BMJ Open

Association between work situation and life satisfaction during the COVID-19 pandemic: prospective cohort study in Norway

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ABSTRACT

Objectives To estimate the impact of being laid off from work, having to work from home or having been diagnosed with COVID-19 on self-reported satisfaction with life.

Design Nationwide population-based cohort study.

Setting Norway.

Participants We followed more than 80 000 participants in an ongoing cohort study, the Norwegian Mother, Father and Child Cohort Study (MoBa), during the COVID-19 pandemic. We analysed current life satisfaction in April and again in September/October 2020 for subjects whose work situation and infection status had changed.

Main outcome measures Self-reported satisfaction with life, using a scale from 0 (worst) to 10 (best). We analysed the scale both continuously and as a binary variable (<or ≥6).

Results Temporary and permanent layoffs, working from a home-based office, and getting a COVID-19 diagnosis were all associated with modestly, but significantly lower concurrent life satisfaction, both in the total on a population level and for subjects experiencing a change in job status between spring and autumn. The associations with change in work situation were stronger for men. For men with permanent job loss, the adjusted odds ratio (OR) for low life satisfaction (<6) was 3.2 (95% CI 2.4 to 4.2) in April and 4.9 (95% CI 3.5 to 6.9) in autumn. Among all, a suspected or confirmed COVID-19 diagnosis was associated with an adjusted OR for low life satisfaction of 1.9 (95% CI 1.6 to 2.3) in spring. The strength of associations between work situation and life satisfaction did not vary much across socio-economic strata, but layoffs were more common among those with low education.

Conclusion Layoffs, home office and infection status had clear impact on the quality of life as measured with a global life satisfaction scale. These findings suggest that social differentials in quality of life, are increasing during the pandemic.

Strengths and limitations of this study

► A main strength is the large sample size and continued high participation rates over all survey rounds.
► Both genders and participants from all parts of the country are well represented in the study, and there is a wide age span.
► A limitation may be generalisability of the magnitude of associations observed to a childless population.

low income and educational level were most often affected by layoffs.[1 4] Studies conducted before the pandemic found that layoffs are associated with decreased life satisfaction.[5] Whether the same applies in a situation where layoffs are more widespread due to a collective crisis such as the ongoing pandemic, and whether a similar association can be seen for more moderate changes in work situation, remain to be elucidated.

Mental health and psychological well-being has decreased during the first part of the pandemic, in line with findings from previous pandemics or major lockdown situations, leading to concern about the global impact on mental health.[6–9] Some groups experience a larger burden of stressors and may be particularly vulnerable.[10] A German study found overall decreased satisfaction with work and family life during lockdown.[11] Effects on private and work life was found to differ by household composition in another study, where perceived impact on work-life as a consequence of the pandemic was associated with mental well-being and self-rated health.[12] A study from Cyprus found increased levels of anxiety and depression among those who were unemployed, but no clear findings with regard to working from home compared with normal working days.[13] A study from China suggested that people who stopped working as a consequence of the pandemic

INTRODUCTION

The COVID-19 pandemic has led to an increase in permanent and temporary layoffs as well as possible permanent changes in how we work.[1–3] Early studies from spring 2020 suggested that young people and those with

reported worse mental and physical health conditions.[14] Yet another study found an association with lower life satisfaction among those with a negative job prospect as a result of the COVID-19 pandemic.[15]

There is a need to estimate more precisely the effects of both being temporarily or permanently laid off from work and the effect of working from home on life satisfaction. Although Norway is a quite egalitarian society with relatively low unemployment rates prior to the pandemic,[16] we hypothesised that the pandemic would negatively influence life satisfaction at least for those who lost their jobs, if not for the population as a whole. To arrive at population-based estimates, we examine these associations in a large, ongoing cohort, where participants were recruited several years prior to the pandemic. We describe the level of self-rated life satisfaction during the spring and autumn of 2020, at time points when the duration of the pandemic and the possible development of vaccines were still highly uncertain. While infection rates in Norway had been low during summer 2020, a second wave of increasing infection rates emerged in August 2020. Although the incidence of new SARS-CoV-2 cases was still relatively low, the situation in Norway was much influenced by the higher infection rates in Europe. Thus, both time periods covered in this study (spring and autumn 2020) could be characterised by worry and uncertainty regarding the duration of the pandemic.

Our main aim was to examine whether changes in work situation during the first months of the pandemic was associated with life satisfaction on a population level. We contrasted people with a stable work situation to people with moderate (home office) or major changes (permanent or temporary layoff) in either spring or autumn 2020. Similarly, we describe changes in life satisfaction following a COVID-19 diagnosis. We also aimed to assess whether associations varied across various socioeconomic measures.

METHODS
Study design and participants
The Norwegian Mother, Father and Child Cohort Study (MoBa)[17] is an ongoing nationwide cohort study in which 95 000 pregnant women and 75 000 partners were recruited between 1999 and 2008. Parents and children have been followed with questionnaires and registry linkages with the aim to understand causes of disease.

Since March 2020, MoBa parents, now aged 30–65 years, have been invited to answer short mobile-phone questionnaires every 14 days regarding symptoms related to COVID-19, chronic illnesses, job situation, life satisfaction and more. About 149 000 parents, who were still active MoBa participants, were invited to answer the repeated surveys, in this paper referred to as rounds. We used questionnaire rounds 2 and 3 (April 2020) and 14 and 15 (September/October 2020), including questions on both work situation and life satisfaction. Data from the various rounds were linked to previous MoBa data to
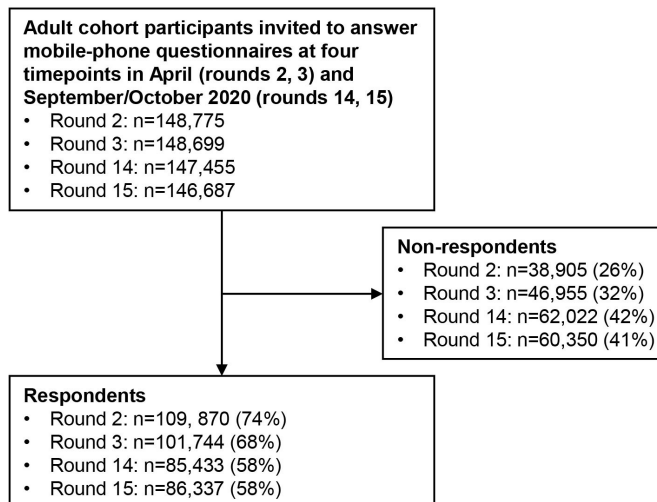

Figure 1 Flow chart of MoBa participants responding to four questionnaires in April, September and October 2020. MoBa, The Norwegian Mother, Father and Child Cohort Study.

obtain information on educational level and previously reported levels of life satisfaction. The participation rates were 74%, 68%, 58% and 58%, for rounds 2, 3, 14 and 15, respectively (figure 1).

Outcomes
Our main outcome measure was the participants' global judgement of their own life, referred to as life satisfaction, measured on an adapted version of the Cantril ladder.[18] Participants were asked at three different timepoints (mid-April, end of April and September 2020) to rate their life at the moment on a scale from 0 to 10, with 0 representing the worst possible life and 10 being the best. We used life satisfaction both as a continuous variable (original and z-score) and as a binary variable, where a score of 6 or more was labelled 'High Life Satisfaction' and less than 6, 'Low Life Satisfaction'.

Exposures
The main exposure was participants' response to the item 'have you experienced change in work situation due to the COVID-19 pandemic' categorised as 'no' or 'yes'. In autumn, the response alternatives were extended to include the categories 'no', 'yes—previously' or 'yes-still change in work situation'. If 'yes', the answers were further grouped into loss of job, layoff from job, home-based office or other change. A secondary exposure was self-reported COVID-19 diagnosis in spring (round 2 or 3), or in the period from late spring to autumn (rounds 4–14), based on participants answer to 'have you tested positive for COVID-19' or if they reported to have a suspected or confirmed COVID-19 diagnosis from their physician.

Covariates
Age was provided in 5-year and 10-year intervals. Educational level was coded as less than high school, high

school, university/college up to and including 4 years, more than 4 years of university/college. For men, this information was provided in 2015 or at recruitment, and if not available, from the maternal report of their partner's educational attainment in the recruitment questionnaire, where she reported on her partner's educational attainment. For the women, educational level was extracted from a questionnaire sent out 8 years after recruitment or from the recruitment questionnaire. From previous MoBa data collections, we had information on their answers to the standardised Satisfaction With Life Scale (SWLS).[19] This scale includes the following five items: In most ways my life is close to my ideal; The conditions of my life are excellent; I am satisfied with my life; So far, I have had the important things I want in life; If I could live my life over, I would change almost nothing. Each item is scaled from 1 to 7, where 1 is 'disagree completely' and 7 is 'agree completely'. The mean value across the responses to all items was calculated, to obtain a score between 1 and 7. For women, the scale was responded to during pregnancy, as well as 3, 5 and 8 years after childbirth, while men answered in the recruitment questionnaire as well as in a questionnaire issued in 2015. The internal consistency (Cronbach's alpha) of SWLS has generally been estimated exceeding values of 0.80,[19] also in Norwegian samples.[20] In the current sample the Cronbach's alpha was estimated to be 0.85–0.89 for men and 0.89–0.90 for women for the different questionnaires. We constructed an individual base-level life satisfaction score by calculating the mean across all available assessments of the Life Satisfaction Scale. As an alternative approach, we also calculated the base-level life satisfaction score using the most recent available assessment, which was adjusted for number of years since this was reported. From the COVID-19 questionnaires, we also obtained information on the number of persons in their household, and whether they suffered from any of a series of listed chronic disease (coded as dummy variables for each chronic disease).

Statistical analysis

We estimated associations between changes in work situation or COVID-19 infection status and life satisfaction at three different time points in spring and autumn 2020 using complete case linear and logistic regression models. Life satisfaction score was used as a continuous or binary dependent variable. Associations were reported as unadjusted and adjusted beta or odds ratio (OR), with 95% CIs, to test the hypothesis that changes in work situation or COVID-19 infection status were associated with life satisfaction on a population level. Multivariable regression analyses were adjusted for age group, chronic diseases, number of persons in the household, educational level, as well as their mean score on the previously recorded SWLS. As a sensitivity analysis, we adjusted for the most recent life satisfaction measure and number of years since this was reported, which did not change our findings (results not shown). To examine whether

associations differed across socioeconomic measures, we also performed analyses stratified by gender, educational level and age group.

We also describe person-specific changes in life satisfaction z-scores from spring to autumn in groups who did or did not experience a change in work situation or COVID-19 infection status. These changes were reported as mean differences in scores from spring to autumn. CIs were calculated by multiplying the SE for each mean value with a t-value of 1.96. The analyses were performed using R, V.4.0.2.

Patient and public involvement

Patients or the public were not involved in the design or conduct of this study. Participants in MoBa are informed about the project and results from the project through the MoBa newsletter and MoBa homepage at www.fhi.no.

RESULTS

Men's life satisfaction was similar in spring and autumn 2020, while women appeared to have slightly higher life satisfaction in the autumn (table 1). The overall proportion with low life satisfaction score was 16% and 13% in the two survey rounds in spring and 12% in the autumn survey. The proportion of participants who reported to have lost their jobs was stable (<1%) during the study period, while the proportions who reported temporary layoff and use of home-based office substantially declined from spring to autumn: from 8% to 1% for layoff and from 35% to 13% for home-based office (table 1). The proportion of participants reporting suspected/confirmed COVID-19 was 0.9% in spring (rounds 2–3). In the autumn rounds, another 0.9% of the respondents reported suspected/confirmed COVID-19 to have occurred (rounds 4–14).

Temporary layoff or permanent job loss was more common among those with low education level than those with high educational level, both in spring (figure 2) and autumn (online supplemental figure 1). Home-based office was more common among those with high education. The proportions experiencing changes in work situation were relatively similar across genders and age groups (<or ≥45 years) both in spring (figure 2) and autumn (online supplemental figure 1).

Those who had permanently lost their jobs reported lower life satisfaction (table 2), and their OR of having low life satisfaction increased in both genders when compared with those who had no or 'other' change in their work situation (table 3). For temporary layoffs, the results were similar, but the associations were of smaller magnitude than for those who had permanently lost their job. The magnitudes of associations between job loss or layoffs and reduction in life satisfaction were larger for men than women. Magnitudes of associations with life satisfaction were larger in autumn than in spring for layoffs in both genders, and for permanent job loss in women, but not in men.

Table 1 Descriptive characteristics of the study population

Characteristics	14 April 2020	29 April 2020	30 September 2020	14 October 2020
	Round 2	Round 3	Round 14	Round 15
Participants, no	109 870	101 744	85 433	86 337
Men, no (%)	45 344 (41)	41 281 (41)	33 238 (39)	33 876 (39)
Women, no (%)	64 526 (59)	60 463 (59)	52 195 (61)	52 461 (61)
Age (years), no (%)				
25–34	1110 (1)	975 (1)	637 (1)	659 (1)
35–39	9951 (9)	8909 (9)	6764 (8)	6862 (8)
40–44	30 786 (28)	28 478 (28)	23 399 (27)	23 563 (27)
45–49	40 412 (37)	37 577 (37)	32 064 (38)	32 375 (37)
50–54	21 124 (19)	19 726 (19)	17 186 (20)	17 420 (20)
55–59	5216 (5)	4888 (5)	4308 (5)	4353 (5)
60+	1271 (1)	1191 (1)	1075 (1)	1105 (1)
Any chronic disease, no (%)*	30 984 (28)	28 304 (28)	24 985 (29)	25 236 (29)
Educational level, no (%)				
<High school	7314 (7)	6447 (6)	4843 (6)	5004 (6)
High school	33 122 (30)	30 097 (30)	24 230 (28)	24 713 (29)
College ≤4 years	38 799 (35)	36 527 (36)	31 786 (37)	31 905 (37)
College >4 years	25 865 (24)	24 488 (24)	21 421 (25)	21 461 (25)
Missing/other	4770 (4)	4185 (4)	3153 (4)	3254 (4)
Current work situation, no (%)				
No/other change	62 252 (57)	63 255 (62)	NA	73 720 (85)
Home-based office	38 136 (35)	30 304 (30)	NA	10 981 (13)
Lay-off	8653 (8)	7477 (7)	NA	1019 (1)
Loss of job	637 (0.6)	559 (0.5)	NA	477 (0.6)
Missing	192 (0.2)	149 (0.1)	NA	140 (0.2)
Life satisfaction (0–10), mean (SD)				
Men	7.3 (1.7)	7.4 (1.6)	7.4 (1.6)	NA
Women	7.1 (1.7)	7.3 (1.6)	7.5 (1.6)	NA
Life satisfaction, no (%)				
Low (≤5)	17 458 (16)	13 035 (13)	10 184 (12)	NA
High (≥6)	92 150 (84)	88 521 (87)	75 139 (88)	NA
Missing	262 (0.2)	188 (0.2)	110 (0.1)	NA

*Information on chronic disease was collected in rounds 2 and 3 only. For rounds 14 and 15, proportions with chronic disease are calculated among those with available information from rounds 2 and 3 (10% had missing information about chronic disease both in round 14 and 15).
NA, not available.

For home-based office, we found associations with reduced mean life satisfaction both in spring and autumn, but of a smaller magnitude than for job loss and layoffs (table 2). We found no clear associations between home-based office and low life satisfaction during spring. In the autumn, men with home-based office had an increased OR of having low life satisfaction, and a similar but weaker trend was seen for women (table 3).

In analyses stratified by educational level, we found only small differences between low and high educational level in the ORs of low life satisfaction. For temporary layoff, ORs were slightly higher for those with college or higher education in spring, while for permanent job loss, ORs were slightly higher among those with high school or lower education (online supplemental table 1). However, after restricting analyses to only those aged under 45 years, we found higher ORs for low life satisfaction among those with high education who had permanently lost their job, and the associations were even stronger in the autumn (online supplemental table 2). When stratifying by both gender and age, the magnitudes of associations with low life satisfaction were highest in autumn among men above 45 years, followed by men in both age groups
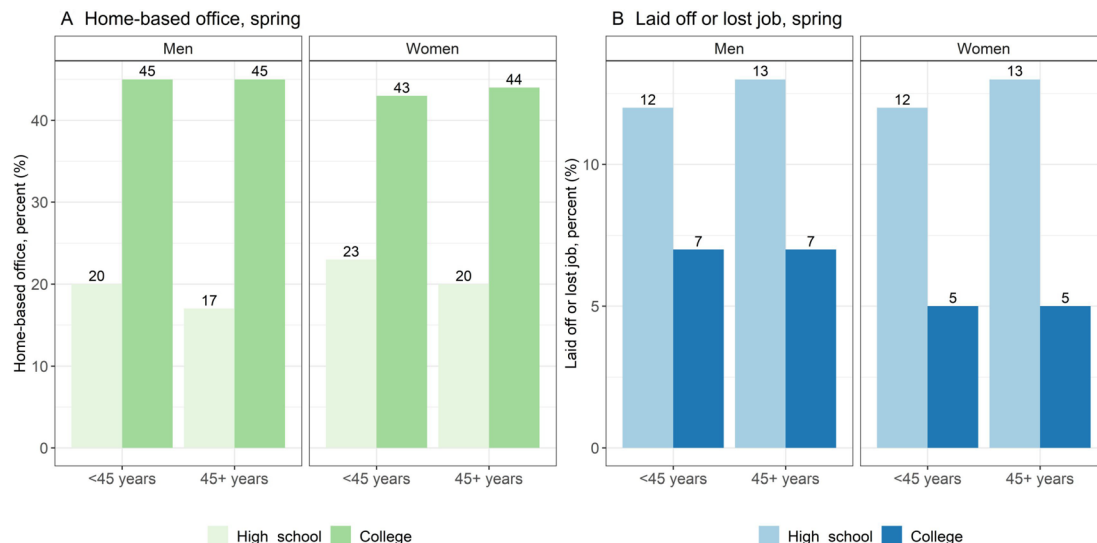
Carlsen EØ, *et al. BMJ Open* 2022;**12**:e049586. doi:10.1136/bmjopen-2021-049586

Figure 2 Proportions with (A) home-based office and (B) who were laid off (temporary) or lost job (permanently) in spring (survey round 2) across gender, age group and educational level.

in spring, who had in both cases permanently lost their job (online supplemental table 3).

Within individuals, difference in life satisfaction from spring to autumn were associated with changes in work situation (figure 3). Those who were laid off in spring and were back to their normal working situation in autumn had an increased (0.13, 95% CI 0.10 to 0.16) life satisfaction z-score from spring to autumn. For those who were laid off in both spring and autumn, life satisfaction z-scores decreased (−0.12, 95% CI −0.19 to −0.05) from spring to autumn, while those with no change in work situation in either spring or autumn reported no change

(−0.01, 95% CI −0.02 to 0.0) in life satisfaction between spring and autumn.

In spring, those with a suspected (by physician) or confirmed (by testing) COVID-19 diagnosis had increased ORs (1.9, 95% CI 1.6 to 2.3) of low life satisfaction compared with those who did not report COVID-19 at all. In autumn, those who got a COVID-19 diagnosis in the period May–October also had an increased OR (1.7, 95% CI 1.3 to 2.0), although with weaker magnitude than those in spring, of low life satisfaction compared with those with no COVID-19 diagnosis in either spring or autumn (table 4).

Table 2 Regression analyses of mean life satisfaction (scale 0–10), stratified by survey round and gender

Exposure	Round 2 (spring)		Round 3 (spring)		Round 14/15 (autumn)	
	Beta (95% CI), unadjusted	Beta (95% CI), adjusted*	Beta (95% CI), unadjusted	Beta (95% CI), adjusted*	Beta (95% CI), unadjusted	Beta (95% CI), adjusted*
Work situation						
Men:	n=42 861		n=39 102		n=25 274	
No/other change (reference)	0 (Ref)	0 (Ref)	0 (Ref)	0 (Ref)	0 (Ref)	0 (Ref)
Home-based office	−0.2 (−0.3 to −0.2)	−0.3 (−0.3 to −0.3)	−0.2 (−0.3 to −0.2)	−0.3 (−0.3 to −0.2)	−0.3 (−0.3 to −0.2)	−0.3 (−0.3 to −0.2)
Lay-off	−0.5 (−0.6 to −0.5)	−0.5 (−0.6 to −0.5)	−0.6 (−0.6 to −0.5)	−0.6 (−0.6 to −0.5)	−1.0 (−1.2 to −0.9)	−1.1 (−1.2 to −0.9)
Loss of job	−1.0 (−1.2 to −0.8)	−1.1 (−1.3 to −0.9)	−1.5 (−1.7 to −1.3)	−1.4 (−1.6 to −1.2)	−1.6 (−1.8 to −1.4)	−1.4 (−1.6 to −1.2)
Women:	n=61 873		n=58 222		n=41 793	
No/other change (reference)	0 (Ref)	0 (Ref)	0 (Ref)	0 (Ref)	0 (Ref)	0 (Ref)
Home-based office	−0.1 (−0.1 to 0.0)	−0.1 (−0.1 to −0.1)	−0.1 (−0.1 to −0.1)	−0.2 (−0.2 to −0.1)	−0.2 (−0.2 to −0.1)	−0.2 (−0.3 to −0.2)
Lay-off	−0.2 (−0.3 to −0.2)	−0.2 (−0.3 to −0.2)	−0.3 (−0.3 to −0.2)	−0.3 (−0.3 to −0.2)	−0.6 (−0.8 to −0.5)	−0.7 (−0.8 to −0.5)
Loss of job	−0.5 (−0.7 to −0.4)	−0.6 (−0.8 to −0.4)	−0.9 (−1.0 to −0.7)	−0.9 (−1.0 to −0.7)	−1.2 (−1.5 to −1.0)	−1.1 (−1.3 to −0.9)

*Adjusted for: age, educational level, chronic conditions, base-level life satisfaction and number of people in household.

Table 3 Odds Ratios (OR) for having low life satisfaction (below 6) according to work situation, stratified by survey round and gender

Exposure	Round 2 (spring)		Round 3 (spring)		Round 14/15 (autumn)	
	OR (95% CI), unadjusted	OR (95% CI), adjusted*	OR (95% CI), unadjusted	OR (95% CI), adjusted*	OR (95% CI), unadjusted	OR (95% CI), adjusted*
Work situation						
Men:	n=42 861		n=39 102		n=25 274	
No/other change (reference)	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)
Home-based office	1.1 (1.0 to 1.1)	1.1 (1.1 to 1.2)	1.0 (0.9 to 1.1)	1.1 (1.0 to 1.2)	1.2 (1.1 to 1.3)	1.2 (1.1 to 1.4)
Lay-off	2.0 (1.8 to 2.1)	2.0 (1.8 to 2.2)	2.1 (1.9 to 2.3)	2.2 (2.0 to 2.4)	3.6 (2.8 to 4.4)	4.0 (3.1 to 5.1)
Loss of job	3.2 (2.5 to 4.1)	3.2 (2.4 to 4.2)	5.2 (4.0 to 6.7)	4.8 (3.6 to 6.3)	5.6 (4.1 to 7.5)	4.9 (3.5 to 6.9)
Women:	n=61 873		n=58 222		n=41 793	
No/other change (reference)	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)
Home-based office	0.9 (0.9 to 1.0)	1.0 (0.9 to 1.0)	1.0 (0.9 to 1.1)	1.0 (0.9 to 1.0)	1.1 (1.0 to 1.1)	1.1 (1.0 to 1.2)
Lay-off	1.4 (1.3 to 1.5)	1.4 (1.3 to 1.5)	2.1 (1.9 to 2.3)	1.5 (1.3 to 1.6)	2.2 (1.7 to 2.7)	2.4 (1.9 to 3.0)
Loss of job	2.1 (1.7 to 2.6)	2.2 (1.7 to 2.8)	5.2 (4.0 to 6.7)	2.8 (2.1 to 3.6)	3.8 (2.8 to 5.1)	3.7 (2.7 to 5.0)

*Adjusted for: age, educational level, chronic conditions, base-level life satisfaction and number of people in household.
OR, Odds ratio.

Changes in life satisfaction from spring to autumn was also related to infection status (figure 4). Those who had reported a suspected or confirmed COVID-19 diagnosis in the period between spring and autumn, had a −0.22 (95% CI −0.32 to −0.11) reduction in life satisfaction z-score from spring to autumn. For those reporting COVID-19 in spring, life satisfaction z-score tended to increase from spring to autumn (0.10, 95% CI 0.01 to 0.20), while we found no change (0.0, 95% CI −0.01 to 0.0) in life satisfaction among those not reporting a COVID-19 diagnosis.

DISCUSSION

In this large population-based study, we estimated life satisfaction levels as a consequence of the changing work situations and infection status during the first 6 months of the COVID-19 pandemic in Norway. We found clear indications of lower life satisfaction among those who experienced either a permanent or temporary job loss and among those who changed to working from a home-based office, compared with subjects who did not experience a change in work situation. The associations were
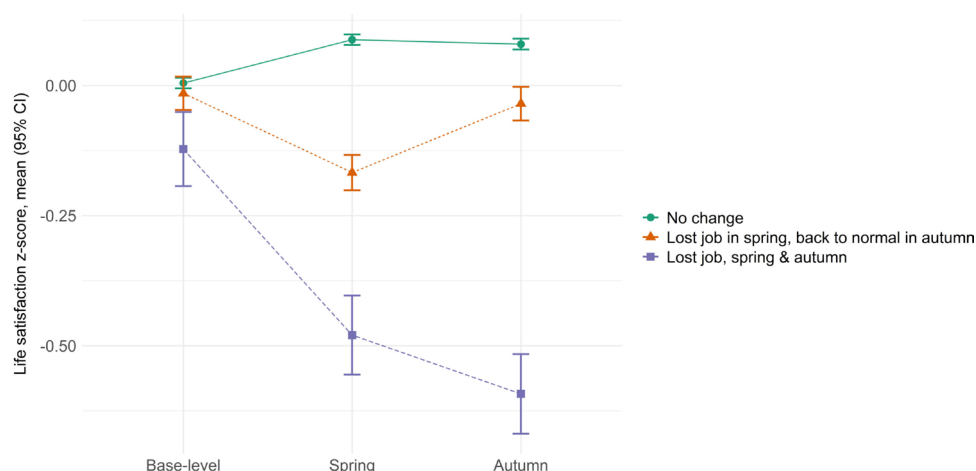

Figure 3 Satisfaction with life (mean z-score and 95% CI) among those with no change in work situation in spring or autumn (n=39 280), those who had temporarily or permanently lost their job in spring (April, round 2 or 3), but were back to their normal work situation in autumn (September/October, n=3976); and those who reported to have lost their job in both spring and autumn (n=984).

Carlsen EØ, et al. BMJ Open 2022;**12**:e049586. doi:10.1136/bmjopen-2021-049586

Table 4 Logistic and linear regression analyses of infection status (suspected or confirmed COVID-19) and life satisfaction stratified by survey round

	Spring, rounds 2–3		Autumn, rounds 4–14		Spring, rounds 2–3		Autumn, rounds 4–14	
	OR (95% CI), unadjusted	OR (95% CI), adjusted	OR (95% CI), unadjusted	OR (95% CI), adjusted	Beta (95% CI), unadjusted	Beta (95% CI), adjusted	Beta (95% CI), unadjusted	Beta (95% CI), adjusted
	n=89622		n=73416		n=89622		n=73416	
COVID-19								
No (reference)	1 (Ref.)	1 (Ref.)	1 (Ref.)	1 (Ref.)	0 (Ref.)	0 (Ref.)	0 (Ref.)	0 (Ref.)
Yes	2.1 (1.8 to 2.5)	1.9 (1.6 to 2.3)	1.7 (1.4 to 2.1)	1.6 (1.3 to 2.0)	−0.3 (−0.4 to −0.3)	−0.5 (−0.6 to −0.4)	−0.4 (−0.5 to −0.3)	−0.3 (−0.5 to −0.2)

Adjusted analyses adjusted for: chronic conditions, base-level life satisfaction and number of people they cohabit with.
OR, Odds ratio.

somewhat stronger for men. We found that the association between layoffs and reduced life satisfaction was stronger after the summer, when a lower proportion of participants reported to be laid off. Our findings indicate that associations with reduced life satisfaction were of a larger magnitude for job loss than for a COVID-19 diagnosis.

A main strength of our study is the large sample size and continued high participation rates over all survey rounds. The participation rates were higher in spring (68% and 74%) than in autumn (58%), but the composition of the samples did not differ much according to gender, age, chronic illness and educational level. Both genders and participants from all parts of the country are well represented in the study, and there is a wide age span. Furthermore, the advantages of using pre-existing cohorts as opposed to panels recruited during the pandemic has been outlined as advantageous.[21] MoBa is a cohort that was recruited among pregnant women and their partners during 1999–2008. Thus, we do not know whether the association between job loss and life satisfaction is of the same magnitude in childless adults, although it seems unlikely that it would be very different. A study of the recruitment into MoBa indicated a higher socioeconomic status among participants than the general Norwegian population.[22] However, the effect of job loss on life satisfaction in this study was about the same across levels of educational attainment.

Norway has a relatively generous welfare state, and it is likely that the gradients we find in reduced life satisfaction would have been stronger in countries where temporary and permanent layoffs are associated with less generous compensations. The economic compensation system was even improved during the pandemic to minimise the burden on those laid off as a consequence of the pandemic,[23] indicating that economic consequences of a job loss alone would probably not explain the whole effect seen on satisfaction with life. According to the Organisation for Economic Co-operation and Development (OECD) Economic Survey from 2016, Norwegians were in overall more satisfied with their lives than populations in other OECD countries.[24] Life satisfaction for Norwegians in 2016 was also slightly higher (score 7.6) than for participants in the current study (7.1–7.5), which may indicate decreased overall life satisfaction in the population due to the pandemic.

Other, smaller, studies have shown conflicting results regarding overall changes in population mental health and psychological well-being during the COVID-19 pandemic, but certain groups, such as younger age groups, may be more vulnerable.[6 9 25 26] Individuals rate their life satisfaction relative to their conception of what maximum and minimum satisfaction would be. In addition to a rather stable life satisfaction level rooted in personality, it is hypothesised that life satisfaction is achieved when various needs are met, and when engaging in meaningful activities.[27] A job can both fulfil needs of income, belonging and provide meaningful activities for individuals.
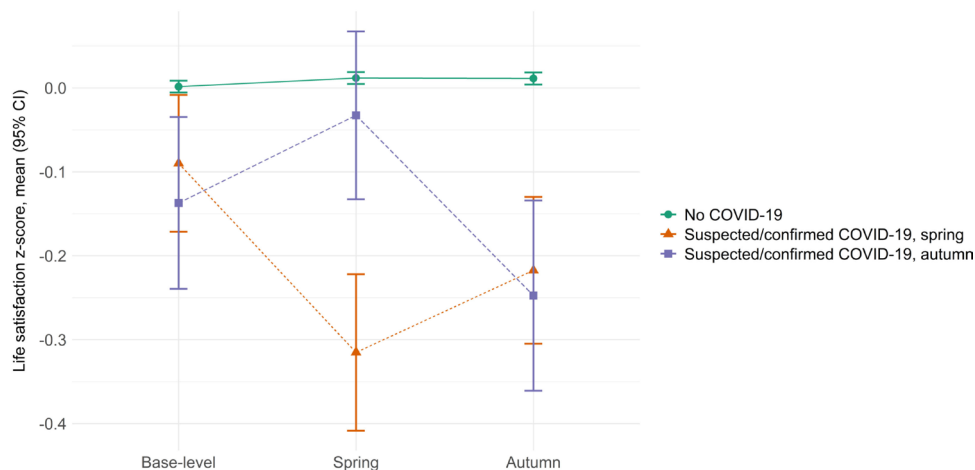
Figure 4 Satisfaction with life (mean z-score and 95% CI) among those with no suspected/confirmed COVID-19 diagnosis (n=73 837), those who had suspected or confirmed COVID-19 in spring (round 2 or 3, n=844), and among those who reported in autumn that they had a suspected or confirmed COVID-19 diagnosis in the period between spring and autumn (new cases in rounds 4–14, n=422).

There is little available evidence on effects of mandatory home-based office on mental health. However, in a small study from China, life satisfaction decreased among those who stopped working due to the COVID-19 pandemic, but no differences were seen between those working from home vs from an office.[14] In a study from Germany, work satisfaction decreased among women who were forced to reduce their working hours, but no associations were found between home-based office and work or family satisfaction.[11] However, a small study from Switzerland found that increase in leisure time due to shorter workdays or home-based office was associated with increased mental well-being for those not living alone,[12] suggesting that household composition could affect how important work life is for individuals.

In addition to affecting quality of life, unemployment has been suggested as a risk factor for morbidity and mortality, in particular for men,[28 29] with an increased risk of myocardial infarction the first year after losing their job.[30] We found that layoffs were associated with decreased life satisfaction to a higher extent in the autumn than in spring, which could be due to fewer layoffs in the autumn, meaning that those affected at that time point felt less as part of a collective crisis. However, unemployment has been associated with increased risk of suicide even in the context of a collective financial crisis.[31] Although the incidence of ST-elevation myocardial infarctions dropped after the COVID-19 pandemic hit Northern Europe,[32] long-term health consequences might be substantial. Continued research into effects of changes in working situations on somatic and mental health are required to better inform healthcare personnel on how to follow up patients who have been affected by layoffs during the COVID-19 pandemic.

Our findings indicate that changes in work situation ranging from home-based office to permanent job loss during the COVID-19 pandemic impacts life satisfaction. Temporary layoff or permanent job loss was more common among those with low education level than those with high educational level and may thus widen social differentials in health. There is a need to follow population-based cohort studies through and after the pandemic for better estimates of long-term health consequences.

To conclude, temporary and permanent layoffs, transition to working from a home-based office, and getting a COVID-19 diagnosis were associated with lower concurrent life satisfaction during April to October 2020.

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ONLINE SUPPLEMENTARY MATERIAL

Supplementary Table 1. Logistic regression analyses of low life satisfaction stratified by survey round and education level. Adjusted analyses adjusted for: age, chronic conditions, base-level life satisfaction, and number of people they cohabit with.

	Round 2 (spring)		Round 3 (spring)		Round 14/15 (autumn)	
	OR low life satisfaction (95% CI), unadjusted	OR low life satisfaction (95% CI), adjusted	OR low life satisfaction (95% CI), unadjusted	OR low life satisfaction (95% CI), adjusted	OR low life satisfaction (95% CI), unadjusted	OR low life satisfaction (95% CI), adjusted
≤ High school	n=39,566		n=35,833		n=22,558	
Work situation						
No/other change (reference)	1 (Ref.)	1 (Ref.)	1 (Ref.)	1 (Ref.)	1 (Ref.)	1 (Ref.)
Home-based office	1.0 (0.9, 1.1)	1 (1.0, 1.1)	0.9 (0.8, 1.0)	0.9 (0.9, 1.0)	1.1 (0.9, 1.3)	1.1 (1, 1.3)
Lay-off	1.4 (1.3, 1.6)	1.5 (1.4, 1.6)	1.5 (1.4, 1.7)	1.6 (1.5, 1.8)	2.7 (2.1, 3.3)	3.0 (2.4, 3.7)
Loss of job	2.8 (2.2, 3.5)	2.9 (2.2, 3.7)	3.3 (2.6, 4.3)	3.4 (2.6, 4.5)	4.5 (3.3, 6.2)	4.3 (3.1, 5.9)
College	n=63,736		n=60,212		n=53,207	
Work situation						
No/other change (reference)	1 (Ref.)	1 (Ref.)	1 (Ref.)	1 (Ref.)	1 (Ref.)	1 (Ref.)
Home-based office	1.0 (1.0, 1.1)	1.0 (1.0, 1.1)	1.0 (1.0, 1.1)	1.0 (1.0, 1.1)	1.2 (1.1, 1.3)	1.2 (1.1, 1.3)
Lay-off	1.8 (1.6, 1.9)	1.8 (1.6, 1.9)	1.8 (1.7, 2.0)	1.9 (1.7, 2)	2.7 (2.0, 3.4)	2.9 (2.2, 3.8)
Loss of job	2.4 (1.8, 3.1)	2.3 (1.8, 3)	3.6 (2.7, 4.7)	3.4 (2.6, 4.5)	4.4 (3.2, 5.9)	4.1 (3.0, 5.6)

Supplementary Table 2. Logistic regression analyses of low life satisfaction(score <6) in a subset with age<45 and educational level ≤high school stratified by survey round. Adjusted analyses adjusted for: chronic conditions, base-level life satisfaction, and number of people they cohabit with.

	Spring, round 2		Spring, round 3		Autumn, round 14/15	
	OR (95% CI), unadjusted	OR (95% CI), adjusted	OR (95% CI), unadjusted	OR (95% CI), adjusted	OR (95% CI), unadjusted	OR (95% CI), adjusted
Age <45 , <= High school	n=17,301		n=15,410		n=8779	
Work situation						
No/other change (reference)	1 (Ref.)	1 (Ref.)	1 (Ref.)	1 (Ref.)	1 (Ref.)	1 (Ref.)
Home-based office	0.9 (0.8, 1.0)	1.0 (0.9, 1.1)	0.8 (0.7, 0.9)	0.8 (0.7, 1.0)	1.0 (0.8, 1.3)	1.0 (0.8, 1.3)
Lay-off	1.3 (1.1, 1.4)	1.3 (1.2, 1.5)	1.4 (1.2, 1.6)	1.5 (1.3, 1.7)	2.1 (1.4, 3.1)	2.1 (1.4, 3.1)
Loss of job	3.4 (2.3, 5.0)	3.6 (2.4, 5.3)	3.2 (2.1, 4.8)	3.3 (2.2, 5.0)	3.3 (1.8, 5.9)	2.9 (1.6, 5.3)
Age <45 , College	n=22,364		n=21,126		n=14,600	
Work situation						
No/other change (reference)	1 (Ref.)	1 (Ref.)	1 (Ref.)	1 (Ref.)	1 (Ref.)	1 (Ref.)
Home-based office	1.0 (0.9, 1.1)	1.0 (0.9, 1.1)	1.0 (0.9, 1.1)	1.0 (0.9, 1.1)	1.1 (0.9, 1.3)	1.1 (0.9, 1.3)
Lay-off	1.7 (1.5, 2.0)	1.7 (1.5, 2.0)	1.5 (1.2, 1.8)	1.5 (1.2, 1.8)	1.4 (0.7, 2.5)	1.3 (0.6, 2.4)
Loss of job	2.6 (1.6, 4.2)	2.4 (1.5, 3.9)	4.6 (2.7, 7.4)	4.2 (2.5, 7.0)	5.5 (3.0, 9.7)	5.3 (2.9, 9.6)

Supplemental material

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Supplementary Table 3. Logistic regression analyses of low life satisfaction (score <6) stratified by survey round, gender, and age group. Adjusted analyses adjusted for: chronic conditions, base-level life satisfaction, and number of people they cohabit with.

	Spring, round 2		Spring, round 3		Autumn, round 14/15	
	OR (95% CI), unadjusted	**OR (95% CI), adjusted**	**OR (95% CI), unadjusted**	**OR (95% CI), adjusted**	**OR (95% CI), unadjusted**	**OR (95% CI), adjusted**
Men, <45 years	n=13,079		n=11,701		n=6827	
Work situation						
No/other change (reference)	1 (Ref.)	1 (Ref.)	1 (Ref.)	1 (Ref.)	1 (Ref.)	1 (Ref.)
Home-based office	1.0 (0.9, 1.1)	1.0 (0.9, 1.2)	1.1 (0.9, 1.2)	1.1 (1.0, 1.3)	1.1 (0.9, 1.3)	1.1 (0.9, 1.3)
Lay-off	2.1 (1.8, 2.4)	2.0 (1.7, 2.4)	2.2 (1.8, 2.6)	2.1 (1.8, 2.5)	3.2 (1.9, 5.2)	2.6 (1.5, 4.2)
Loss of job	5.0 (3.1, 8.1)	5.2 (3.2, 8.5)	5.3 (3.2, 8.5)	5.0 (3.0, 8.3)	4.4 (2.0, 9.0)	3.7 (1.6, 7.8)
Men, 45+ years	n=29,782		n=27,401		n=18,447	
Work situation						
No/other change (reference)	1 (Ref.)	1 (Ref.)	1 (Ref.)	1 (Ref.)	1 (Ref.)	1 (Ref.)
Home-based office	1.1 (1, 1.2)	1.2 (1.1, 1.3)	1.0 (0.9, 1.1)	1.1 (1.0, 1.2)	1.2 (1.1, 1.4)	1.3 (1.2, 1.5)
Lay-off	2.0 (1.8, 2.2)	2.0 (1.8, 2.2)	2.1 (1.9, 2.4)	2.2 (1.9, 2.4)	4.0 (3.1, 5.3)	4.5 (3.4, 6.0)
Loss of job	2.8 (2.0, 3.8)	2.5 (1.8, 3.5)	5.0 (3.6, 6.9)	4.6 (3.3, 6.4)	5.9 (4.1, 8.4)	5.3 (3.6, 7.7)
Women, <45 years	n=27,007		n=25,194		n=16,745	
Work situation						
No/other change (reference)	1 (Ref.)	1 (Ref.)	1 (Ref.)	1 (Ref.)	1 (Ref.)	1 (Ref.)
Home-based office	0.9 (0.8, 0.9)	0.9 (0.9, 1.0)	0.8 (0.8, 0.9)	0.9 (0.8, 1.0)	1.0 (0.8, 1.1)	1.0 (0.9, 1.2)
Lay-off	1.2 (1.1, 1.4)	1.2 (1.1, 1.4)	1.2 (1.1, 1.4)	1.3 (1.1, 1.5)	1.5 (1.0, 2.3)	1.5 (0.9, 2.2)
Loss of job	2.4 (1.6, 3.5)	2.2 (1.5, 3.3)	3.3 (2.2, 5.0)	3.2 (2.1, 4.8)	4.4 (2.7, 7.2)	4.0 (2.4, 6.6)
Women, 45+ years	n=34,866		n=33,028		n=25,048	
Work situation						
No/other change (reference)	1 (Ref.)	1 (Ref.)	1 (Ref.)	1 (Ref.)	1 (Ref.)	1 (Ref.)
Home-based office	0.9 (0.8, 0.9)	0.9 (0.9, 1.0)	1.0 (0.9, 1.1)	1.0 (1.0, 1.1)	1.1 (1.0, 1.2)	1.2 (1.0, 1.3)
Lay-off	1.2 (1.1, 1.4)	1.2 (1.1, 1.4)	1.6 (1.4, 1.8)	1.7 (1.5, 1.9)	2.8 (2.1, 3.6)	3.0 (2.3, 4.0)
Loss of job	2.4 (1.6, 3.5)	2.2 (1.5, 3.3)	2.6 (1.8, 3.5)	2.6 (1.8, 3.6)	3.8 (2.6, 5.5)	3.5 (2.4, 5.1)
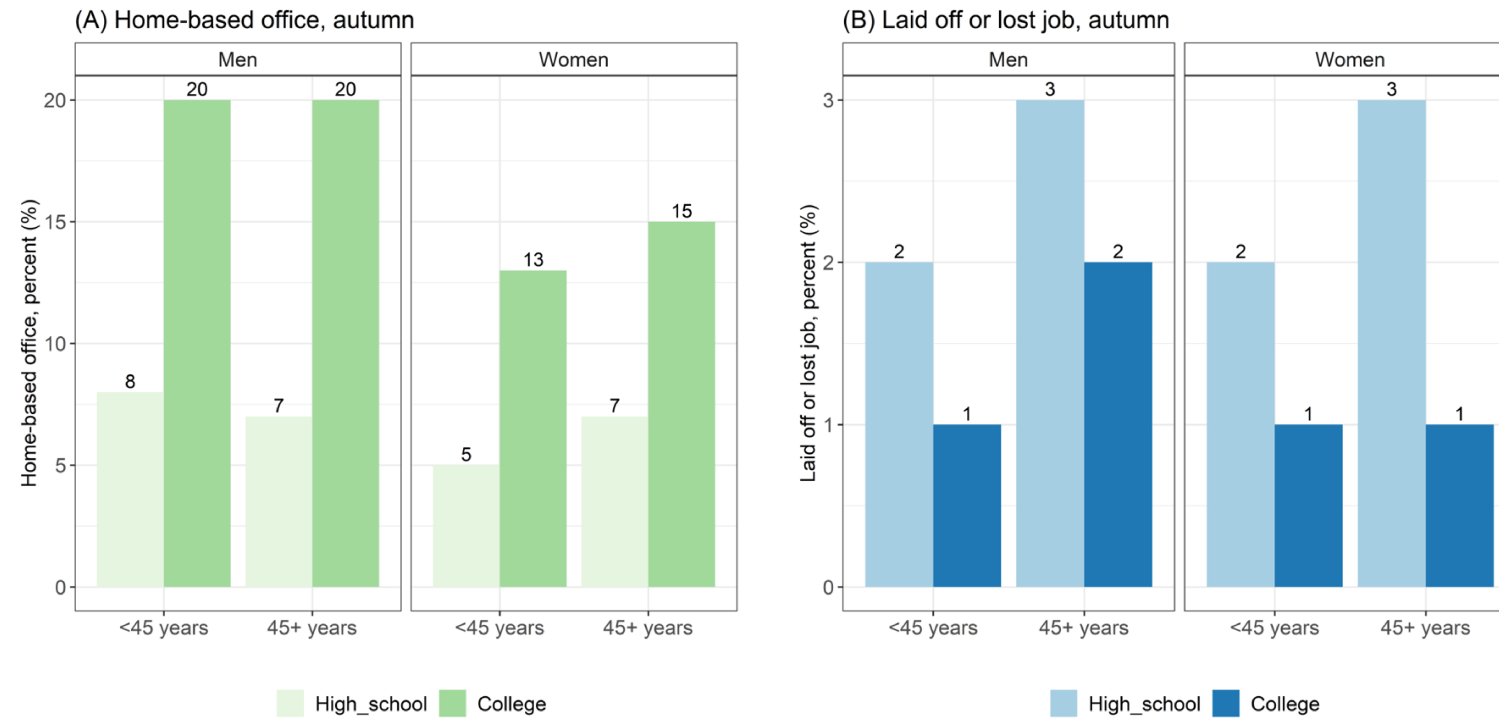
Supplementary Figure 1. Proportions with (A) home-based office and (B) who were laid off (temporary) or lost job (permanently) in autumn (survey round 15) across gender, age group and education level.