

RESEARCH ARTICLE

Impact of stress during adolescence on general
and work-related stress in early adulthood:
A prospective cohort studyTrine Nøhr Winding^{1*} , Mette Lykke Nielsen², and Regine Grytnes¹¹Department of Occupational Medicine, University Research Clinic, Danish Ramazzini Center, Goedstrup Hospital, Herning, Denmark²Department of Culture and Learning, Center for Youth Research, Aalborg University, Copenhagen, Denmark**Abstract**

High-stress levels during youth can negatively impact an individual's long-term physical and psychological health and overall well-being, potentially extending into adulthood and affecting their work life. Further investigation is required to deepen our understanding of how the stress experienced during adolescence correlates with stress in early adult work life. Furthermore, exploring how factors within the psychosocial work environment and temporary employment contribute to stressful experiences is crucial. This study followed a cohort of 1275 Danish working adults born in 1989, tracking them from age 15 – 28. Participants reported perceived stress levels at ages 15, 18, and 21, and the outcomes included perceived stress and work-related stress at age 28. Additional information on the psychosocial work environment and temporary employment was collected at age 28. The study consistently identified associations between perceived stress during adolescence and perceived stress or work-related stress in adulthood. The psychosocial work environment variables significantly contributed to work-related stress and partially explained general perceived stress, particularly among those with more work experience. Occupational health professionals should be aware that stress during adolescence can result in stress in future work life. It is important to understand that perceived stress and work-related stress are distinct facets, requiring different prevention approaches.

Keywords: Adolescents; Perceived stress; Work stress***Corresponding author:**Trine Nøhr Winding
(trwind@rm.dk)**Citation:** Winding, T.N., Nielsen, M.L., & Grytnes, R. (2025). Impact of stress during adolescence on general and work-related stress in early adulthood: A prospective cohort study. *International Journal of Population Studies*, 11(4): 25-40. <https://doi.org/10.36922/ijps.0864>**Received:** April 26, 2023**Revised:** October 11, 2023**Accepted:** April 12, 2024**Published online:** August 6, 2024**Copyright:** © 2024 Author(s). This is an Open-Access article distributed under the terms of the Creative Commons Attribution License, permitting distribution, and reproduction in any medium, provided the original work is properly cited.**Publisher's Note:** AccScience Publishing remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.**1. Introduction****1.1. Stress in youth**

The prevalence of mental health challenges, such as stress, anxiety, and depression, among young individuals is on the rise both in Denmark (Jeppesen *et al.*, 2020) and internationally (Johnson *et al.*, 2018; Kaasbøll *et al.*, 2021; the World Health Organization [WHO], 2020). The mental health issues often begin during their school years and can persist into their work lives. The explanations behind the increase in psychological problems, including stress, in young individuals are multifaceted. A clear social gradient

in the reporting of stress among young individuals has been documented (National Institute of Public Health, 2020), and many young individuals experience mounting pressures and expectations in their academic or vocational pursuits, leading to elevated levels of stress (Due *et al.*, 2014). International comparative surveys show an increase in educational stress during school years (Klinger *et al.*, 2015; Löfstedt *et al.*, 2019), with girls reporting the highest stress levels (Trolle *et al.*, 2017). Sociologists have argued that the negative trends in the development of mental health and stress reflect a wider social trend in the “Performance Society,” where young individuals are described as “Generation Performance,” whose experience of worth and identity is increasingly about performing optimally and being positioned as a winner (Madsen, 2018; Petersen, 2016), making success in life the predominant idea in life (Sørensen *et al.*, 2017). The young generation commonly demonstrates high levels of discipline and displays a thoughtful approach when weighing the outcomes of their decisions in relation to future prospects (Farrugia, 2020), which often leads to feelings of worry and stress (Nielsen *et al.*, 2010).

1.2. The negative health consequences of stress

Basically, perceived stress develops when demands in the environment exceed a person's resources and thus endanger the person's well-being (Lazarus & Folkman, 1984). Stress in youth can have major repercussions on young individuals' lives. In the short term, this can lead to an extension of the time required to complete their education or to the risk of dropping out of school or university. However, high-stress levels in youth can also have potential negative long-term consequences for the individual's physical and psychological health and well-being (WHO, 2009). A high degree of perceived stress among young adults has been found to relate to poorer self-rated health, poorer health behavior, and a higher risk of depression (Due *et al.*, 2014; Nielsen *et al.*, 2010). Furthermore, a study by Hanson *et al.* (2016) discovered that accumulated stress that occurs in childhood affects reward-related activity in the brain, causing decreased motivation and increased negative mood at age 26.

1.3. Stress and work-life

Stress during adolescence can have an enduring negative effect that extends into adult work life, contributing to stressful working conditions (work stress). In fact, a recent study on the same cohort revealed that stress during adolescence doubled the risk of low labor market participation between ages 25 and 29 compared to those who had not been stressed (Winding *et al.*, 2023). The labor market is in great need for young workers, and they should

ideally be able to work for many years. However, there is a lack of studies investigating how the well-being of young individuals influences their subsequent work lives. It is essential to understand the initiatives that should be taken to ensure that the next generation of workers establishes a good and stable connection to the labor market. However, the role of the psychosocial work environment in the stress and psychological well-being of young adults remains debated. In Denmark, workers below the age of 35 report higher stress levels compared to the general working population (NFA, 2017). Studies investigating the association between work environment and the development of stress or other mental health problems have identified associations between poor psychosocial work environment factors like a low degree of procedural and interactional organizational justice and the experience of stress (Oshio *et al.*, 2014) and between job resources such as variety, autonomy, or good relations with superiors or coworkers and mental well-being (Taris, 1999). These results are supported by the conclusion of a review from 2011, which revealed that high psychological demands and a low level of social support are associated with mental health problems, including stress among young workers (Laberge & Ledoux, 2011). At the same time, a reverse association between stress and work environment was demonstrated, where mental health problems can affect the experienced work environment of young workers (Taris, 1999), and a previous Danish study documented that mentally vulnerable young individuals experience more demanding work environments early in their careers compared to their peers (Winding *et al.*, 2015). However, it remains unclear if this negative association is due to the vulnerable position of new employees and whether it diminishes with more experience. This knowledge is important for implementing preventive measures in the workplace.

1.4. Temporary employment

In recent years, the negative consequences of part-time work, short-term employment, and insecurity in employment have gained focus, especially since different forms of temporary employment have become increasingly common among young individuals transitioning from education to work life (Nielsen *et al.*, 2017; Nielsen *et al.*, 2018). Temporary employment has been identified as a potential social determinant that can affect the health and well-being of employees and their families (Benach *et al.*, 2016). However, research in this area is still sparse, particularly regarding the impact of temporary work on stress development, especially early in one's career.

Thus, there is a need for more knowledge about the potential negative impact of high-stress levels during

adolescence on the experience of stress, both general perceived stress and work stress, during young adulthood. It is also essential to understand how psychosocial work environment factors and temporary employment affect the experience of stress in the early career stages. Furthermore, there is a need to investigate whether the perceived stress diminishes as young individuals gain more experience in the labor market.

In this study, stress is measured as perceived or experienced stress, which is different from clinical stress and is viewed from a psychological perspective. Lazarus' cognitive stress model (Cohen *et al.*, 1997) is the basis for the definition of the concept. Lazarus' theory suggests that the experience of stress is not fixed or unchanging but rather emerges as an ongoing interaction between the individual and their surroundings (Lazarus & Folkman, 1984).

1.5. Aim

This theoretical understanding and interest have led to the following three study aims:

- (i) To investigate the strength of the association between perceived stress during adolescence and stress experienced in young adult work life.
- (ii) To investigate the extent to which the association between perceived stress in adolescence and stress in young adult work life is explained by a poor psychosocial work environment and temporary employment.
- (iii) To investigate whether the association between perceived stress in adolescence and stress in young adult work life is dependent on work experience.

2. Methods

2.1. Participants

The individuals included in this study were drawn from the West Jutland Cohort, which consisted of all individuals ($n = 3681$) born in 1989 and residing in Ringkjøbing County, Denmark, in early April 2004. The primary objective of the West Jutland Cohort study was to examine and explore various dimensions of inequalities and social disparities affecting physical and mental health as well as overall well-being across the lifespan (Glasscock *et al.*, 2013; Winding & Andersen, 2015). At the age of 15, in 2004, a baseline questionnaire was administered during school hours, with participants who were absent from school on the collection day receiving the questionnaire by mail. Out of the 3681 potential participants invited, 3054 (83%) chose to participate. Subsequent follow-up surveys were conducted in 2007 (age 18), 2010 (age 21), and

2017 (age 28), with response rates of 65%, 58%, and 57%, respectively. For the present study, the study population comprises individuals who indicated having a job at age 28 in the 2017 questionnaire and provided information about stress (perceived stress from ages 15 – 28 or work stress at age 28) on at least one questionnaire ($n = 1275$).

2.2. Measures

To measure stress in young adults at the age of 28, two measures were employed:

- (i) The PSS-10, known as the Perceived Stress Scale 10-item version, is a widely used psychological tool developed to gauge the level of global stress individuals perceive in their lives. It was designed to measure the degree to which individuals find their lives unpredictable, uncontrollable, and overloaded (Cohen *et al.*, 1983). In clinical research, the Danish version of the PSS-10 has been proven to be feasible and possesses strong psychometric properties such as agreement, reliability, validity, responsiveness, and interpretability, particularly among patients who experience work-related stress complaints (Eskildsen *et al.*, 2015). To calculate stress scores at the age of 28, the 2017 questionnaire included 10 items with response categories ranging from “never” to “very often” on a scale of 0 to 4. These responses were then summed to create a score ranging from 0 to 40. To distinguish between high and low-stress levels, the scores were dichotomized at the 75th percentile (≥ 18).
- (ii) Work stress at age 28 was assessed using a single-item question: “is your normal daily work stressful in an unpleasant way?” This measure has been used in previous studies to measure work-related stress in a Danish work context (Haahr, 2006). It contains six response categories, from 1 (always) to 6 (rarely/never), that were dichotomized into low work stress (rarely/never; sometimes) and high work stress (always; almost always; usually; frequently).

The abbreviated version of the Perceived Stress Scale, known as PSS-4, was used to assess stress levels in adolescents (Cohen *et al.*, 1983). Information was collected using questionnaires at ages 15, 18, and 21. The PSS-4 was a subset of the PSS-10 used at age 28, and the response categories were identical to those of the PSS-10 scale. The items were likewise summarized on a scale ranging from 0 to 16 points and dichotomized at the 75th percentile into a high vs. low-stress score at ages 15 and 18 (≥ 7) and 21 (≥ 8).

An assessment of accumulated stress throughout adolescence was created, consisting of three categories: (i) individuals who reported low-stress scores in all three rounds of questionnaires; (ii) individuals who

reported a high-stress score in one of the three rounds of questionnaires; and (iii) individuals who reported high-stress levels in two or all three rounds of questionnaires. Missing data were handled using multiple imputations. The accumulated stress scale was based on the imputation of stress scale scores at ages 15, 18, and 21.

The parental socioeconomic background was measured using the following two perspectives: equivalized household income and the highest attained level of education of the parents, according to Statistics Denmark, using information from the Central Office of Civil Registration (Pedersen, 2011). The equivalized household income was determined by calculating the average income over a 4-year period when the children were between 7 and 10 years old. This period was chosen as it reflects a time when the children were still living at home and financially dependent on their parents. Equivalized income takes into account the number of household members and is calculated as a weighted average. The weight assigned is 1.0 for the first adult, 0.5 for the second adult and individuals above age 14, and 0.3 for children below age 14 (Baadsgaard & Quitzau, 2011). Household income was split into tertiles: low (<11,072 €), medium (11,072 – 13,489 €), and high (>13,489 €) yearly equivalized average income.

The highest level of education achieved by the parents, based on information provided by both parents, was collected in 2004. In addition, the participants' own highest educational attainment was obtained at age 28 in 2017. In both cases, the education levels were categorized into primary level (<10 years), secondary level (10 – 13 years), and tertiary level (>13 years) of education (Jensen & Rasmussen, 2011). Information about gender also came from registers (Pedersen, 2011). Information about the time since the last educational completion was likewise derived from the educational registers (Jensen & Rasmussen, 2011).

Temporary employment at age 28 was assessed by an item asking, "In your main occupation, you are," with the two response options "permanently employed" or "temporarily employed" from the national work environment cohort (NFA, 2020). Questionnaire information about the following four psychosocial working conditions at age 28 was used:

Psychosocial work climate was collected by the item: "how is the atmosphere and the mental work climate usually in your workplace?" from the national work environment cohort (NFA, 2020). The six response categories were dichotomized into good (very good, good, reasonably good) and bad (not so good, bad, very bad).

Work-life balance was collected by four items from the Danish Psychosocial Questionnaire (DPQ) asking about

conflicts between work and private life, for example, if work takes too much energy and time from private life (NFA, 2021). Based on the five response categories (scores of 0, 25, 50, 75, or 100), a mean sum score between 0 and 100 was calculated and dichotomized at the 75th percentile of the scale, with scores >50 indicating a high degree of work-life conflict.

Work justice was measured by four items from the DPQ (NFA, 2021) asking about justice in relation to, for example, how conflicts are solved, decisions are made, or how you are treated at the workplace. Based on the five response categories (scores of 0, 25, 50, 75, or 100), a mean sum score between 0 and 100 was calculated and dichotomized at the 25th percentile of the scale, with scores <56 indicating low work justice.

Worries about losing one's job were measured by three items from the DPQ (NFA, 2021), asking about worries about getting fired, troubles in finding a new job, or worries about being moved to a new job against your will. Based on the five response categories (scores of 0, 25, 50, 75, or 100), a mean sum score between 0 and 100 was calculated and dichotomized at the 75th percentile of the scale, with scores >33 indicating many worries about losing one's job.

2.3. Analysis

The final set of data had a small number of missing values in both outcome variables (perceived stress at age 28, $n = 17$ [$<0.01\%$]; work stress at age 28, $n = 9$ [$<0.01\%$]). Among exposures and covariates, the number of missing values ranged from 8 ($<0.01\%$) for psychosocial work climate to 365 (29%) for perceived stress at age 21.

Initially, a multiple imputation chained model was performed. This model utilized 100 imputations to impute missing values for various variables. These variables included five stress scale measures spanning from age 15 – 28, two socioeconomic position measures, one measure of temporary employment, and four psychosocial work environment measures. Chains were constructed, utilizing either regress logit or ologit, depending on the nature of the data.

Certain variables had complete information, including gender, highest completed education, and time since educational completion. In addition to the aforementioned variables, other variables were included in the imputation process: (i) self-reported information about depressive symptoms at ages 15, 18, 21, and 28 was included when imputing the stress measures and (ii) additional measures of work satisfaction, influence, and workload were included when imputing measures of the psychosocial work environment at age 28. The final estimates were derived by averaging the sets of estimates obtained from

the imputations, while standard errors were computed using Rubin's rule, a formula that accounts for multiple imputations (results not shown) (Ruben, 1987). The dichotomization of scales was performed after multiple imputations of missing values.

A correlation analysis between the two measures of young adult stress (work stress and perceived stress) at age 28 revealed a correlation of $r = 0.32$. In addition, a correlation analysis between all exposure variables showed the strongest correlation between the stress measures at ages 15, 18, and 21, with correlations of $r = 0.33$ and $r = 0.38$. All the other correlations were below 0.3. All correlations were performed before dichotomization. Descriptive statistics in relation to the two outcome measures were presented for all exposures and covariates as the number and percentile distribution of the scales. Multiple logistic regression analyses were computed to study the associations between perceived stress at ages 15, 18, and 21 and perceived stress or work stress at age 28. The selection of covariates included in the analyses was based on a priori considerations and informed by a literature review. The associations between adolescent stress and young adult stress were analyzed by two different models. First, the crude associations between adolescent stress or covariates and young adult stress were performed. Second (model 1), the associations between adolescent stress and young adult stress measures were adjusted for gender, own educational level, parental education, and level of income. Third, (model 2), the fully adjusted analyses were performed, additionally adjusting for temporary employment and the four psychosocial work environment factors.

Finally, a stratified analysis was performed to investigate the association between accumulated adolescent stress and young adult stress among individuals who had completed their education less or more than 2 years ago.

All odds ratios (OR) were presented with 95% confidence intervals (95% CIs) with a significance level of $p < 0.05$. Data analysis was performed using Stata version 16.0 (Stata Corporation, College Station, Texas, USA).

2.4. Ethics

This study adheres to the principles outlined in the 1975 Declaration of Helsinki (WMA, 2021). Approval for the study was obtained from the Danish Data Protection Agency. Participants were provided with information regarding the project's purpose, and their completion and return of the questionnaire were regarded as informed consent and willingness to participate in the study. These procedures were consistent with the regulations in place during the data collection period in Denmark. According

to Danish legislation, written informed consent or approval from ethics or scientific committees is not required for questionnaire- and register-based studies (NVK, 2021).

3. Results

Table 1 displays the distribution of exposure variables in relation to perceived stress and work stress at age 28. Among those who reported feeling stressed between the ages of 15 and 21, the percentage reporting high perceived stress at age 28 increased from 34% to 44% with increasing age, compared to percentages between 18% and 22% among those who had not previously felt stressed. A similar tendency was observed for work stress, where 23% to 26% of those who experienced stress during adolescence reported high work stress compared to between 15% and 16% of those who did not experience stress during adolescence. Considering the accumulative stress measure, individuals who reported stress at ≥ 2 time points during adolescence experienced higher proportions of high perceived stress and work stress at age 28, compared to those who had not reported feeling stressed during adolescence (46% vs. 13% and 27% vs. 13%). A lower proportion of the temporary employed experienced work stress compared to the permanently employed (16% vs. 19%). Regarding the work environment, the proportion of individuals who experienced high perceived stress and work stress at age 28 was higher among those with a poor psychosocial work environment compared to those with a good psychosocial work environment. The proportions of females who reported high perceived stress or work stress at age 28 were higher than in males.

Table 2 presents the associations between stress at ages 15, 18, and 21 and perceived stress or work stress at age 28. Statistically significant crude associations were seen between high stress at ages 15, 18, or 21 and perceived stress or work stress at age 28, with increasing associations in relation to increasing age and the strongest associations in relation to perceived stress being seen at age 21 (crude association between perceived stress at ages 21 and 28: OR = 4.0). Adjustments for gender and socioeconomic variables in Model 1 changed the estimates by a maximum of 0.1 in relation to both outcome measures.

When additional adjustments for temporary employment and the four measures of psychosocial work environment were performed (model 2), the associations between adolescent stress and young adult work stress decreased to non-significant ORs in the range of 1.1 – 1.4. After adjusting for temporary employment and psychosocial work environment measures, the ORs between adolescent stress and perceived stress at age 28 decreased; however, statistically significant associations

Table 1. Distribution of exposure variables in relation to perceived stress and work stress at age 28 (*n* = 1275)

Variables	Perceived stress		Work stress	
	High, <i>n</i> (%)	Low, <i>n</i> (%)	High, <i>n</i> (%)	Low, <i>n</i> (%)
Stress age: 15				
High	108 (33.5)	214 (66.5)	74 (23.0)	248 (77.0)
Low	205 (21.5)	748 (78.5)	157 (16.5)	796 (83.5)
Stress age: 18				
High	140 (42.9)	186 (57.1)	78 (24.0)	248 (76.1)
Low	173 (18.2)	776 (81.8)	153 (16.1)	796 (83.9)
Stress age: 21				
High	149 (44.1)	189 (55.9)	87 (25.7)	251 (74.3)
Low	164 (17.5)	773 (82.5)	144 (15.4)	793 (84.6)
Accumulated stress (number of time points)				
≥2	117 (45.5)	140 (54.5)	69 (26.8)	188 (73.2)
1	113 (29.8)	266 (70.2)	79 (20.8)	300 (79.2)
0	83 (13.0)	556 (87.0)	83 (13.0)	556 (87.0)
Sex				
Female	191 (26.2)	538 (73.8)	147 (20.2)	582 (79.8)
Male	122 (22.3)	424 (77.7)	84 (15.4)	462 (84.6)
Equivalized parental income (ages 7 – 10)				
Low	108 (27.3)	287 (72.7)	73 (18.4)	322 (81.5)
Medium	100 (23.3)	329 (76.7)	82 (19.1)	347 (80.9)
High	105 (23.3)	346 (76.7)	76 (16.9)	375 (83.1)
Parental educational level (age 15)				
<10 years	51 (31.5)	111 (68.5)	33 (20.0)	132 (80.8)
10 – 13 years	143 (22.9)	481 (77.1)	104 (16.7)	520 (83.3)
>13 years	116 (23.9)	370 (76.1)	94 (19.3)	392 (80.7)
Own educational level				
<10 years	22 (39.3)	34 (60.7)	12 (21.4)	44 (78.6)
10 – 13 years	98 (24.5)	302 (75.5)	69 (17.3)	331 (82.8)
>13 years	793 (55.9)	626 (44.1)	150 (18.3)	669 (81.7)
Forms of employment				
Temporarily employed	67 (32.5)	139 (67.5)	32 (15.5)	174 (84.5)
Permanently employed	246 (23.0)	823 (77.0)	199 (18.6)	870 (81.4)
Psychosocial work climate				
Poor	45 (46.0)	53 (54.1)	49 (48.5)	52 (51.5)
Good	268 (22.8)	906 (77.2)	182 (15.5)	992 (84.5)
Work-life balance				
Poor	115 (47.1)	129 (52.9)	98 (40.2)	146 (59.8)
Good	198 (19.2)	833 (80.8)	133 (12.9)	898 (87.1)
Work justice				
Poor	146 (44.5)	182 (55.5)	107 (32.6)	221 (67.4)
Good	167 (17.6)	780 (82.4)	124 (13.1)	823 (86.9)
Worries about losing job				
Many	150 (40.0)	225 (60.0)	90 (24.0)	285 (76.0)
Few	163 (18.1)	737 (82.9)	141 (15.7)	759 (84.3)

Table 2. The association between stress at ages 15, 18, and 21 and perceived stress or work stress at age 28, *n* = 1275

Variables	Perceived stress			Work stress		
	Crude, OR (95% CI)	Model 1 [†] , OR (95% CI)	Model 2 [‡] , OR (95% CI)	Crude, OR (95% CI)	Model 1 [†] , OR (95% CI)	Model 2 [‡] , OR (95% CI)
Stress age 15						
High	1.7 (1.3 – 2.3)	1.7 (1.2 – 2.3)	1.3 (0.9 – 1.8)	1.5 (1.1 – 2.1)	1.5 (1.0 – 2.0)	1.1 (0.8 – 1.7)
Low	Reference	Reference	Reference	Reference	Reference	Reference
Stress age 18						
High	3.1 (2.3 – 4.2)	3.1 (2.3 – 4.2)	2.5 (1.7 – 3.5)	1.7 (1.2 – 2.4)	1.6 (1.1 – 2.3)	1.2 (0.8 – 1.7)
Low	Reference	Reference	Reference	Reference	Reference	Reference
Stress age 21						
High	4.0 (2.9 – 5.5)	3.9 (2.8 – 5.4)	3.1 (2.2 – 4.4)	1.9 (1.4 – 2.7)	1.9 (1.3 – 2.7)	1.4 (0.9 – 2.1)
Low	Reference	Reference	Reference	Reference	Reference	Reference
Accumulated stress (number of time points)						
≥2	5.4 (1.9 – 4.0)	5.5 (3.7 – 8.0)	3.7 (2.4 – 5.6)	2.5 (1.7 – 3.6)	2.4 (1.6 – 3.6)	1.5 (0.9 – 2.4)
1	2.7 (1.9 – 4.0)	2.8 (1.9 – 4.1)	2.3 (1.5 – 3.5)	1.5 (1.0 – 2.2)	1.4 (1.0 – 2.2)	1.0 (0.7 – 1.6)
0	Reference	Reference	Reference	Reference	Reference	Reference
Sex						
Female	1.2 (0.9 – 1.6)			1.4 (1.0 – 1.9)		
Male	Reference			Reference		
Equivalentized parental income (ages 7 – 10)						
Low	1.3 (0.9 – 1.8)			1.1 (0.8 – 1.6)		
Medium	1.0 (0.7 – 1.4)			1.2 (0.8 – 1.6)		
High	Reference			Reference		
Parental educational level (age 15)						
<10 years	1.5 (1.0 – 2.3)			1.1 (0.7 – 1.7)		
10 – 13 years	0.9 (0.7 – 1.3)			0.9 (0.6 – 1.2)		
>13 years	Reference			Reference		
Own educational level						
<10 years	2.1 (1.2 – 3.7)			1.1 (0.6 – 2.2)		
10 – 13 years	1.1 (0.8 – 1.4)			0.9 (0.7 – 1.3)		
>13 years	Reference			Reference		
Forms of employment						
Temporarily employed	1.6 (1.1 – 2.2)			0.8 (0.5 – 1.2)		
Permanently employed	Reference			Reference		
Psychosocial work climate						
Poor	2.8 (1.8 – 4.2)			5.2 (3.4 – 7.9)		
Good	Reference			Reference		
Work-life balance						
Poor	3.7 (2.7 – 5.0)			4.6 (3.3 – 6.3)		
Good	Reference			Reference		
Work justice						
Poor	3.8 (2.9 – 5.0)			3.2 (2.4 – 4.4)		
Good	Reference			Reference		
Worries about losing job						
Many	3.1 (2.4 – 4.1)			1.7 (1.3 – 2.4)		
Few	Reference			Reference		

Notes: [†]Adjusted for gender, parental education and income, and own educational level. [‡]: Model 1 and adjusted for psychosocial work climate, precariousness, work-life balance, work justice, and worries about losing the job.
Abbreviations: CI: Confidence interval; OR: Odds ratio.

were present between stress at age 18 or 21 and perceived stress at age 28 (OR 2.5 and 3.1, respectively). Regarding the accumulated stress measure, those who reported high-stress levels at ≥ 2 -time points during adolescence had 2.4 (1.6 – 3.6) and 5.5 (3.7 – 8.0) increased odds of reporting high perceived stress or high work stress at age 28 after adjustment for gender and socioeconomic measures. When further adjusted for measures of temporary employment and psychosocial work environment, the association with perceived stress at age 28 decreased to 3.7 (2.4 – 5.6) and was still statistically significant, and the association with work stress decreased to 1.5 (0.9 – 2.4) but was no longer statistically significant. For both outcomes, ORs increased as the number of stress time points in the accumulated stress measure increased. When adjusting for one psychosocial work environment variable at a time, all variables resulted in attenuation of the estimates, with poor work-life balance explaining a big part of the association between stress during adolescence and young adult work stress, whereas adjustment for temporary employment did not change the estimate (results not shown). In addition, we made supplementary analyses, adjusting all analyses for the other outcome (adjusting perceived stress for work stress and vice versa). This resulted in attenuations of the estimates to a maximum of 0.2 (results not shown).

Table 3 displays the associations between accumulated stress during adolescence and perceived stress or work stress at age 28 stratified by time since completion of education.

Overall, crude and adjusted measures of both perceived stress and work stress at age 28 are quite similar among those who have completed their education more than or less than two years ago. However, adjusting for gender, temporary employment, and psychosocial work environment variables attenuated the associations between accumulated adolescent stress and perceived stress at age 28 to non-statistically significant associations among those who had completed their education more than 2 years ago, whereas statistically significant associations were seen in the group with less than 2 years since completion of education, after adjustment for temporary employment and psychosocial work environment factors (if ≥ 2 stress time points [OR: 3.3]; 95% CI: 1.5 – 7.1).

4. Discussion

The major finding of this study was the consistent association between perceived stress in adolescence and perceived stress or work stress at age 28, especially if the stress was accumulated during adolescence. Moreover, we observed that when adjusting for the psychosocial work environment variables, the associations between

adolescent stress and work stress at age 28 attenuated, whereas only small attenuations were observed in relation to general perceived stress at age 28 among those who had completed education within less than 2 years. A poor work-life balance was found to be the psychosocial work environment aspect with the greatest impact on the association between adolescent stress and young adult work stress, whereas temporary employment did not have any important impact. We found an interesting difference between those with short or longer work experience (time since completion of education) regarding the influence of temporary employment and psychosocial work environment on stress. It seems that temporary employment and the psychosocial work environment aspects play an important role in explaining the association between adolescent stress and work stress or perceived stress at age 28 among the more experienced participants (those with more than 2 years since completed education). For the less experienced (those with less than 2 years since completion of education), temporary employment and the psychosocial work environment did not, to the same degree, affect the high general perceived stress level.

This finding indicates that experiencing stress during adolescence increases the likelihood of perceiving the transition into the labor market as stressful. This effect is particularly pronounced among individuals with less work experience, indicating that the stress burden is not solely due to poor employment or poor psychosocial working environment conditions. The result implies that psychosocial pressure on young individuals can arise from other areas of life than work. This resonates with research that argues that young individuals are expected to perform well in all areas of life, expectations which potentially lead to psychosocial stress (Madsen, 2018; Petersen, 2016; Sørensen *et al.*, 2017) as well as to other mental health problems such as depressive symptoms and anxiety (Johnson *et al.*, 2018; Kaasbøll *et al.*, 2021). In the performance society, young individuals increasingly measure and evaluate themselves through their performances, and it becomes absolutely crucial to appear successful both in youth and work life, which can have negative consequences for the transition to work life (Semmer *et al.*, 2007).

Previous studies documented that a range of childhood physical and mental health, socioeconomic, and school-related factors (Winding *et al.*, 2015; Wang *et al.*, 2018), as well as student burnout (Robins *et al.*, 2018), affect later perceived work environments and work stress. At the same time, it is well known that a demanding work environment among young workers, like experiencing high psychological demands and a low level of social support, is associated with several different mental health problems, including

Table 3. The association between stress at ages 15, 18, and 21 and perceived stress or work stress at age 28 stratified by time since educational completion (n = 1275)

Educational completion	Perceived stress		Work stress	
	Crude OR (95%CI)	Adjusted [†] OR (95%CI)	Crude OR (95%CI)	Adjusted [†] OR (95%CI)
Less than 2 years since completion				
Accumulated stress (number of time points)				
≥2	5.4 (2.8 – 10.5)	3.3 (1.5 – 7.2)	2.4 (1.2 – 4.8)	1.6 (0.7 – 3.7)
1	2.7 (1.4 – 5.3)	2.2 (1.0 – 4.8)	1.3 (0.6 – 2.7)	1.0 (0.5 – 2.3)
0	Reference	Reference	Reference	Reference
More than 2 years since completion				
Accumulated stress (number of time points)				
≥2	5.3 (3.5 – 8.2)	1.4 (0.8 – 2.4)	2.5 (1.6 – 4.0)	1.4 (0.8 – 2.4)
1	2.8 (1.8 – 4.3)	1.1 (0.6 – 1.9)	1.5 (0.9 – 2.5)	1.1 (0.6 – 1.9)
0	Reference	Reference	Reference	Reference

Notes: [†]Adjusted for gender, own educational level, psychosocial work climate, precariousness, work-life balance, work justice, and worries about losing the job.

stress (Laberge & Ledoux, 2011). However, to the best of our knowledge, this study is the first to investigate how stress is transferred from youth to adult life in a Danish population, taking into account temporary employment and psychosocial work environment factors.

Based on our findings, the two stress outcome measures (perceived stress and work stress at age 28) are affected differently by work environment aspects. A good work environment seems important to reduce work stress among individuals who are previously stressed, whereas work environment aspects only have a positive effect on the general stress level of individuals who have been in the labor market for some time. However, previous stress experiences and the psychosocial work environment seem to mutually influence each other, which was also observed by Taris in his study of the mutual effects between job resources and mental health (Taris, 1999).

The previous reports documented that temporary employment can affect the health and well-being of employees (Benach *et al.*, 2016; Rugulies *et al.*, 2008; Standing, 2011), but the results of our study did not substantiate this finding. The reason for the conflicting results could be that the population of our study was relatively young and, therefore, did not expect (or need) permanent employment to the same degree as older employees. Temporary employment has traditionally involved young individuals working in part-time jobs during their education (Nielsen *et al.*, 2018). Yet, based on the results of our study, it seems that young workers during the first 2 years after educational completion do not have expectations of permanent employment. If they have not yet settled down, for example, if they have a family

and a home mortgage, the immediate negative effects of temporary employment might not have surfaced.

This study has several notable strengths. First, it employs a prospective design with a high initial response rate of 83%. In addition, it spans a 13-year follow-up period, with stress measures collected every 3rd year from the ages of 15 to 21. This extended timeframe provides valuable insights into the evolving impact of these stress exposures. In line with Lazarus's stress theory, which highlights the dynamic nature of perceived stress, the study's design is well suited to examine the changes in stress levels over time. According to Lazarus and Folkman (1984), perceived stress is not a static condition but can be influenced by daily hassles and major life events. By capturing stress measures at multiple time points, this study can effectively explore these fluctuations.

Given that perceived stress is a subjective assessment, the utilization of a self-reported questionnaire, specifically the Perceived Stress Scale (PSS), is a sensible choice. The PSS is specifically designed to capture the extent to which individuals perceive their lives as unpredictable, uncontrollable, and overloaded, essential components of the stress experience. Moreover, this measure takes into account individual differences in the perception of stress, providing a comprehensive assessment of stress levels (Cohen *et al.*, 1983). However, it is important to emphasize that stress can result from various factors, such as negative life events and poor social relationships.

The present study has potential limitations related to the methods used to measure perceived stress at ages 15, 18, and 21. The utilization of derivative scales, specifically the 4-item perceived stress scale (Cohen *et al.*, 1983), poses certain disadvantages such as limited internal

reliability and a less adequate approximation of perceived stress levels compared to the 10-item scale (Eskildsen *et al.*, 2015). Consequently, there is a possibility of non-differentiated misclassification. In addition, the study may be susceptible to healthy worker bias, as individuals with psychosocial demanding work environments might be underrepresented. This bias could arise because younger workers facing high work demands or experiencing elevated stress levels may have already left the labor market, leading to potential underestimation of the associations examined in the study. Moreover, there is a risk that individuals with the most demanding work environments or highest stress levels did not choose to participate and, therefore, were not represented in the study population.

When using questionnaire data to measure stress and work environment, there is a risk of introducing negative affectivity (Watson & Clark, 1984), where high-stress could influence the way the individual perceives the working environment. This may result in more negative reports on all aspects of the work environment for those with high stress. However, as the correlation of these measures is low, we do not consider it to significantly affect the validity of the measures.

In this study, we attempt to capture work experience by measuring “time since educational completion.” However, there is a risk that short work experience (<2 years) could be due to long tertiary education, which is why the results must be interpreted with caution.

The socioeconomic characteristics of the West Jutland Cohort study, such as income and parental educational level, were comparable to those of families of young individuals of the same age in Denmark (Glasscock *et al.*, 2013). Comparison of the 2406 non-responders to the 1275 responders on socioeconomic measures shows that more non-responders (17%) than responders (13%) had low-educated parents and had grown up in low-income families (39% vs. 31%), and more non-responders had low educational level (17%) compared to the responders (4%). This selection may have underestimated the true association. It is important to note that the external validity and generalizability of the current study are confined to individuals residing in Denmark and other countries sharing similar welfare systems.

The response rate was 83% at the first collection of questionnaires, declining slightly to 57% at the collection in 2017. A previous study investigating non-participation across questionnaire collection rounds in the same cohort found that the selection of socioeconomic measures had no significant impact on the validity of the measured risk estimates (Winding *et al.*, 2014). The present study only included those who had indicated being employed at age 28 in the 2017 questionnaire, which corresponds to 71% of

those responding in 2017. This percentage is comparable to official data from Statistics Denmark, which shows that 76% of 25 – 34 years olds had a job in 2017 (DST, 2020).

In this study, we used multiple imputation analyses, which enabled us to analyze the complete sample, potentially enhancing statistical power and reducing bias (Sterne *et al.*, 2009). Information on the participants responding to the questionnaires (without imputed data) can be seen in appendix (Tables A1 and A2).

In addition, a complete case analysis containing 846 respondents was performed that substantiated the results of the study (results not shown).

When using self-reported information, there is a risk of participants’ over- or under-reporting, and a risk that a negative response to one question concerning well-being may negatively affect the answers to other questions related to well-being. This potential bias, called common method bias (Podsakoff *et al.*, 2003), has, to some extent, been minimized using both questionnaire and registered data and using prospectively collected data. However, there could be a potential problem related to the collection of information on the two stress outcome measures and the information about temporary employment and psychosocial work environment aspects because they were collected at the same time. However, as there was a low correlation between these measures, this does not seem to have caused any substantial information bias.

The limitations presented are not considered to result in serious bias concerning the observed associations. However, caution is advised when interpreting causality.

5. Conclusion

This study reveals a significant association between stress levels during adolescence and stress experienced in early adulthood. From a public health perspective, it is important for both occupational health-care professionals and educators at secondary and tertiary educational institutions to recognize that stress during adolescence can increase the risk of stress in early adult working life. The fact that those who experience stress during adolescence reported high levels of general perceived stress at the beginning of work life underscores the need for nuanced and tailored support for young individuals entering the workforce. Moreover, this study underlines the importance of employers prioritizing psychosocial aspects of the work environment, such as promoting work-life balance. These factors can significantly influence levels of work-related stress among young adults.

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Conflict of interest

The authors declare that they have no conflicts of interest.

Author contributions

Conceptualization: All authors

Formal Analysis: Trine Nøhr Winding

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Ethics approval and consent to participate

This study was conducted in accordance with the 1975 Declaration of Helsinki (<https://www.wma.net/policies-post/wma-declaration-of-helsinki-ethical-principles-for-medical-research-involving-human-subjects>). The study was approved by the Danish Data Protection Agency, which is an independent authority that supervises compliance with the rules on the protection of personal data. The participants were informed about the purpose of the project, and their return of the questionnaire was interpreted as informed consent and willingness to participate. This was in accordance with Danish regulations at the time of the data collection. According to Danish law, questionnaire and register-based studies require neither approval by ethical or scientific committees nor written informed consent (<https://en.nvk.dk/rules-and-guidelines/act-on-research-ethics-review-of-health-research-projects>). It is not possible to apply for ethical approval of studies unless they involve clinical examinations or biological material. The Danish Research Ethics Committee specifically waived the need for consent before the collection of any data with the following statement, translated from Danish: “it can be hereby announced that in connection with a questionnaire survey of 15 year olds such as the one outlined, there is no requirement for informed consent (either oral or written) from parents/guardians.”

Consent for publication

The participants were informed about the purpose of the project, and their returning of the questionnaire was interpreted as informed consent and willingness to participate. This was in accordance with Danish regulations at the time of data collection. According

to Danish law, questionnaire and register-based studies require neither approval by ethical or scientific committees nor written informed consent (<https://en.nvk.dk/rules-and-guidelines/act-on-research-ethics-review-of-health-research-projects>).

Availability of data

Data are available from the authors on reasonable request and with permission of the corresponding author and Statistics Denmark.

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Appendix

Table A1. Distribution of exposure variables in relation to perceived stress and work stress at age 28

Variables	Perceived stress		Work stress	
	High, n (%)	Low, n (%)	High, n (%)	Low, n (%)
Stress age: 15				
High	90 (32)	195 (68)	65 (22)	225 (78)
Low	178 (22)	639 (78)	133 (16)	697 (84)
Stress age: 18				
High	105 (41)	149 (59)	59 (23)	201 (77)
Low	130 (18)	588 (82)	106 (15)	619 (85)
Stress age: 21				
High	109 (44)	139 (56)	61 (24)	189 (76)
Low	103 (16)	538 (84)	90 (14)	564 (86)
Accumulated stress (number of time points)				
≥2	60 (42)	82 (58)	37 (26)	106 (74)
1	68 (30)	159 (70)	40 (17)	192 (83)
0	179 (20)	699 (80)	151 (17)	740 (83)
Sex				
Female	188 (26)	528 (74)	146 (20)	579 (80)
Male	119 (22)	412 (78)	82 (15)	459 (85)
Equivalentized parental income (ages 7 – 10)				
Low	99 (23)	333 (77)	72 (19)	314 (81)
Medium	98 (23)	321 (77)	80 (19)	343 (81)
High	106 (28)	278 (72)	75 (17)	370 (83)
Parental educational level (age 15)				
<10 years	51 (33)	106 (67)	33 (20)	126 (79)
10 – 13 years	138 (23)	460 (77)	101 (17)	503 (83)
>13 years	112 (24)	351 (76)	91 (19)	383 (81)
Own educational level				
<10 years	22 (39)	34 (61)	11 (20)	44 (80)
10 – 13 years	96 (25)	290 (75)	68 (17)	329 (83)
>13 years	189 (23)	616 (77)	149 (18)	665 (82)
Forms of employment				
Temporarily employed	65 (32)	137 (68)	32 (16)	171 (84)
Permanently employed	240 (23)	792 (77)	195 (19)	857 (81)
Psychosocial work climate				
Poor	45 (45)	54 (55)	49 (49)	52 (51)
Good	259 (23)	880 (77)	179 (15)	983 (85)
Work-life balance				
Poor	110 (48)	120 (52)	94 (40)	140 (60)
Good	192 (19)	807 (81)	129 (13)	886 (87)
Work justice				
Poor	140 (45)	174 (55)	103 (33)	213 (67)
Good	154 (17)	733 (83)	114 (13)	795 (87)
Worries about losing job				
Many	144 (40)	215 (60)	88 (24)	280 (76)
Few	156 (18)	710 (82)	135 (15)	748 (85)

Table A2. The association between stress at ages 15,18, and 21 and perceived stress or work stress at age 28 (n = 1266)

Variables	Perceived stress			Work stress		
	Crude, OR (95% CI)	Model 1*, OR (95% CI)	Model 2**, OR (95% CI)	Crude, OR (95% CI)	Model 1*, OR (95% CI)	Model 2**, OR (95% CI)
Stress age 15						
High	1.7 (1.2 – 2.2)	1.6 (1.1 – 2.2)	1.1 (0.8 – 1.6)	1.5 (1.1 – 2.1)	1.5 (1.1 – 2.2)	1.1 (0.8 – 1.7)
Low	Reference	Reference	Reference	Reference	Reference	Reference
Stress age 18						
High	3.2 (2.3 – 4.4)	2.9 (2.1 – 4.1)	2.4 (1.6 – 3.5)	1.7 (1.2 – 2.4)	1.6 (1.1 – 2.2)	1.1 (0.7 – 1.7)
Low	Reference	Reference	Reference	Reference	Reference	Reference
Stress age 21						
High	4.1 (3.0 – 5.7)	4.1 (2.9 – 5.7)	3.0 (2.0 – 4.3)	2.0 (1.4 – 2.7)	2.0 (1.4 – 3.0)	1.4 (0.9 – 2.1)
Low	Reference	Reference	Reference	Reference	Reference	Reference
Accumulated stress (number of time points)						
≥2	2.9 (2.0 – 4.1)	3.0 (2.0 – 4.4)	2.4 (1.5 – 3.7)	1.7 (1.1 – 2.6)	1.6 (1.0 – 2.5)	1.3 (0.8 – 2.1)
1	1.7 (1.2 – 2.3)	1.7 (1.2 – 2.4)	1.7 (1.1 – 2.5)	1.0 (0.7 – 1.5)	1.0 (0.7 – 1.5)	0.9 (0.6 – 1.4)
0	Reference	Reference	Reference	Reference	Reference	Reference
Sex						
Female	1.2 (0.9 – 1.6)			1.4 (1.0 – 1.9)		
Male	Reference			Reference		
Equivalentized parental income (ages 7 – 10)						
Low	1.3 (0.9 – 1.8)			1.1 (0.8 – 1.6)		
Medium	1.0 (0.7 – 1.4)			1.2 (0.8 – 1.6)		
High	Reference			Reference		
Parental educational level (age 15)						
<10 years	1.5 (1.0 – 2.3)			1.1 (0.7 – 1.7)		
10 – 13 years	0.9 (0.7 – 1.3)			0.8 (0.6 – 1.2)		
>13 years	Reference			Reference		
Own educational level						
<10 years	2.1 (1.2 – 3.7)			1.1 (0.6 – 2.2)		
10 – 13 years	1.1 (0.8 – 1.4)			0.9 (0.7 – 1.3)		
>13 years	Reference			Reference		
Forms of employment						
Temporarily employed	1.6 (1.1 – 2.2)			0.8 (0.5 – 1.2)		
Permanently employed	Reference			Reference		
Psychosocial work climate						
Poor	2.8 (1.9 – 4.3)			5.2 (3.4 – 7.9)		
Good	Reference			Reference		
Work-life balance						
Poor	3.9 (2.8 – 5.2)			4.6 (3.3 – 6.4)		
Good	Reference			Reference		
Work justice						
Poor	3.8 (2.9 – 5.1)			3.4 (2.5 – 4.6)		
Good	Reference			Reference		
Worries about losing job						
Many	3.0 (2.3 – 4.0)			1.7 (1.3 – 2.4)		
Few	Reference			Reference		

Notes: *Adjusted for gender, parental education and income, and own educational level. **Model 1 and adjusted for psychosocial work climate, precariousness, work-life balance, work justice, and worries about losing the job.
Abbreviations: CI: Confidence interval; OR: Odds ratio.

Educational completion	Perceived stress		Work stress	
	Crude OR (95%CI)	Adjusted [†] OR (95%CI)	Crude OR (95%CI)	Adjusted [†] OR (95%CI)
Less than 2 years since completion				
Accumulated stress (number of time points)				
≥2	5.4 (2.8 – 10.5)	2.4 (1.4 – 4.0)	1.3 (0.6 – 2.9)	1.0 (0.4 – 2.6)
1	2.7 (1.4 – 5.3)	1.8 (1.2 – 2.8)	1.0 (0.5 – 2.0)	0.8 (0.4 – 1.9)
0	Reference	Reference	Reference	Reference
More than 2 years since completion				
Accumulated stress (number of time points)				
≥2	2.7 (1.4 – 5.4)	2.0 (0.9 – 4.5)	1.9 (1.2 – 3.1)	1.4 (0.8 – 2.5)
1	1.7 (0.9 – 3.1)	1.4 (0.7 – 2.9)	1.0 (0.7 – 1.6)	1.0 (0.6 – 1.6)
0	Reference	Reference	Reference	Reference