, work, independence, social activities) [10].

Following the large outbreak of Q-fever in the Netherlands, with a total of 4,107 notified patients over the period 2007–2011 [11], there were a number of reports regarding the long-term impact of Q-fever on work participation of patients [12,13]. In the latter study, work participation was reported retrospectively by patients, and this limited the accuracy of the results.

It is unclear whether the reduction in work participation is higher in patients that underwent a Q-fever infection than patients that underwent other major health events, e.g. another infectious disease. Q-fever and Legionnaires' disease are both acute febrile diseases that may present with similar clinical manifestations [1,14], and there are currently no data on work participation of patients with Legionnaires' disease. The aim of our study was to compare work participation in these two groups. Another aim was to quantify the progress of work participation of Q-fever patients prospectively over the period 3–12 months after onset of illness, and to identify which individual, lifestyle, medical and psychological factors are associated with work participation.

METHODS

The design used was a prospective cohort study of Q-fever patients and a cross-sectional survey of patients with Legionnaires' disease. The study protocol was submitted to the Medical Ethical Review Board of the region Arnhem-Nijmegen, which indicated that ethical review was not required.

Study population

Patients with Q-fever

Patients diagnosed with Q-fever in 2010 and 2011 in the Netherlands who were at least 18 years of age and fulfilled the Dutch notification criteria for Q-fever [11] were eligible for this study (as described in the study protocol [15]). A total of 376 patients were invited to participate.

Patients with Legionnaires' disease

Patients fulfilling the Dutch notification criteria for Legionnaires' disease [11] with onset of illness in 2010 were eligible for this study (as described in the study protocol [15]). A total of 243 patients were invited to participate.

Data collection

Municipal Health Services in the Netherlands were asked to invite Q-fever patients and patients with Legionnaires' disease to participate in our study. Patients who gave permission received an information letter and a consent form by post. After receiving written consent, Q-fever patients were posted a questionnaire at 3, 6, 9 and 12 months after onset of illness [15]. Patients with Legionnaires' disease were contacted only at 12 months after onset of illness. Patients who did not return the questionnaire received a reminder by telephone or post.

Questionnaire

The first study questionnaire that patients received collected information on the number of hours per week they worked before infection (Q-fever or Legionnaires' disease) and currently, for paid work as well as voluntary work. If they currently worked less than before their illness (defined in this manuscript as a 'reduced work participation'), patients indicated whether this was due to Q-fever or Legionnaires' disease, according to their opinion. Further, patients reported the symptoms they had suffered during the previous 2 weeks, and for each symptom whether they suspected this was due to their previous infection. We included an instrument to assess the different stages of the grieving process due to the infection that patients underwent: the Acceptance of Disease and Impairments Questionnaire (ADIQ), which has so far been used in patients with chronic obstructive pulmonary disease (COPD) [16]. Patients who answered 'not applicable' on one of the questions of this instrument were given the lowest possible score for denial, resistance and sorrow, and the highest possible score for acceptance for the respective question. Information on the individual characteristics of Q-fever patients that could affect work participation was also collected and consisted of socio-demographic, lifestyle and medical aspects (self-reported).

For Q-fever patients, the number of hours worked per week and symptoms were included in all successive questionnaires, and the ADIQ only on time points 3 and 12 months. A question on additional treatment due to the long-lasting health effects of Q-fever was included at the 12-month time point.

Data analysis

Differences in gender and age of the patients were analysed between participants and non-participants using independent samples *t*-tests and chi-square tests. Baseline characteristics were determined for the complete groups of Q-fever patients and patients with Legionnaires' disease, and separately for the patients that performed paid work before their illness (defined in the manuscript as 'working patients'). Working patients include both employed and self-employed patients. For working patients, we determined work participation (also separately for patients that

performed voluntary work), the number of symptoms and a score for each stage of the grieving process. Grief scores were compared between the patient groups using independent samples *t*-tests.

Factors associated with work participation of working Q-fever patients were identified using univariate logistic regression models. These analyses were only performed for Q-fever patients due to the relatively small number of working patients with Legionnaires' disease. All factors that showed statistical significance in the univariate analyses were combined in a multivariate model. In addition, factors that were not statistically significant in the multivariate model were removed through backward analysis. To assess multicollinearity, correlation coefficients were calculated between all significant factors, and a Spearman's rho $\geqslant 0.80$ was considered to be too high. A *p*-value <0.05 was considered to be statistically significant, based on two-sided tests. Data were analysed using the software SPSS for Windows (version 20).

RESULTS

Participation and characteristics of the study population

The number of participants was 336 Q-fever patients (response of 89%) and 190 patients with Legionnaires' disease (response of 78%). There were no differences between participants and non-participants for gender and age (data not shown). The number of Q-fever patients that entered and dropped out of the study at each time point is presented in Table I. The composition of the groups of Q-fever patients differed only slightly between the different time points, in terms of gender and age (data not shown).

[TABLE I.]

The characteristics of both patient groups are presented in Table II, for the whole study populations as well as separately for the working patients (74% of the Q-fever patients and 54% of the patients with Legionnaires' disease). For both patient groups, the working population consists of a higher proportion of males, is younger, had a higher education and a lower proportion of pre-existing health problems than the total population. The group of patients with Legionnaires' disease was older, and had a higher proportion of males, (former) smokers and patients with pre-existing health problems than the group of Q-fever patients. The descriptive information on the patient groups that performed voluntary work is not presented in Table II as this group was too small for further analyses. They consist of 54.8% and 61.0% males, and a mean age of 54.3 and 62.2 years for 84 Q-fever patients and 41 patients with Legionnaires' disease, respectively.

[TABLE II.]

WORK PARTICIPATION

Figure 1 shows the proportion of working patients with a reduced work participation, both for paid and voluntary work, due to Q-fever (at each time point) or Legionnaires' disease (at 12 months). There is a general decrease in the proportion of Q-fever patients with reduced work participation over time, for both paid and voluntary work, up until 12 months. At 12 months, a slightly higher proportion of working Q-fever patients had reduced work participation than patients with Legionnaires' disease (19% vs. 15% respectively). The median proportion of hours that patients worked less remained fairly stable over time, varying from 60% at 3 months to 50% at 12 months for paid work and around 80% overall for voluntary work for Q-fever patients, compared with approximately 40% and 90% respectively for patients with Legionnaires' disease at 12 months after onset of illness (data not shown).

[FIGURE 1.]

The proportion of all patients from the working population that had a reduced work participation due to Q-fever from 3 to 12 months after onset of illness (n = 248 for paid work and 84 for voluntary work over all time points) or Legionnaires' disease at 12 months after onset of illness (n = 102 for paid work and 41 for voluntary work).

Symptoms

The progress in the number of symptoms in working Q-fever patients is presented in Supplementary Figure 1. This shows an increase in the proportion of patients that do not report symptoms up until 12 months. Of the working patients with Legionnaires' disease, the proportion that reported no symptoms at 12 months was 57%, which is higher than the respective group of Q-fever patients at 12 months (44%, Supplementary Figure 1). The most frequently reported symptoms in working Q-fever patients at 12 months were concentration and memory problems, severe fatigue, headache (all 24%) and muscular pain (23%); the most frequently reported symptoms in working patients with Legionnaires' disease were concentration and memory problems (21%), severe fatigue, respiratory problems and pain in the joints (all 13%).

Grief

For each stage of the grieving process, we calculated the levels for working Q-fever patients (at 3 and 12 months) and working patients with Legionnaires' disease (at 12 months). The mean score of Q-fever patients is significantly higher at 12 months for denial and resistance, and significantly lower for acceptance compared to patients with Legionnaires' disease (Table III). Each of the four stages of the grieving process remains fairly constant between 3 and 12 months for the group of Q-fever patients (data not shown).

[TABLE III.]

Factors associated with reduced work participation (paid work)

The highest correlation between individual characteristics that were significant in the univariate analyses, using Spearman's Rho, was found between resistance and sorrow (r = 0.70). Since this was below 0.80, there was no multicollinearity in the model. Factors that were significantly associated with a reduced work participation in the multivariate analysis were having symptoms, having a higher level of sorrow, being a former smoker (compared with never smoking), not consuming any alcohol and following an additional treatment for the long-term health effects of Q-fever (Table IV).

[TABLE IV.]

DISCUSSION

Our study shows that the outcomes for Q-fever patients and patients with Legionnaires' disease, in terms of symptoms, work participation and grief, are similar at 12 months after onset of illness, although the impact of Q-fever seems to be somewhat higher. A higher proportion of Q-fever patients report symptoms (56% vs. 43% with one or more symptoms), they have a higher reduction in work participation (19% vs. 15%) and have significantly higher scores for denial and resistance and lower scores for acceptance of their illness, although all these findings lie in the same order of magnitude. This is striking since patients with Legionnaires' disease are older and have more pre-existing health problems, which are generally associated with more limitations [17⇓–19]. A previous study that compared Q-fever patients and patients with Legionnaires' disease found that the self-reported health impact of Q-fever is slightly higher [9], which supports our findings. The response rate and number of participants for both patient groups were high (especially for the Q-fever patients), suggesting that the results from this study are representative for the two patient groups, although there might be a small response bias.

This first prospective study on work participation of Q-fever patients showed that there is an increase in work participation over time, both for paid and voluntary work. Compared with the proportion of sick leave in the general Dutch population (4.0% in 2012) [20], the proportion of patients who have a reduced work participation due to Q-fever at 12 months after onset of illness is high (19%, Figure 1). The reduction in work participation is also high compared to a study on return to work of patients after infectious mononucleosis, since this study found that only 2–3% of those patients was still absent from work at 12 months after infection, although the mean age of this group was lower than of patients in our study (31 vs. 49 years) and the results from this study are based on data from a national sickness registration database [21]. Finally, we compared our results to a Swedish study that reported the median duration of return to work for a large number of diagnoses, based on data from the national sickness insurance scheme in 617,611 cases [22]. The diseases with the longest median duration until return to work were malign neoplasms, severe mental disorders and severe cardiovascular diseases, with a return

to work varying between two months and twelve months, while infectious diseases usually had a short return to work of one month or less [22]. Based on Figure 1, we estimate the median full return to work of our Q-fever population as a little under three months (since 55% of the patients does not have a reduced work participation at 3 months), which is long compared with other infections in Sweden but short compared with the more severe diagnoses mentioned above. Our results show that despite a general improvement in work participation of Q-fever patients over time, almost one in five patients has a reduced work participation due to their illness at 12 months after onset of illness.

Our study found that Q-fever patients generally have higher levels of denial and resistance and a lower level of acceptance compared to patients with Legionnaires' disease (Table III), possibly due to the lower mean age of Q-fever patients. Compared with a group of COPD patients in a Dutch study, Q-fever patients show similar levels of grief [16]. This suggests that undergoing Q-fever actually leads to a process of grief similar to undergoing a progressive disease that leads to persistent airway limitations such as COPD, which underlines the severity.

We identified several factors that are associated with a reduced work participation in a multivariate model (Table IV). For all associations, we cannot infer a causal relationship with work participation, as the characteristics we used in the analysis were measured after onset of illness. Since we were interested in work participation, we chose this as the outcome variable. Some associations were to be expected, such as having more symptoms and a higher level of sorrow. We are not sure why former smokers have more reduced work participation than non-smokers, while this is not seen for current smokers, and why patients who consume no alcohol have the highest reduction of work participation. One explanation may be that the patients who are the most severely affected by their illness change their lifestyle due to their health problems. Patients who follow an additional treatment for long-lasting effects of Q-fever are more reduced in their work participation, which may be explained by the fact that patients only seek additional treatment for Q-fever when their health is seriously impaired.

Limitations

All data were self-reported by the patients. Infor-mation on reasons for reduced work participation are registered in employer databases, but it was not possible to obtain these data within the context of our study, which is a minor limitation in the reliability of our data. All the data were collected prospectively, except for the amount of hours that patients worked before their illness. We assume that patients gave a fairly good estimate of this amount, even after 12 months, since for most patients this was based on a work contract. We feel that it is not likely that working patients exaggerate their symptoms to receive disability benefit as this is checked by occupational physicians and insurance physicians and leads to reduced income in the Netherlands.

CONCLUSIONS

Despite an increase in work participation of Q-fever patients over time, 19% of the patients are still affected at 12 months. The proportions of working Q-fever patients and patients with Legionnaires' disease with a reduced work participation and symptoms are comparable at 12 months after onset of illness, although the impact of Q-fever is slightly higher. This study has important implications for occupational and insurance physicians, who should be aware of the long-term impact of these diseases on work participation. It would be of interest to assess whether similar results are found after other infectious diseases, e.g. Lyme disease. The Dutch foundation Q-Support is currently providing individual guidance and information to Q-fever patients with long-term health problems [12], and this might lead to higher levels of disease acceptance and work participation in this group of patients. We recommend a study to assess the effectiveness of this intervention.

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TABLES AND FIGURES

Table I. Participation of Q-fever patients with an onset of illness in 2010/2011 in the Netherlands at each time point. The total number of patients that participated in the study was 336.

Cohort	Number of patients per time point[a] (months)				Drop-out[b] (between 3 and 12)
	3	6	9	12	
Inclusion at 3 months	90	88	89	87	3
Inclusion at 6 months		118	107	109	9
Inclusion at 9 months			123	109	4
Inclusion at 12 months				5	n/a
Total	90	206	319	310	

[a]The number of patients that entered the study at each time point together form the total study population (n = 336).
[b]Patients that stopped participating at a certain time point are considered drop-outs. The total number of drop-outs was 16.

Table II. Individual characteristics of Q-fever patients and patients with Legionnaires' disease at time of inclusion in the study, both for complete study populations and for working populations separately.

Variable	Q-fever		*Legionella*	
	All (n=336)	Working[a] (n=248)	All (n=190)	Working[a] (n=102)
Age[b] (years) mean (± SD)	48.5 (13.9)	44.7 (12.1)	60.1 (11.5)	54.1 (10.7)
Male sex %	54.8	60.1	68.9	77.5
Educational level %				
Low	41.2	31.6	54.0	48.0
Middle	30.4	35.6	21.2	19.6
High	28.4	32.8	24.9	32.4
Pre-existing health problems[c] %	39.7	34.3	59.5	51.0
Severe Q-fever episode[d] %	51.0	47.2	n/a	n/a
Body Mass Index %				
Underweight	0.6	0.8	0.0	0.0
Normal weight	40.7	38.9	36.0	33.7
Moderately overweight	46.1	47.4	41.3	41.6
Seriously overweight	12.6	13.0	22.8	24.8
Smoking behaviour %				
Current	30.4	31.9	37.4	37.3
Former	37.5	35.1	47.4	46.1
Never	32.1	33.1	15.3	16.7
Alcohol consumption (beverages/week) %				
0	34.8	31.9	24.2	21.6
1–6	39.6	41.1	33.7	36.3
≥ 7	25.6	27.1	42.1	42.2
Additional treatment for Q-fever[e] %				
Regular treatment	12.5	11.5	n/a	n/a
Non-regular treatment	4.3	5.3	n/a	n/a
No additional treatment	83.3	83.2	n/a	n/a
Working Full-time[f] %	n/a	66.1	n/a	75.5
Reduction in work participation %				
Due to Q-fever / Legionnella[g]	n/a	26.2	n/a	14.7
Due to other circumstances[h]	n/a	8.1	n/a	19.6
No reduction in work participation	n/a	65.7	n/a	65.7

[a]The working populations consist of patients that were performing paid labour before they became infected by Q-fever or Legionnaires' disease.
[b]Age during onset of illness.
[c]Pre-existing health problems consists of a large number of conditions, including but not limited to cardiovascular, pulmonary, renal, neurological conditions, diabetes, depression.
[d]A patient is considered as having a severe Q-fever episode if he/she suffered from pneumonia, meningitis, endocarditis, hepatitis or pregnancy complications.
[e]Additional treatment for long-lasting health effects of Q-fever (e.g. fatigue). Treatments for Q-fever that are considered regular are Cognitive Behavioural Therapy, Graded Exercise Therapy, additional treatment with antibiotics or participation in the Qure study [23]. Other treatments are considered non-regular. The values are the proportion of patients at 12 months after onset of illness (N = 305 for all Q-fever patients and N = 226 for the working Q-fever patients).
[f]Patients who worked at least 32 hours per week are considered full-time workers.
[g]The proportion of patients that worked less due to Q-fever or Legionnaires' disease compared with before they became ill (according to their opinion) at inclusion in the study.
[h]The proportion of patients that worked less compared with before they became ill, but due to another reason than their infection (according to their opinion) at inclusion in the study. These reasons were not further specified.

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Table III. Mean scores and standard deviations of the four stages of the grieving process (denial, resistance, sorrow, acceptance) for working Q-fever patients (n = 248) and working patients with Legionnaires' disease (n = 102), at 12 months after onset of illness. Each score has a range of 1–4.

	Q-fever[a] (n = 228)		Legionnaires' disease (n = 102)		Difference[c]
	Mean	SD[b]	Mean	SD[b]	p-value
Denial	2.6	1.1	2.1	1.1	< .001
Resistance	1.9	1.0	1.6	0.9	.017
Sorrow	1.7	0.9	1.6	0.9	.128
Acceptance	2.8	1.0	3.1	0.9	.034

[a]n for the Q-fever patients was 224 for denial and sorrow and 223 for acceptance due to some missing values.
[b]SD = Standard Deviation.
[c]Whether the difference between the patient groups was statistically significant was tested using an independent samples t-test.

Figure 1. T he proportion of all patients from the working population that had a educed work participation due to Q-fever from 3 to 12 months after onset of illness (n = 248 for paid work and 84 for voluntary work over all time points) or Legionnaires' disease at 12 months after onset of illness (n = 102 for paid work and 41 for voluntary work).

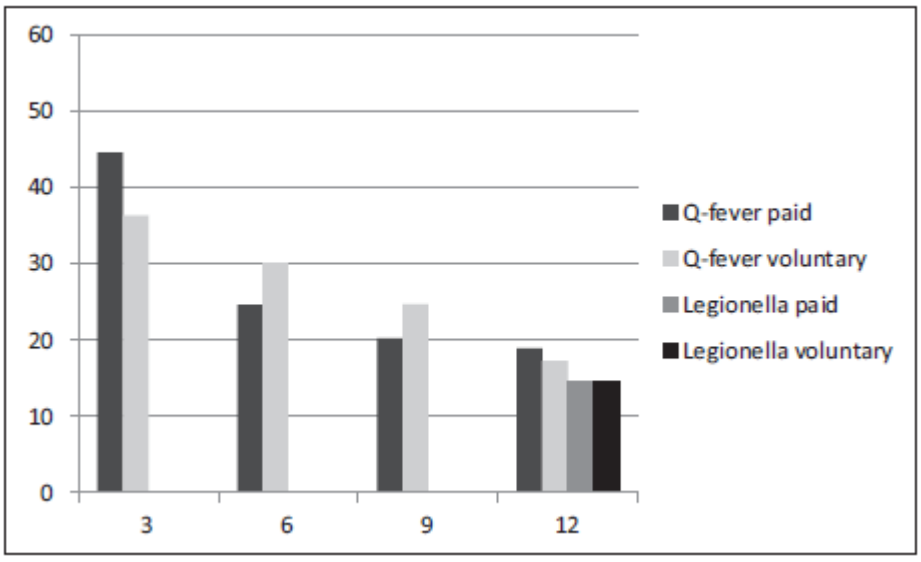

Table IV. Factors associated with a reduced work participation in working Q-fever patients at 12 months using logistic regression (n = 168).

Independent variable[a,b]	Affected in work		
	OR[c]	95% CI[d]	*p*-value
Symptoms			0.005
5 or more	11.71	1.99 to 68.78	0.006
1 to 4	17.21	3.04 to 97.41	0.001
None			
Sorrow	2.19	1.29 to 3.74	0.004
Smoking behaviour			0.031
Current	2.11	0.60 to 7.40	0.242
Former	6.05	1.57 to 23.28	0.009
Never	Ref.		
Current alcohol consumption (week)			0.070
0	3.73	0.86 to 16.17	0.079
1–6	5.05	1.26 to 20.16	0.022
⩾ 7	Ref.		
Additional treatment for Q-fever			0.001
Regular treatment	12.09	2.90 to 50.42	0.001
Non-regular treatment	8.88	1.11 to 70.98	0.040
No additional treatment	Ref.		

[a]Factors that were tested but which did not have a significant association with work participation due to Q-fever in the univariate analyses were gender, age, educational level, pre-existing health problems, BMI (tested as a continuous variable) and denial.
[b]Factors associated with a reduced work participation that were statistically significant in the univariate analysis but not in the multivariate analysis were having a higher level of resistance, a lower level of acceptance and a severe Q-fever episode. They were removed via a backward analysis.
[c]OR = odds ratio. The dependent variable was binary, with 0 = patients with an equal or higher number of working hours compared to their hours before Q-fever and 1 = patients with less working hours due to Q-fever. Patients who were working less hours due to another reason than Q-fever were excluded. This led to an inclusion of 168 patients (out of a working population of 248).
[d]CI = confidence interval.