

EDUCATION AND WORK-RELATED MENTAL HEALTH – HIGHER EDUCATED EMPLOYEES ARE WORSE OFF

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November 8, 2017

Abstract

This paper analyzes the relationship between work-related mental health and education in the German working population using cross sectional survey data from 2006 and 2012. Low education is associated with lower mild health problems, higher education with increased mild and medium severe problems. In the Job Demands and Resources model, work-related mental health problems arise from an imbalance between job demands and resources. Low education is significantly associated with lower job demands and resources but not with a different stress perception of missing resources. Higher educated have significantly higher demands and resources and perceive high job demands as more stressful. Education is also associated with less job satisfaction but there is suggestive evidence for monetary and some non-monetary compensation.

Keywords: work-related mental health, returns to education, job satisfaction

JEL Classification: I10, I26, J28

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1 Introduction

Education is one of the most important factors of getting into better paying jobs. Apart from the monetary returns to education (e.g. Card, 2001, Heckman et al., 2016), there are non-monetary returns, for higher occupational prestige and less unemployment (overview in Oreopoulos and Salvanes, 2013). Benefits from education are not limited to work. There is a growing literature on health returns to education. More educated people have lower mortality, smoke less, and abuse less of alcohol (Lleras-Muney, 2005, Culter and Lleras-Muney, 2010, Kempter et al., 2011, Heckman et al., 2016). The reason for this is improved health literacy: educated people understand health relevant information and the consequences of bad health behavior better. No such protective effect of education has been documented for mental health suggesting that health literacy does not play any role (Kamhöfer et al., 2015, Dahmann and Schnitzlein, 2017).

Departing from the work and organizational psychology literature, education could be related to work-related mental health through another channel: the working environment. The working environment is important for work-related mental health as unfavorable working conditions are considered as determinants of burnout (e.g. Maslach et al., 2001). According to Demerouti et al. (2001), working conditions can be divided into factors that stress the individual (job demands) and factors that buffer adverse influences (job resources). An employee facing deadline pressure, a high workload, and frequent interruptions has high job demands. This does not automatically lead to detrimental health consequences if she can use help from colleagues and has leeway of decision making e.g. regarding the timing of different tasks, her breaks, and working hours. When demands increase or resources decrease, the resulting imbalance favors the development of work-related mental health problems. In this model, education opens access to different jobs which come with different working environment. Higher educated employees for example have more leeway of decision making (job resource) but also bear more responsibility (job demand).

This paper investigates whether there is a relationship between mental well-being at work and the level of education. The analysis is exploratory and is based on cross-sectional data from the 2006 and 2012 Qualification and Career surveys covering the German working population. Work-related mental health problems are measured in three degrees of severity (ascending): emotional strain, emotional exhaustion, and burnout. Health problems increase with level of education. Low compared to medium education is associated with lower emotional strain but not with more severe outcomes. Higher education is significantly associated with higher strain and exhaustion. The results hold when controlling for job demands, job resources, individual and job characteristics. Education is significantly related to job demands and job resources:

demands and resources are lower for low educated employees and higher for higher educated employees. While low educated employees do not perceive their missing resources as stressful, higher educated employees do not only face higher job demands but also higher perceived stress from these demands. These findings suggest that there is education does not play a protective role regarding work-related mental health. On the contrary, education is detrimental for well-being at work and job satisfaction. As a means of compensation, higher education is associated with better work life balance and less atypical working times.

The remainder of this paper is structured as follows: section 2 introduces the related literature. Section 3 is dedicated to the data and section 4 to the empirical results. Section 5 discusses sources of bias, section 6 examines potential channels and compensation. The last section concludes.

2 Related literature

Studies analyzing health returns to education usually focus on mortality, physical health, or risky health behavior. Lleras-Muney (2005) shows that in the U.S., education decreases the mortality rate. According to Cutler and Lleras-Muney (2010), education increases prevention and decreases smoking and alcohol abuse in Great Britain and the U.S. They suggest cognitive ability as a channel through which education impacts health. Cognitive ability determines how information is processed and understood by individuals. Better economic resources, such as income and health insurance, and social integration can also result in better health. In Germany, Kemptner et al. (2011) document that education protects against long-term illness and work disability. The health effects Clark and Royer (2013) estimate in Great Britain are rather small.

Evidence on mental health is sparser. Kamhöfer et al. (2015) use information on parental income and instrument education by eligibility to an education subsidy (“BaFöG”). For individuals taking up university education between 1958 and 1990, they do not find any effect on mental health measured in a summary score. Dahmann and Schnitzlein (2017) instrument education with a compulsory schooling reform and distance to college for men born between 1933 and 1952. They document a positive association between years of schooling and general mental health in OLS but do not find a causal effect with IV. It is not implausible that education does not affect mental health to similar degree as it affects physical health. Better health literacy reduces bad health behavior (e.g. smoking) but does not seem to provide advantages to more educated individuals regarding their mental health.

The present paper focuses on clearly work-related mental health outcomes. The mechanism

through which education can have an impact on mental health is therefore different. Education grants access to different jobs which come with different working environments. Working environments in turn matter for the development of work-related mental health problems. A common analytical framework for the job environment regarding burnout is the Job Demands and Resources model (JD-R, Demerouti et al., 2001, Peterson et al., 2008). In this model, the job environment is divided into two categories: job demands and job resources. Job demands are factors which put strain on the individual, e.g. deadline pressure or a high workload. Job resources are factors which favor an individual's engagement at work, e.g. leeway of decision making or good collaboration with colleagues. Resources can buffer the negative influence of demands to some extent. In this model, burnout arises from an imbalance between job demands and job resources: when job demands weigh more heavily than job resources, mental health at work deteriorates. The deterioration is a long process which is often imperceptible in the beginning. Burnout consists of the three components emotional exhaustion, cynicism, and personal inefficacy which develop over time and reinforce one another (Maslach and Jackson, 1981 and 1984, Jackson and Schuler, 1982). Individuals perceive the burden of job demands but believe that this will be a transitory state and that they can handle it. Good collaboration for example can help to overcome a stressful working situation when facing a deadline. As the situation persists, resources are depleted, e.g. because colleagues also suffer from deadline pressure or because work pressure increases. Individuals feel exhausted and try to cope by adopting a cynical attitude towards their work or by withdrawing from work. As this aggravates over time, the individual becomes less productive and experiences personal inefficacy. In response to this, she may increase her effort thereby becoming more exhausted. Burnout is a long-term illness that does neither develop quickly nor disappear quickly (Schaufeli and Enzmann, 1998).

The following table provides an overview of the determinants of burnout (table 1). Determinants are categorized into job demands, job resources, individual factors, and job factors. Important job demands are a high workload, role conflict, and pressure. Demands are not necessarily located at the job level but are also present at the organizational level (bad leadership) or the macroeconomic level (austerity). The main job resources are leeway of decision making (control, autonomy, influence, freedom) and social support. Among the individual factors associated with burnout are sociodemographic characteristics such as gender (women are affected more often) and age (burnout occurs more often at the beginning or close to the end of the career) but also personality and values. Conflicts in private life are important contributors to burnout, while recovery activities (e.g. yoga and mediation) can buffer adverse influences. Job factors such as working hours (longer hours favor exhaustion) and employment type (higher job

insecurity in limited contracts) are also relevant.

Table 1: Determinants of burnout – literature overview

| | |
|----------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|
| job demands | |
| role ambiguity/stress/conflict | Jackson and Schuler (1982), Schwab et al. (1986), McHugh et al. (2011), Basińska and Wilczek-Rużyczka (2013), Bakker and Costa (2014) |
| high workload | Leiter et al. (2009), Bakker and Costa (2014) |
| work/time/performance pressure | Gusy et al. (2010), Basińska and Wilczek-Rużyczka (2013), Bakker and Costa (2014) |
| conflicts at work | Lundqvist et al. (2013) |
| interruptions | Hasselhorn and Nübling (2004) |
| lack of decision making/social support | Schwab et al. (1986) |
| obstacles | Llorens-Gumbau and Salanova-Soria (2014) |
| bad leadership | Nübling et al. (2013), Ray et al. (2013) |
| financial austerity/shortages | Rachiotis et al. (2014) |
| job resources | |
| control | Jackson and Schuler (1982), Lundqvist et al. (2013) |
| autonomy | Basińska and Wilczek-Rużyczka (2013), Lundqvist et al. (2013) |
| influence | Lundqvist et al. (2013) |
| freedom | Lundqvist et al. (2013) |
| social support (colleagues) | Basińska and Wilczek-Rużyczka (2013), Hombrados-Mendieta and Cosano-Rivas (2013), Lundqvist et al. (2013) |
| feedback | Basińska and Wilczek-Rużyczka (2013), Lundqvist et al. (2013) |
| satisfaction/task identity | Tsigilis (2006), Basińska and Wilczek-Rużyczka (2013) |
| rewards | Jackson and Schuler (1982) |
| individual factors | |
| age, gender | Maslach et al. (2001) |
| overestimation | Sandmark and Renstig (2010) |
| private & work life conflicts | Lundqvist et al. (2013) |
| family conflicts | Sandmark and Renstig (2010), Singh et al. (2012), Piko (2006) |
| personality factors | Langelaan et al. (2006), Bakker and Costa (2014), Innanen et al. (2014), Laschinger and Fida (2014) |
| values | Leiter et al. (2009) |
| recovery activities | Singh et al. (2012), Bakker and Costa (2014), Lin et al. (2014) |
| job factors | |
| salary | Basińska and Wilczek-Rużyczka (2013) |
| career opportunities | Basińska and Wilczek-Rużyczka (2013) |
| job security | Basińska and Wilczek-Rużyczka (2013) |
| hours | Montero-Marín et al. (2013 and 2014) |
| high expectations | Jackson and Schuler (1982) |
| atypical employment | Mantocci et al. (2014) |

Note: Selected list of papers, not exhaustive.

There are two ways to measure burnout. Most studies in the fields of work psychology and organization research use a validated measure. Participants have to answer a set of questions or rate a set of statements on Likert scales which relate to an unmentioned underlying factor (e.g. emotional exhaustion). The individual items are then combined to give an overall rating of mental health. Examples are the Maslach Burnout Inventory (MBI), the Oldenburg Burnout Intenvory (OLBI) or the Burnout Clinical Subtype Questionnaire (BCSQ-36). The disadvantage

of this measure is that it is time and cost intensive. Not surprisingly, nearly all burnout studies focus on a small professional group of people. The second way to measure burnout are self-reported measures. In this case, participants are asked directly for the information required, e.g. whether they feel emotionally exhausted. Self reports in general are subject to social desirability effects (e.g. Montero-Marín et al. 2014) but have also been found to be similar to objective measurements.¹ Self-reported measures can easily be incorporated in large scale surveys.

Work psychology and organization research has long focused on ill-health. This changed with the emergence of positive psychology. The focus of positive psychology is on desirable health states instead of ill-health. Along with this trend, engagement is considered as the positive counterpart of burnout (Maslach et al., 2001 and 2012, Schaufeli et al., 2002, Zhang et al., 2007). Validated measures for engagement are applied to small samples (similar to burnout). An alternative positive outcome variable which is often found in large scale surveys is self-reported life or job satisfaction. Research on job satisfaction or happiness has long been common in psychology and sociology. In economics, satisfaction experienced a rise in interest as an alternative measure of utility which complements monetary measures (such as wage). Empirical evidence that there is more to utility derived from labor than just payment comes e.g. from unemployment studies (Winkelmann and Winkelmann, 1998). There is a large literature on satisfaction showing that subjective assessments of satisfaction are correlated to observable events and actions (e.g. poor mental health, length of life, coronary heart disease, labor turnover, absenteeism, counter- and non-productive work), and that assessments are consistent over time (Clark et al., 1996 and Lévy-Garboua et al., 2004). Empirically, job satisfaction has proven to be a good indicator for quit behavior (Clark et al., 1998).

3 Data and descriptives

The data come from the 2006 and 2012 surveys on the German working population (Qualification and Career Survey, QaC). The surveys are run every six years and represent a cross section of the working population older than 15 years working at least ten hours a week.² The surveys include questions on health complaints during or on working days. Participants select complaints they experienced frequently during the last 12 months from a list which includes burnout (2006)

¹Härenstam et al. (2003) gathered data on individual (employee) and organizational level (managers) through observations, interviews, and questionnaires and conclude that self-reported work conditions are similar to objectively measured work conditions.

²Operators are the Research Data Centre of the German Federal Institute for Vocational Training (*Bundesinstitut für Berufsbildung*, BIBB) and the Federal Institute for Occupational Safety and Health (*Bundesanstalt für Arbeitsschutz und Arbeitsmedizin*, BAuA). Work is defined as a paid activity/occupation or an activity related to income. Individuals who interrupted their activity for a maximum of three months (e.g. parental leave) are included. Voluntary work and people employed as part of their initial training are excluded (Rohrbach-Schmidt, 2009 and Rohrbach-Schmidt and Hall, 2013).

and emotional exhaustion (2012).³ They also state whether they consulted a physician due to the specific problem. Assuming that consultation indicates severity, the variable takes the value 0 for no burnout/exhaustion, 1 for burnout/exhaustion but no consultation, and 2 for burnout/exhaustion and consultation. The third dependent variable comes from a section on job characteristics. Individuals provide information on the degree to which they feel emotional strain at work (often, sometimes, rarely, never; coded from 3 to 0). Since the wording is very similar to emotional exhaustion, this variable is considered as an additional work-related mental health outcome.⁴ Exhaustion is more severe than emotional strain. In the literature, exhaustion is a (sometimes even considered to be *the*) component of burnout. Ranked by severity (ascending), the outcomes are: emotional strain, emotional exhaustion, and burnout. The fourth dependent variable is a constructed combined measure that sums each individual's burnout/exhaustion and strain scores and ranges from 0 to 5. Job satisfaction is considered as a positive counterpart of these health complaints. Participants state their degree of satisfaction with the job in general and several facets: income, career opportunities, hours, working atmosphere, supervisor, tasks, application of skills, further training, equipment, and physical working conditions. Answer categories are "very dissatisfied", "dissatisfied", "satisfied", and "very satisfied" (0 to 3). All dependent variables are standardized for the analysis.

The surveys were designed to close thematic gaps in the official statistics and ask very detailed questions on qualification and career. There is information on which secondary and tertiary education participants obtained.⁵ The common education measure in Germany is the degree obtained: no professional training (low education), apprenticeship (medium), tertiary education (higher). There is a fourth category, "medium plus", consisting of individuals who

³The surveys date back to 1979 but health first entered in 1999. Work-related mental health was not explicitly present in the health section before 2006.

⁴Work-related mental health measures are self-reported. The results could at least partially be driven by higher educated employees being more likely to answer "yes" when the list of health problems is read out to them. This is a considerable shortcoming which is, however, unavoidable. Even "objective" health data, e.g. health insurance data based on physicians' diagnoses, suffer from this limitation. Diagnosing a physical health problem such as a broken leg is very easy compared to diagnosing mental health problems where physicians ask their patient a set of questions and base their diagnosis on the patient's answers which are subject to the same self-reporting bias. A problem regarding the validity of work-related mental health measurement is potential over-reporting that uses work-related mental health problems as a reason for sickness leaves, work incapacity, or early retirement. Because work-related mental health problems are more difficult to diagnose, mis-reporting is also more difficult to detect. As extensive tools for diagnosis have reduced mis-reporting in physical health problems, mis-reporting might now move to mental health problems. While this might be true for single cases, work-related mental health problems are still highly stigmatized on average. Affected individuals are often diagnosed with physical health problems instead (e.g. back pain). Stigmatization decreases over time but was still very high in 2006 and 2012.

⁵The German school system sorts children at the age of ten into three different tracks. The low track (*Hauptschule*) finishes after the obligatory nine years. Traditionally, students can do unskilled work and access few apprenticeship programs. The medium track (*Realschule*) is completed after ten years and allows access to apprenticeship programs which combine theory in occupation specific schools and practice in companies. The high track (*Gymnasium*) takes twelve to thirteen years depending on federal state and grants access to the tertiary education system.

first completed an apprenticeship, worked for some years, and later went through additional job specific training that prepares them to climb up the hierarchy ladder (technician, craftsman; *Techniker, Meister* in German). Years of education are not recorded in Germany but can be constructed based on school degree and educational training according to the SOEP group (2014). Using the information given in the QaC, years of schooling are calculated according to table 2.

Table 2: Constructed years of education

| school education | years | professional training ^a | years |
|---------------------------------------------------|-------|------------------------------------|-------|
| no degree | 7 | no professional training | 0 |
| low school degree (<i>Hauptschule</i>) | 9 | apprenticeship | 2 |
| intermediary degree (<i>Realschule</i>) | 10 | additional job specific training | 3 |
| professional college degree (<i>Fachabitur</i>) | 12 | university degree | 5 |
| high school degree (<i>Abitur</i>) | 13 | | |

^a Refers to highest training completed in the QaC and is broader than in the SOEP. The SOEP data distinguish between apprenticeships (1.5 years) and technical schools (2 years) and between higher technical college (3 years) and university degree (5 years). I impute 3 years for additional job specific training which is composed of the 2 years from the apprenticeship and 1 year for the additional training.

The data contain several questions on requirements at work and their frequency (often, sometimes, rarely, never). These can be divided into job demands and job resources as displayed in table 3. Job demands are physical and mental factors straining the individual at the work place, while job resources are strain containing factors such as leeway of decision making.

Table 3: Job demands and resources in the BIBB/BAuA Qualification and Career Survey

| Job demands | Job resources |
|------------------------------------------|-----------------------------|
| reach limits of own capacity | plan/schedule own work |
| interrupted during work | influence own workload |
| deadline/performance pressure | decide when to break |
| work fast | good collaboration |
| minimum performance | feel as part of community |
| overstrained | get help from colleagues |
| risk of financial loss | get help from supervisor |
| no timely information about future | perform tasks independently |
| do not receive all necessary information | |
| details predetermined | |
| repetition | |

Four variables can act as either demands or resources depending on individual preferences (e.g. shaped by personality): to be a supervisor, to think through tasks before starting to

work, to improve methods, and to be demanded unknown things. While some individuals may perceive these factors as challenging and motivating, others may feel additional stress due to responsibility. Job demands and resources are standardized. There is also information on whether individuals feel stressed by high demands or missing resources (binary).

The analysis is limited to German employees aged 18 to 65. Another 3,000 individuals who did not provide information on their education (school degree and further education) are excluded.⁶ 30,800 individuals remain. The data is weighted according to census data. The mean age is 42 years. 54% are men. The majority acquired medium education (62.4%). 6.6% supplemented their medium with additional education (medium plus). 22.4% completed tertiary education and 8.6% have low education. For an overview of all variables including their mean, standard deviation, minimum, and maximum, see table A.1.

Work-related mental health problems increase with level of education (figure 1). The difference in the prevalence of any work-related mental health problem (“combiend”) between low and higher educated employees amounts to 0.6 standard deviations. The linear relationship is clearest for the least severe condition emotional strain. For emotional exhaustion, the pattern looks similar but the difference between low and higher educated employees is reduced to 0.2 standard deviations. Differences in prevalence between low and medium educated employees, between medium and medium plus, and between medium plus and higher educated employees are not statistically different as the 95% confidence intervals overlap. Nevertheless, exhaustion is higher for medium plus than for low educated employees and higher for higher educated employees than for medium educated employees. The share of burnout does not seem to differ for low, medium, and medium plus educated employees. Higher educated employees are significantly more exposed to the severest condition. The difference is around 0.2 standard deviations. Thus, while mild and medium severe work-related mental health problems clearly increase with education, only higher education versus not higher education seems to be relevant for the severest problem.

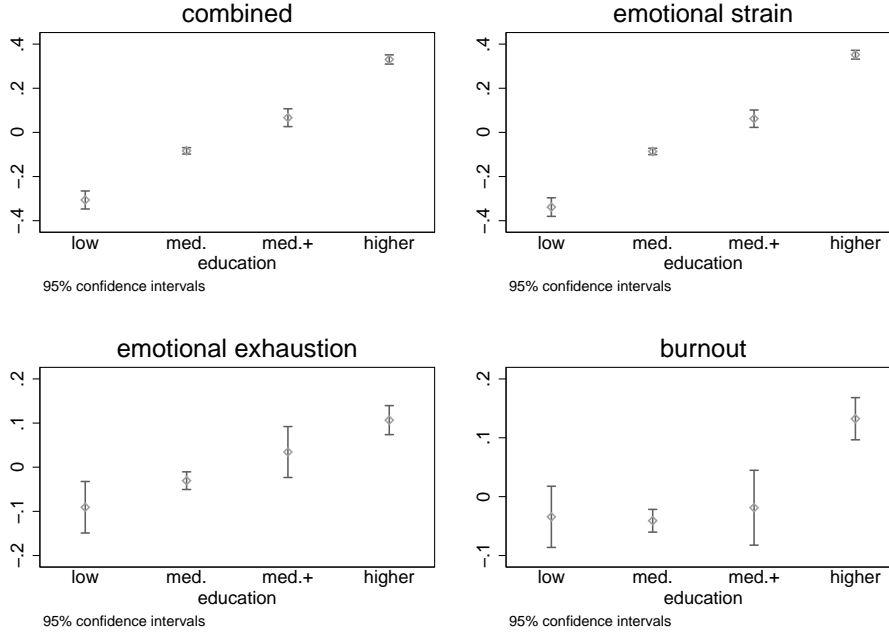
4 Estimation

4.1 Estimation procedure

The relationship between work-related health outcomes Y_i and education \mathbf{Educ}_i of an individual i is formalized in equation 1 where \mathbf{Educ}_i is a vector of dummy variables for low education

⁶Excluded individuals are more often women, are younger, slightly less educated and satisfied with their job, work somewhat longer hours, and have longer tenure and experience. Contract types (limited versus unlimited) are not statistically different.

Figure 1: Standardized work-related mental health outcomes by level of education



Emotional exhaustion and burnout range from 0 (no) to 1 (yes, no physician consultation) and 2 (yes, and physician consultation). Emotional strain ranges from 1 (never) to 4 (often). Combined is a measure indicating the presence of exhaustion/burnout and/or strain (0 to 6). Data sources: BIBB/BAuA. Own calculations. See text for details.

(no professional raining), medium plus education (apprenticeship and additional professional training), and higher education (tertiary education). Medium education (apprenticeship) is the reference category. Two specifications are estimated. In the sparse one, \mathbf{X}_i only contains controls unaffected by educational choice (age, gender, survey dummy). Gender is relevant since work-related mental health problems tend to be more prevalent among women (e.g. Sandmark and Renstig, 2010). Age accounts for individual time effects such as different attitudes regarding mental illness or differences in potential exposure to the work environment. A survey dummy captures macroeconomic time effects such as a higher public perception of burnout and other work-related mental health problems in 2012. The full model adds job demands, job resources, individual and job characteristics as in table ?? . u_i is the error term, α a constant.

$$Y_i = \alpha + \mathbf{Educ}_i' \beta + \mathbf{X}_i \gamma + u_i \quad (1)$$

The coefficients of interest, $\hat{\beta}$, are associations and not a causal effect of education on work-related mental health. Education itself is a choice and potentially endogenous. An underlying variable could drive both education and health outcomes, e.g. a character trait encouraging an

individual to acquire higher education but also making her work-related mental health more vulnerable. A discussion on threats to causality and counter-strategies is provided in section 5.

4.2 Estimation results

Table 4 displays the education coefficients and the constant of sparse (1) and full models (2) for all four outcomes. Numbers of observations are between 20,000 (both years) and 7,500 (2006) due to missing information on covariates.⁷

Low compared to medium education is associated with a decrease in any work-related mental health problem of 0.215 standard deviations. The coefficient decreases to 0.091 in the full model but is still highly significant. Medium plus and higher education are associated with increases in work-related mental health problems. The coefficient for higher education is larger than for medium plus education (0.295 standard deviations and 0.195 standard deviations in the sparse model). Both coefficients roughly halve in the full model but remain highly significant. The sparse model explains 4% of the variation in the outcomes, the full model 28%. The results are very similar for emotional strain. Point estimates are slightly larger for low and higher education. Low education is associated with a decrease in strain of 0.109 standard deviations in the full model. Medium plus and higher education are associated with increases of 0.092 and 0.148 standard deviations. The full model explains 25% of the variation. Low education is not significantly associated with medium and severe work-related mental health problems: the coefficients for exhaustion and burnout are insignificant. This is not due to slightly increased standard errors but rather because point estimates are five to eight times smaller. Medium plus education is associated with higher exhaustion at the 10% level (full model: 0.071 standard deviations) but not with higher burnout. Point estimates are more than half the size for exhaustion compared to strain, while the estimates for burnout are close to zero. Higher education is significantly associated with an increase in emotional exhaustion of 0.085 standard deviations (full model, 5% level) but only significant in the sparse model for burnout (0.068 standard deviations, 5% level). Full models explain 15% of the variation in exhaustion and 8% of the variation in burnout.

⁷Of the 30,800 individuals, 20,100 provide information on outcomes, all job demands and resources, individual and job characteristics. Individuals providing all information are more likely to be women, are older and less likely to have limited contracts, work longer hours, have somewhat lower tenure but higher experience, and are slightly more satisfied with their job. Education does not differ significantly.

Table 4: OLS estimates for work-related mental health outcomes

| | combined | | strain | | exhaustion | | burnout | |
|------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|--------------------|-------------------|
| | (1) | (2) | (1) | (2) | (1) | (2) | (1) | (2) |
| low education | -0.215*** (0.036) | -0.091*** (0.032) | -0.242*** (0.037) | -0.109*** (0.034) | -0.047 (0.041) | -0.012 (0.040) | -0.028 (0.052) | -0.000 (0.049) |
| medium plus | 0.195*** (0.031) | 0.101*** (0.027) | 0.195*** (0.030) | 0.092*** (0.027) | 0.104** (0.041) | 0.071* (0.039) | 0.016 (0.050) | 0.015 (0.048) |
| higher education | 0.295*** (0.019) | 0.152*** (0.021) | 0.302*** (0.019) | 0.148*** (0.021) | 0.136*** (0.027) | 0.085** (0.033) | 0.068** (0.030) | 0.056 (0.035) |
| constant | -0.217*** (0.036) | -0.334*** (0.066) | -0.105*** (0.037) | -0.240*** (0.067) | -0.137*** (0.045) | -0.227*** (0.087) | -0.060 (0.046) | 0.038 (0.107) |
| N | 20096 | 20096 | 20120 | 20120 | 12532 | 12532 | 7570 | 7570 |
| Adj. R^2 | 0.042 | 0.284 | 0.046 | 0.254 | 0.018 | 0.153 | 0.001 | 0.083 |

Standardized dependent variable given in column header. Combined: emotional exhaustion, burnout and/or emotional strain. Model specifications: (1) sparse model (age, gender, survey dummy), (2) full model (job demands and resources, sociodemographic and job covariates) according to table A.2. Standard errors in parentheses. Significance levels * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Data sources: BIBB/BAuA. Own calculations.

To relate the findings to the literature, the following repeats the analysis with years of education instead of level of education (table 5) and alternative health outcomes (table 6). An internationally comparable measure of education are years of education. Years of education range from 7 to 18, the mean is 13.1 and the standard deviation 2.8 years. Years of education are significantly related to all work-related mental health outcomes (table 5). An additional year of education is associated with an increase in any work-related mental health problem of 0.033 standard deviations. This coefficient appears to be driven by the least severe condition. The point estimate is half the size for exhaustion (0.017) and one third for burnout (0.011). The size of the education coefficients make sense compared to the results from table 4. Medium educated employees should complete three additional years of education compared to low educated employees on average. The low educated employees coefficient for strain is -0.109. The corresponding years of education coefficient is 0.033 implying that a three-year difference would equal 0.099. Similarly, the higher educated employees coefficient is 0.148 which is in between the four- to five-year difference range of 0.132 to 0.165 (tertiary education takes four to five years on average).

Table 5: OLS estimates for work-related mental health outcomes, years of education

| | combined | | strain | | exhaustion | | burnout | |
|----------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|--------------------|
| | (1) | (2) | (1) | (2) | (1) | (2) | (1) | (2) |
| years of educ. | 0.056*** (0.003) | 0.033*** (0.004) | 0.058*** (0.003) | 0.033*** (0.004) | 0.025*** (0.004) | 0.017*** (0.005) | 0.013*** (0.005) | 0.011** (0.005) |
| constant | -0.985*** (0.056) | -0.715*** (0.067) | -0.893*** (0.057) | -0.621*** (0.070) | -0.472*** (0.069) | -0.414*** (0.093) | -0.240*** (0.076) | -0.083 (0.108) |
| N | 20096 | 20096 | 20120 | 20120 | 12532 | 12532 | 7570 | 7570 |
| Adj. R^2 | 0.044 | 0.285 | 0.048 | 0.255 | 0.019 | 0.154 | 0.002 | 0.084 |

Standardized dependent variable given in column header. Combined: emotional exhaustion, burnout and/or emotional strain. Model specifications: (1) sparse model (age, gender, survey dummy), (2) full model (job demands and resources, sociodemographic and job covariates) according to table A.2. Standard errors in parentheses. Significance levels * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Data sources: BIBB/BAuA. Own calculations.

Table 6 displays estimates for alternative outcomes which are not necessarily work-related in the same strict sense although the framing is still “during work or on working days”.⁸ Alternative outcomes are complaints that can have their origin in mental health problems (night-time sleeping disorders, general tiredness, nervousness, and the blues) but also general health and physical health. All outcomes are binary. The exception are two summary indexes, one for mental and one for physical health, which are standardized. The mental health summary measure consists of the four mental conditions sleeping disorders, tiredness, nervousness, and blues as suggested by Lohmann (2012). Similarly, physical health problems is a summary measure for the presence of shoulder, neck or back pain and problems with extremities, hips or knees.

Low education is significantly related to three of five general mental health problems (higher depression, sleeping disorders, and tiredness), and the summary mental health measure. The magnitude of this association is between 3.5 and 5.2 percentage points. Low education is not associated with nervousness, blues, and the physical health measure but with worse general health (3.6 percentage points). Medium plus and higher education are significant for physical health problems (-5.7 and -7.3 percentage points respectively). Higher education is also associated with an increase in sleeping disorders of 3.1 percentage points. The insignificance of higher education for general mental health is in line with the existing literature that often uses summary measures. As illustrated here, this might hide significant effects for components (sleeping disorders). The significant and positive medium plus and higher education coefficients for physical health are also in line with the literature.

⁸As outlined in section 2, burnout and emotional exhaustion arise in the context of work only, i.e. cannot occur in a work-free context. All other health problems can develop independently from the work context.

Table 6: OLS estimates for alternative health outcomes

| | depri | sleeping | tired | nervous | blues | mental | physical | bad health |
|------------------|--------------------|---------------------|---------------------|---------------------|---------------------|---------------------|----------------------|---------------------|
| low education | 0.035** (0.017) | 0.032** (0.016) | 0.052*** (0.019) | -0.011 (0.015) | 0.001 (0.015) | 0.046** (0.018) | -0.025 (0.016) | 0.036*** (0.013) |
| medium plus | 0.007 (0.009) | 0.002 (0.013) | -0.003 (0.015) | -0.008 (0.014) | -0.009 (0.012) | 0.017 (0.015) | -0.057*** (0.015) | -0.004 (0.009) |
| higher education | 0.009 (0.006) | 0.031*** (0.010) | 0.015 (0.011) | 0.016 (0.010) | -0.008 (0.009) | 0.010 (0.011) | -0.073*** (0.012) | -0.003 (0.007) |
| constant | 0.014 (0.021) | 0.046 (0.030) | 0.435*** (0.035) | 0.293*** (0.031) | 0.182*** (0.029) | 0.454*** (0.035) | 0.612*** (0.035) | -0.004 (0.023) |
| N | 7574 | 20106 | 20111 | 20110 | 20114 | 20126 | 20126 | 20114 |
| Adj. R^2 | 0.076 | 0.143 | 0.149 | 0.146 | 0.142 | 0.162 | 0.126 | 0.113 |
| Mean | 0.036 | 0.226 | 0.438 | 0.270 | 0.208 | 0.546 | 0.709 | 0.125 |

Binary dependent variable given in column header. Sleeping: night-time sleeping disorder, tired: general tiredness, nervous: nervousness/irritability, mental: mental health problem (sleeping disorder, tiredness, nervousness, blues), phys.: physical health problem (shoulder, neck, back, extremities, hips, knees). Full model controlling for job demands and resources, sociodemographic and job covariates according to table A.2. Standard errors in parentheses. Significance levels * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Mean: weighted mean among medium educated. Data sources: BIBB/BAuA. Own calculations.

5 Bias discussion

The previous section showed that low compared to medium education is associated with decreased mild work-related mental health problems. Medium plus and in particular higher education are related to mild and medium severe problems. Controlling for job demands and resources, individual and job characteristics reduces point estimates. This suggests that there is considerable bias in the sparse model estimations. The bias is reduced in the full model but might still exist if relevant covariates are unobserved. It is very likely that not all relevant job demands and resources are included in the model. Individual job demands and resources are determinant for the development of work-related mental health problems but demands and resources should be more similar within an occupation than across occupations. Appendix table A.3 includes two-digit occupation dummies in both the sparse model (1) and the full model (2). This is not the preferred specification as variance inflation factors larger than 10 indicate multicollinearity problems. Low, medium plus, and higher education are still significantly associated with the combined measure and mild work-related mental health problems but not with exhaustion and burnout. The signs remain the same as in table 4 but coefficients are smaller for low and higher education and slightly larger for medium plus. Medium plus education is associated with higher exhaustion in the sparse model at the 10% level but the coefficient becomes insignificant in the full model. Higher education is not significant for emotional exhaustion and burnout.

An econometrically less problematic attempt to further reduce potential bias is to include

one-digit occupation or industry dummies. Multicollinearity is not an issue in these models but they are less convincing from a theoretical point of view: due to the higher level of aggregation, jobs in one-digit occupations or industries are less similar to each other than jobs in two-digit occupations. The results for both specifications can be found in appendix tables A.4 and A.5. With one-digit occupation dummies, higher education coefficients are smaller and not significant in the full exhaustion model nor in any burnout model (A.4). Point estimates are smaller for low education and slightly larger for medium plus education but equally significant as in table 4. With industry dummies, education coefficients are smaller than in table 4 and twice significant at a lower level (higher education coefficient in full exhaustion and sparse burnout model, A.5). Overall, these robustness checks suggest that there might be some omitted variable bias but education remains significant for mild and medium severe (and partially for severe) work-related mental health problems.

There are two other sources of bias: reversed causality and selection into education. Reversed causality would drive the findings if work-related mental health problems existed before the completion of professional education. Despite lifelong learning and training, the majority still completes professional education before beginning to work.⁹ This is not true for medium plus educated employees. A reduced number of medium educated people chooses to upgrade their education after some years on the job to acquire a higher professional status (such as technician for example). Reversed causality could explain the positive association between emotional strain/exhaustion and medium plus education: medium educated employees who select into medium plus education could be emotionally strained or more fragile in work-related mental health already before they choose to acquire more education. Similarly, selection into education could explain the positive association if there is for example an underlying characteristic that is driving individuals simultaneously to take up higher education and to be more vulnerable in mental health. Individuals who worry more about the future might select into higher education as a means to get better jobs which protect against low wages and unemployment. These individuals might also be more concerned by challenges from their working environment (job demands, missing resources) which could drive them into work-related mental health problems. The positive association between work-related mental health problems and education would then arise from the underlying factor (which in this sense can also be considered an omitted variable).

There are several approaches to solve the endogeneity problem in the German context (e.g.

⁹Some people complete apprenticeships after school and work in their jobs for some time until they – rarely more than five years later – acquire tertiary education. Common reasons are missing economic resource restraints after school and hope for better career opportunities.

Gross et al., 2017). Literature examples are not exhaustive and focus on mental health where available. Kamhöfer et al. (2015) use college availability based on geographical proximity (number of universities and number of student places) and student loan eligibility based on parental income as instruments for higher education in their estimation of non-monetary returns to education. Dahmann and Schnitzlein (2017) instrument education with proximity to university and the prolongation of compulsory schooling after WWII. What follows is a brief discussion of these strategies. Student loans, education expansion, and geographical proximity are instruments for higher education, while the prolongation of compulsory schooling affects the lower end of the ability distribution. Based on the descriptive findings and the results from OLS, variation towards the upper end of the ability distribution seems to matter more for work-related mental health.¹⁰

Regarding student subsidies, there should be a discontinuous jump in the enrollment into tertiary education (among eligible students) around the time of the introduction in 1971. I do not observe enrollment, nor parental income but educational attainment and parental occupation. The jump in attainment should occur four to five years after the introduction. Eligible students must have the highest school leaving degree (“Abitur”). Parental background is not strictly necessary as the jump should also be visible in the full population. There is no jump in the data. A reason for this might be that the educational expansion occurring at the same time increased the share of people acquiring the highest school leaving degree and that a lower fraction of these continued into tertiary education.

One could take advantage of this parallel occurring expansion by exploiting increasing university capacities in and around the 1980s. New universities were build and existing ones took in more students. An increased offer of tertiary education attracts more people into enrollment. First, if there is a university close to the student’s parental home, enrollment is more likely as accommodation costs are low. There more universities there are, the higher the probability of one of them being close enough to enroll. Secondly, entry barriers are lower if more spots are to be filled up. The issue here is that in the 1980s, people were less mobile than they are today. What mattered to an individual’s decision to enroll were likely not overall but local conditions. In order to appropriately take this into account, disaggregated information on residence at completion of secondary education is necessary. There are two types of residence information in the data: residence at time of survey (both years) and residence at completion of highest school

¹⁰After WWII, the West German federal states successively extended compulsory schooling from eight to nine years. This generates variance in the years of schooling at the lower end of the ability distribution which would relate to the results using years of education as the explanatory variable. While this regression is useful for inter-country comparisons, it is questionable whether years of education translate into different jobs. For jobs, the degree of education, not the length itself, is determinant. The instrument is therefore unlikely to induce treated people to end up in different jobs.

degree (2006 only). Both are measured at the at the federal state level which is too broad a geographical unit to convincingly employ the distance instrument.¹¹

In the returns to schooling literature, Ichino and Winter-Ebmer (1999) use parental background as an instrument. The authors compare father-in-war and father's education as instruments for education. Considering ability and liquidity as the two determinant factors for schooling, they argue that able but liquidity constrained individuals ("smart poor") are affected by the first instrument and less able but not liquidity constrained individuals ("stupid rich") by the second instrument. Their analysis suggests that the first instrument is an upper bound estimate for the returns to schooling and the second one a lower bound estimate. Parental occupation, job position, and supervisor status is recorded in the 2012 data. Following Ichino and Winter-Ebmer (1999), smart and rich people are always-takers, i.e. they acquire higher education independently of whether their parents completed tertiary education. Stupid and poor people never choose tertiary education (never-takers). The compliers are stupid and rich people who acquire tertiary education only if their parents did. Parents commonly want their children to have a higher (or at least similar) standard of living and hence, level of education. Higher educated parents induce their children to higher education and they are able to afford it. Empirically, higher parental education is significantly related to higher education of the child (see the "first stage" column in table 7). With parental higher education, the probability for higher education of the child is 28 percentage points larger.

The problem here is not the relevance assumption but the exclusion restriction. Parental education must not have any influence on children's work-related mental health except through education. One concern is that children of highly educated parents might be exposed to parental work-related mental health problems. Mean age is 42, hence birth years are around 1970. Assume for simplicity that parents are 25 years old at the child's birth (i.e. born around 1945) and work from 16 to 60. Then, their work life lasts from 1961 to 2005. Life and work followed a much slower pace during most of the parents' work life, and mental health problems were less an issue than today. But even if parents experienced work-related mental health problems, the bias is rather downward than upward. Parental health problems could have three effects on children's outcomes: avoidance, better coping strategies, and increased awareness. First, to not repeat parents' mistakes, children might chose different career paths. They might end up in less stressful jobs and experience fewer work-related mental health problems which would lead to a downward bias of the estimate. Second, if children learn coping strategies from parents, e.g. to

¹¹One could obtain more disaggregated information on residence at survey but this instrument is not too convincing due to mobility after school. While it is true that some studies use state of current residence as a proxy and mobility in Germany is lower than e.g. in the U.S., higher educated employees are more mobile than the average of the population.

seek professional help in stressful situations, this should also result in a downward bias. A third effect could be increased awareness of work-related mental health problems. On the one hand, different reporting behavior could overstate the true prevalence of work-related mental health problems. On the other hand, more knowledge about mental health problems, which are still stigmatized and less well-known than physical health problems, might reduce reporting errors (e.g. distinguish between sometimes feeling exhausted and suffering from burnout). A last concern threatening the exclusion restriction comes from underlying character traits in parents which – through nature or nurture – are passed onto children and induce both generations to acquire more education and be more vulnerable in work-related mental health. While there is substantial literature on genetics in mental health problems like depression (e.g. Sullivan et al., 2000, Kendler et al., 2010, Lohoff, 2010), much less is known about work-related mental health problems. Personality measures such as BIG5 might help to address this concern, if they succeed in capturing this specific trait, but are not available in the data.

Being aware of the problems with the instrument, table 7 displays instrumental variable results with parental higher education as an instrument for individual higher education. The first three columns contain the OLS estimates. Higher education compared to lower, medium or medium plus education is associated with increases in strain of 0.397 standard deviations and in exhaustion of 0.127 standard deviations. The first stage is highly significant with a t statistic of 25 (corresponding to an F-statistic of excluded instruments of 225 in the case of a single instrument). Parental higher education is associated with an increase in children’s higher education of 28 percentage points. Second stage estimates are larger than OLS. The coefficient for strain increases by 47% (0.583), the estimate for exhaustion by 37% (0.174, significant at the 5% level).

Even without the problematic exclusion restriction, Card (1999) suggests that univariate OLS with own education and IV estimates with parental education yields more biased estimates than a bivariate OLS with own and parental education as regressors. Table 7 displays the OLS education coefficients with (2) and without (1) a control for parental occupational prestige. The results in (1) are different from the ones in table 4 because only people who provided information on their parental background are included. Parental occupational prestige is not significant. Coefficients for low and medium plus education are unchanged. The higher education estimate for exhaustion is somewhat larger when controlling for parental occupational prestige. While no claim on causality can be made, there is at least evidence that the findings from the previous subsection are robust to the inclusion of parental background. Due to the lack of a fully convincing instrument, the following analyses stay at the descriptive OLS level.

Table 7: Estimates for work-related mental health problems

| | OLS | | | first stage | second stages | | |
|-------------------|----------------------|----------------------|----------------------|---------------------|----------------------|----------------------|----------------------|
| | combined | strain | exhaustion | | combined | strain | exhaustion |
| higher education | 0.383*** (0.023) | 0.397*** (0.022) | 0.127*** (0.023) | | 0.554*** (0.091) | 0.583*** (0.087) | 0.174** (0.083) |
| gender | -0.257*** (0.021) | -0.208*** (0.020) | -0.190*** (0.020) | -0.001 (0.008) | -0.256*** (0.021) | -0.207*** (0.020) | -0.190*** (0.020) |
| age | 0.008*** (0.001) | 0.006*** (0.001) | 0.006*** (0.001) | 0.002*** (0.000) | 0.008*** (0.001) | 0.006*** (0.001) | 0.006*** (0.001) |
| par. higher educ. | | | | 0.283*** (0.012) | | | |
| constant | -0.203*** (0.046) | -0.248*** (0.045) | -0.184*** (0.040) | 0.079*** (0.017) | -0.231*** (0.048) | -0.279*** (0.047) | -0.192*** (0.043) |
| N | 14311 | 14342 | 14322 | 14355 | 14311 | 14342 | 14322 |

Parental education available in 2012 only. Standardized dependent variable given in column header. Combined is a measure for the presence of exhaustion and/or strain. First stage dependent variable: higher education (binary). Par. higher educ.: parental higher education (binary for SIOPS prestige classification larger than 50). Number of observations: 14355. First stage t-statistic (par. higher educ.): 25. Standard errors in parentheses. Significance levels * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Data sources: BIBB/BAuA. Own calculations.

Table 8: OLS estimates for work-related mental health outcomes with parental occupational prestige

| | combined | | strain | | exhaustion | |
|--------------------|----------------------|----------------------|----------------------|----------------------|---------------------|--------------------|
| | (1) | (2) | (1) | (2) | (1) | (2) |
| lower education | -0.081* (0.043) | -0.081* (0.043) | -0.097** (0.045) | -0.097** (0.045) | -0.003 (0.043) | -0.003 (0.043) |
| medium plus | 0.083** (0.035) | 0.083** (0.035) | 0.067* (0.035) | 0.066* (0.035) | 0.060 (0.040) | 0.062 (0.040) |
| higher education | 0.141*** (0.031) | 0.143*** (0.032) | 0.127*** (0.030) | 0.125*** (0.030) | 0.081** (0.035) | 0.088** (0.036) |
| par. occ. prestige | | -0.000 (0.001) | | 0.000 (0.001) | | -0.001 (0.001) |
| constant | -0.257*** (0.090) | -0.248*** (0.096) | -0.287*** (0.089) | -0.302*** (0.094) | -0.232** (0.092) | -0.185* (0.100) |
| N | 11213 | 11213 | 11225 | 11225 | 11216 | 11216 |

Parental education available in 2012 only. Standardized dependent variable given in column header. Combined: emotional exhaustion, burnout and/or emotional strain. Model specifications: (1) sparse model (age, gender, survey dummy), (2) full model (job demands and resources, sociodemographic and job covariates) according to table A.2. Par. occ. prestige: parental occupational prestige (SIOPS, continuous). Standard errors in parentheses. Significance levels * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Data sources: BIBB/BAuA. Own calculations.

6 Potential channels and compensation

6.1 Potential channels

The inclusion of job demands and resources in the full decreased the education coefficients. If – as hypothesized – education itself is the entry ticket into certain jobs, this should not only be visible in health outcomes but also in job environments from which work-related mental health problems can arise. This subsection regresses job demands, job resources, and ambiguous factors on education dummies and the controls from the sparse model providing descriptive evidence on the relationship¹². As discussed in the previous section, causal claims cannot be made.

Low education is associated with lower job demands, medium plus, and higher education are associated with higher demands (table 9). Numbers of observations are larger than for work-related mental health outcomes because there are less missing values. Dependent variables are standardized except for overstrain (binary) and hours (ordinal). Compared to medium education, low education is associated with decreases in deadline pressure (0.437 standard deviations), simultaneity (0.384 standard deviations), and interruptions (0.357 standard deviations). The number of different tasks performed (“multitasking”) is 0.28 standard deviations lower. The coefficients for missing information, being at one’s capacity limit (“limit”), potentially large financial losses for even small mistakes (“loss”), and working fast are between 0.1 and 0.2 standard deviations. Low educated employees work 4.8 hours less. Being demanded too much (“over”) increases by 3 percentage points. Since this concerns 20% of the medium educated employees, the relative increase is 17%. Low education is associated with an increase in repetition of 0.061 standard deviations but is not significantly related to predetermined tasks and minimum performance.

Medium plus education is associated with increased simultaneity (0.324), multitasking (0.296), interruptions (0.269), large financial losses for small mistakes (0.231), and deadline pressure (0.209). Coefficients are around 0.1 standard deviations for capacity limit and missing information. Weekly hours increase by 1.6 hours, predetermined tasks decrease by 0.203 standard deviations, and repetition decreases by 0.295 standard deviations. Medium plus education is not significant for being demanded too much, working fast, and minimum performance.

Higher education is associated with increases in simultaneity (0.417), deadline pressure (0.251), and multitasking (0.194). The estimates for capacity limits, interruptions, and missing

¹²Results are similar including sociodemographic and job characteristics (not reported). I report the sparse specification, since the theoretical framework for job demands and resources does not necessarily correspond to the one for work-related mental health outcomes regarding sociodemographic and job factors. For example, it is rather unlikely that having a partner, children and atypical working times are related to job demands. Controlling for working in one’s dream job could make sense if this made employees more blind regarding demands and more generous in perceiving resources.

information are smaller. Working hours increase by 3.6 hours, being demanded too much by 26% (or 5.5 percentage points). Repetition and predetermined tasks decrease by 0.776 and 0.493 standard deviations. Large financial losses for small mistakes and minimum performance are also lower. These results make sense as low scope (predetermined tasks) and repetition decrease over educational level while psychological demands associated with jobs of higher hierarchical levels (accessible only with more education) increase with educational attainment. Differences across education are more pronounced for simultaneity, deadline pressure, multitasking, interruptions, and repetition.

Education is associated similarly with job resources and ambiguous factors (table 10). Resources are lower for low educated employees compared to medium educated employees and higher for medium plus and higher educated employees. Low education is related to lower scheduling freedom (0.352), community feeling (0.301), and collaboration (0.207). Influence over workload and breaks are 0.1 standard deviations lower, support from coworkers 0.196 standard deviations, and supervisor support 0.092 standard deviations lower. The estimate for task independence is small (0.058). Medium plus education is associated with higher influence over work schedule (0.403), workload (0.235), and breaks (0.207). There is no difference between medium plus and medium educated employees regarding collaboration and colleague support but medium plus feel somewhat more as part of a community (0.096) and get more supervisor support (0.058). They are 0.113 standard deviations more independent in their tasks. Higher education is significantly associated with increased influence – ranging from 0.461 standard deviations for scheduling to 0.181 for task independence – and somewhat higher social support (0.058 to 0.095 standard deviations).

Ambiguous factors are lower for low educated employees. Point estimates are larger for getting familiar with tasks (“familiar”, 0.429) and improving methods (“improve”, 0.347) than for being demanded unknown things (“unknown”, 0.141). The probability to be a supervisor is 8 percentage points lower (28%). The increase in ambiguous factors is larger for higher than for medium plus educated employees except for supervisor status where the increase is 52% for medium plus and 31% for higher educated employees (15 and 9 percentage points respectively). Higher compared to medium education is associated with increases of getting familiar and improving of around 0.5 standard deviations.

It is not clear whether ambiguous factors enter the Job Demands and Resources model on the demand or resource side. Given that low education is associated with lower strain and given that medium plus and higher education are associated with higher strain and exhaustion, one would expect an imbalance between demands and resources. The JD-R predicts higher resources

than demands for decreasing work-related mental health problems (low education) and higher demands than resources for increasing problems (medium plus and higher education). Demands and resources are lower for low educated employees and higher for medium plus and higher educated employees. This could be one reason for why low education is significant only for strain and for why medium plus education is not significant for burnout. An imbalance could still arise due to the weighting of individual demands and resources in the JD-R. Another possibility is a different perception of stress from demands and missing resources. Perceived stress is binary and only recorded for individuals who report to suffer from job demands frequently or to lack job resources (answer “never”). Thus, the following analysis applies to pre-selected groups exposed to high job demands and low job resources and is not necessarily representative of the whole population.¹³

Table 11 displays the results for perceived stress from high job demands. Low education is associated with lower perceived stress from simultaneity, interruptions, and missing information about the future (2.9 to 4.6 percentage points). In relative terms, the change is largest for simultaneity (12%). All other point estimates are insignificant and mostly very small. Medium plus education is related to increased stress from deadline pressure, interruptions, and missing information. Repetition is perceived as less stressful. Relative effect sizes are roughly between 5 and 15%. The association of higher education and perceived stress from job demands is stronger in terms of size but also significance: a single point estimate (“loss”) is insignificant. Higher educated employees perceive both psychological demands and imposed limits (predetermined tasks, repetition) as more stressful. The largest relative increase is the one for perceived stress from simultaneity (31%). Considering that job demands increase for medium plus and higher educated employees and that also perceived stress from job demands increases, the positive association with work-related mental health problems makes sense. Point estimates for job demands and perceived stress are usually larger for higher than for medium plus educated employees which could translate into larger coefficients of higher education for mild to medium severe outcomes.

To shed light on whether the lower resources of low educated employees could affect them differently, table 12 shows the results for perceived stress from missing resources and ambiguous factors. Low education is significantly associated with lower perceived stress from a missing influence over workloads and breaks suggesting that a lack of these resources does not weigh as much for low as for medium educated employees. Perceived stress from lacking coworker support is larger. It is not possible to determine which effect weighs more for the JD-R but lower demands

¹³Stress perception is not available for overstrain, multitasking, hours, task independence, improvising, and supervisor.

and resources and largely unchanged stress perception could explain the insignificant association of low education with medium to severe work-related mental health problems. Perceived stress from lacking resources is higher for medium plus and especially higher educated employees. This is interesting in itself but does not directly contribute to shedding light on possible mechanisms. The last two columns of table 12 are more relevant to this: perceived stress from getting familiar with tasks and being demanded unknown tasks is higher for higher educated employees. Both ambiguous factors also rise by 0.5 to 0.3 standard deviations compared to medium education, suggesting that they could act as job demands and contribute to the development of work-related mental health problems.

To conclude this subsection, education is significantly related to job demands, job resources, and ambiguous factors. Demands and resources are lower for low educated employees and higher for medium plus and higher educated employees. Different stress perceptions play a role for the association of education with work-related mental health: job resources are lower for low compared to medium educated employees but there is no change in perception of missing resources, while job demands are higher for medium plus and higher educated employees and perceived stress from job demands is also higher.

Table 9: OLS estimates for job demands

| | deadline | limit | simult. | inter. | over | multi | no info | hours | det. | rep. | loss | no info II | fast | min |
|------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|---------------------|
| low | -0.437*** (0.034) | -0.159*** (0.031) | -0.384*** (0.035) | -0.357*** (0.032) | -0.029*** (0.011) | -0.280*** (0.028) | -0.185*** (0.031) | -4.809*** (0.374) | -0.003 (0.030) | 0.061** (0.026) | -0.186*** (0.028) | -0.161*** (0.030) | -0.123*** (0.032) | 0.022 (0.029) |
| med plus | 0.209*** (0.024) | 0.109*** (0.026) | 0.324*** (0.024) | 0.269*** (0.025) | 0.012 (0.012) | 0.296*** (0.028) | 0.102*** (0.027) | 1.588*** (0.229) | -0.203*** (0.027) | -0.295*** (0.027) | 0.231*** (0.027) | 0.098*** (0.026) | 0.021 (0.027) | 0.005 (0.027) |
| higher | 0.251*** (0.014) | 0.113*** (0.015) | 0.417*** (0.014) | 0.162*** (0.016) | 0.055*** (0.007) | 0.194*** (0.015) | 0.056*** (0.015) | 3.562*** (0.164) | -0.493*** (0.015) | -0.776*** (0.016) | -0.077*** (0.015) | 0.070*** (0.016) | -0.030** (0.015) | -0.020 (0.016) |
| constant | -0.079** (0.032) | -0.152*** (0.030) | 0.026 (0.031) | 0.178*** (0.031) | 0.183*** (0.012) | -0.083*** (0.030) | -0.020 (0.031) | 33.800*** (0.318) | 0.202*** (0.030) | 0.168*** (0.028) | 0.217*** (0.030) | 0.010 (0.031) | 0.359*** (0.030) | 0.260*** (0.030) |
| N | 30781 | 30766 | 30772 | 30773 | 28125 | 29724 | 30676 | 30758 | 30741 | 30758 | 30670 | 30743 | 30720 | 30713 |
| Adj. R^2 | 0.040 | 0.010 | 0.051 | 0.022 | 0.006 | 0.044 | 0.007 | 0.218 | 0.048 | 0.117 | 0.082 | 0.014 | 0.009 | 0.014 |

Binary dependent variable given in column header. Deadline: deadline/performance pressure, limit: reach limits of own capacity, simult.: do different things simultaneously, inter.: interruptions during work, over: overstrained, unable to cope/asked too much, multi: multitasking/number of different tasks, no info: no timely information about the future, hours: weekly working hours (between 10 and 120), det.: work details are predetermined, rep.: work steps have to be repeated into small details, loss: even small mistakes can lead to large financial losses, no info II: not receiving all information necessary for correct work, fast: work fast, min.: minimum performance. Controls: age, gender, survey dummy as in sparse model in table A.2. Standard errors in parentheses. Significance levels * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Data sources: BIBB/BAuA. Own calculations.

Table 10: OLS estimates for job resources and ambiguous factors

| | job resources | | | | ambiguous factors | | | | | | | |
|--------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|
| | schedule | workload | break | coll. | comm. | support I | support II | indep. | familiar | improve | unknown | supervisor |
| low educ. | -0.352*** (0.035) | -0.115*** (0.028) | -0.120*** (0.031) | -0.207*** (0.037) | -0.301*** (0.038) | -0.186*** (0.036) | -0.092*** (0.032) | -0.058*** (0.016) | -0.429*** (0.033) | -0.347*** (0.031) | -0.141*** (0.029) | -0.081*** (0.011) |
| medium plus | 0.403*** (0.022) | 0.235*** (0.027) | 0.207*** (0.025) | 0.039 (0.026) | 0.096*** (0.025) | -0.014 (0.027) | 0.058** (0.027) | 0.113*** (0.013) | 0.312*** (0.024) | 0.288*** (0.026) | 0.117*** (0.026) | 0.153*** (0.014) |
| higher educ. | 0.461*** (0.013) | 0.256*** (0.015) | 0.198*** (0.015) | 0.068*** (0.015) | 0.095*** (0.014) | 0.058*** (0.015) | 0.077*** (0.016) | 0.181*** (0.007) | 0.534*** (0.014) | 0.497*** (0.015) | 0.302*** (0.016) | 0.090*** (0.008) |
| constant | -0.183*** (0.031) | -0.286*** (0.030) | -0.153*** (0.030) | 0.031 (0.030) | 0.093*** (0.030) | 0.220*** (0.029) | 0.113*** (0.031) | 0.522*** (0.016) | 0.026 (0.030) | 0.039 (0.030) | 0.133*** (0.030) | 0.152*** (0.013) |
| N | 30760 | 30670 | 30707 | 30562 | 30709 | 30613 | 30453 | 25374 | 30773 | 30765 | 30753 | 30756 |
| Adj. R^2 | 0.062 | 0.022 | 0.015 | 0.005 | 0.012 | 0.010 | 0.003 | 0.042 | 0.087 | 0.064 | 0.027 | 0.040 |

Binary dependent variable given in column header. Job resources: schedule: plan/ schedule own work, workload: influence own workload, break: plan and schedule own breaks, coll.: good collaboration, comm.: feel as a part of a community at work, support I: receive help and support from colleagues, support II: receiving help and support from supervisor, indep.: perform tasks independently (binary). Ambiguous factors: familiar: think through/ get familiar with tasks, improve: improve methods/ try new things, unknown: demanded unknown things, supervisor: be a supervisor (binary). Controls: age, gender, survey dummy as in sparse model in table A.2. Standard errors in parentheses. Significance levels * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Data sources: BIBB/BAuA. Own calculations.

Table 11: OLS estimates for perceived stress from job demands

| | deadline | limit | simult. | inter. | no info | det. | rep. | loss | no info II | fast | min |
|------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|
| low | -0.006 (0.018) | 0.002 (0.023) | -0.029** (0.015) | -0.035* (0.019) | -0.046* (0.026) | 0.001 (0.019) | 0.010 (0.012) | 0.012 (0.029) | -0.019 (0.027) | 0.009 (0.018) | -0.035 (0.021) |
| med plus | 0.033** (0.016) | -0.013 (0.023) | -0.003 (0.013) | 0.044** (0.017) | 0.082** (0.023) | 0.029 (0.022) | -0.021* (0.012) | -0.037 (0.023) | 0.122*** (0.022) | 0.005 (0.018) | 0.044* (0.023) |
| higher | 0.099*** (0.009) | 0.067*** (0.012) | 0.077*** (0.008) | 0.096*** (0.010) | 0.099*** (0.013) | 0.121*** (0.015) | 0.027*** (0.009) | 0.025 (0.016) | 0.073*** (0.014) | 0.036*** (0.010) | 0.047*** (0.013) |
| constant | 0.370*** (0.018) | 0.500*** (0.025) | 0.111*** (0.014) | 0.399*** (0.019) | 0.642*** (0.027) | 0.081*** (0.021) | 0.114*** (0.013) | 0.368*** (0.029) | 0.747*** (0.029) | 0.244*** (0.019) | 0.259*** (0.023) |
| N | 21584 | 10842 | 22759 | 19908 | 9592 | 10799 | 17791 | 7860 | 7318 | 17743 | 12006 |
| Adj. R^2 | 0.035 | 0.037 | 0.018 | 0.016 | 0.014 | 0.025 | 0.006 | 0.015 | 0.016 | 0.015 | 0.017 |
| Mean | 0.539 | 0.614 | 0.236 | 0.497 | 0.612 | 0.258 | 0.139 | 0.437 | 0.701 | 0.384 | 0.404 |

Standardized dependent variable given in column header (over: binary, hours; ordinal). Perceived stress due to... deadline: dead-
line/performance pressure, limit: reach limits of own capacity, simult.: do different things simultaneously, inter.: interruptions during work,
no info: no timely information about the future, hours: weekly working hours (between 10 and 120), det.: work details are predetermined,
rep.: work steps have to be repeated into small details, loss: even small mistakes can lead to large financial losses, no info II: not receiving
all information necessary for correct work, fast: work fast, min.: minimum performance. Controls: age, gender, survey dummy as in sparse
model in table A.2. Standard errors in parentheses. Significance levels * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Mean: weighted mean among
medium educated. Data sources: BIBB/BAuA. Own calculations.

Table 12: OLS estimates for perceived stress from missing job resources and from ambiguous factors

| | job resources | | | | ambiguous factors | | | | |
|--------------|---------------------|----------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|
| | schedule | workload | break | coll. | comm. | support I | support II | familiar | unknown |
| low educ. | 0.013 (0.024) | -0.044*** (0.016) | -0.029* (0.016) | 0.022 (0.084) | -0.029 (0.039) | 0.120** (0.054) | 0.014 (0.037) | -0.007 (0.012) | 0.038 (0.030) |
| medium plus | 0.020 (0.046) | 0.064*** (0.022) | 0.042* (0.025) | 0.064 (0.132) | 0.249*** (0.073) | 0.207** (0.082) | 0.120*** (0.044) | -0.012 (0.011) | 0.012 (0.028) |
| higher educ. | 0.107*** (0.035) | 0.151*** (0.013) | 0.124*** (0.015) | 0.203*** (0.071) | 0.149*** (0.037) | 0.017 (0.044) | 0.062** (0.025) | 0.019*** (0.007) | 0.075*** (0.014) |
| constant | 0.155*** (0.030) | 0.189*** (0.020) | 0.237*** (0.022) | 0.752*** (0.119) | 0.324*** (0.054) | 0.506*** (0.076) | 0.498*** (0.043) | 0.016 (0.012) | 0.218*** (0.029) |
| N | 2766 | 9927 | 6772 | 468 | 1531 | 1247 | 3550 | 18953 | 7502 |
| Adj. R^2 | 0.006 | 0.022 | 0.023 | 0.038 | 0.027 | 0.024 | 0.013 | 0.016 | 0.019 |
| Mean | 0.128 | 0.182 | 0.149 | 0.502 | 0.253 | 0.329 | 0.389 | 0.131 | 0.338 |

Binary dependent variable given in column header. Perceived stress due to lack of resources: schedule: plan/ schedule own work, workload: influence own workload, break: plan and schedule own breaks, coll.: good collaboration, comm.: feel as a part of a community at work, support I: receive help and support from colleagues, support II: receiving help and support from supervisor. Perceived stress due to ambiguous factors: familiar: think through/ get familiar with tasks, unknown: demanded unknown things. Controls: age, gender, survey dummy as in sparse model in table A.2. Standard errors in parentheses. Significance levels * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Mean: weighted mean among medium educated. Data sources: BIBB/BAuA. Own calculations.

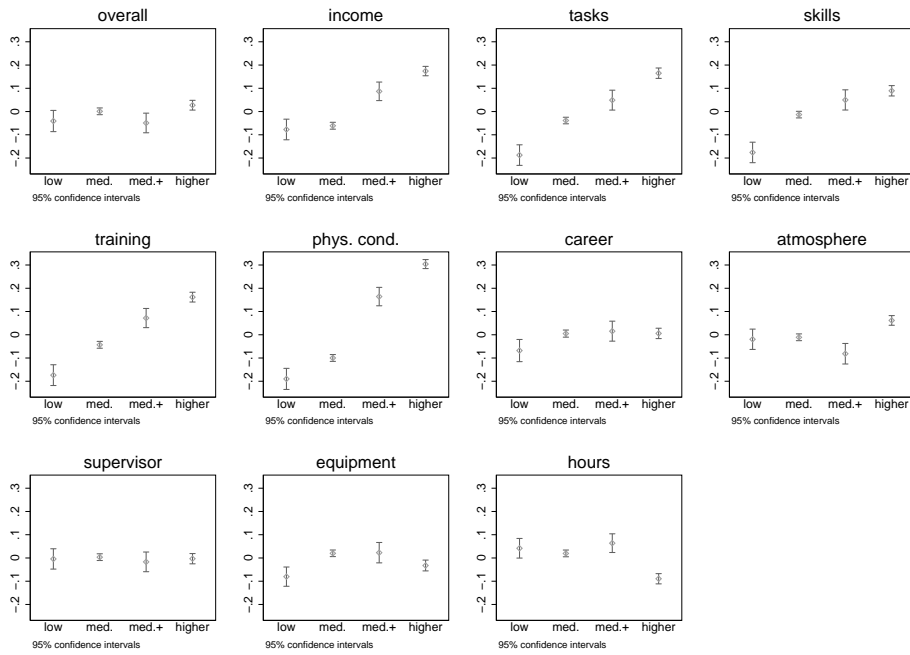
6.2 Potential compensation

This subsection analyzes whether there is monetary or non-monetary compensation for the adverse work-related mental health effects of higher education. A higher exposure to unfavorable working conditions and thus a higher risk for work-related mental health problems could be compensated by other facets of the job, e.g. wage, job satisfaction, job security, and compatibility with private life. Satisfaction with income, tasks, application of skills, training, and physical working conditions increases over education (figure 2). There are no differences for overall and supervisor satisfaction. Higher educated people are more satisfied with working atmosphere but less with working hours. Lower educated employees are less satisfied with career opportunities and working equipment.

Figure 14 depicts potential compensation by level of education. Hourly income and working in one's dream job increase with education. Job insecurity measured as the subjective risk to be laid off soon ("layoff") and limited contracts ("atypical": short-term or temporary contract) decrease from low to medium plus education but are on a comparable level for higher and medium educated employees. There is no difference across education in work life balance success. Night and shift work decrease over education, while standby duty increases. Weekend work is equally common among low, medium, and medium plus educated employees but lower for higher educated employees.

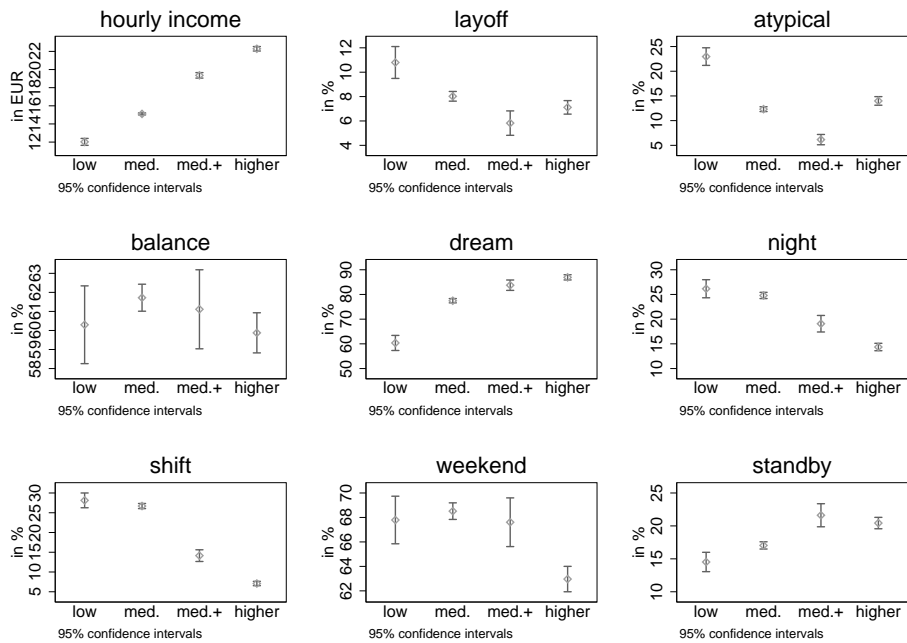
The full model OLS results for job satisfaction are reported in table 13. Low compared to medium education is associated with an increase in overall job satisfaction of 0.083 standard deviations (5% level). The estimates for satisfaction with career and atmosphere are of comparable size and significance. Low educated employees are more satisfied with their income (0.146 standard deviations). The remaining point estimates are small and insignificant. Medium plus education is associated with higher satisfaction with physical working conditions (0.168 standard deviations) and with lower overall (0.112) and career satisfaction (0.084). Satisfaction with application of skills (0.088) and working atmosphere (0.048, 10% level) are also lower. Higher education is related to lower overall, skill, career, and working hours satisfaction (all around 0.1 standard deviations). The coefficients for satisfaction with supervisor (0.07) and income (0.05, 10% level) are smaller but significant. Satisfaction with physical working conditions is 0.168 standard deviations higher. The results mirror the findings for work-related mental health: low education is associated with better outcomes, medium plus and higher education with worse outcomes. The exception is satisfaction with physical working conditions which is higher among medium plus and higher educated employees compared to medium educated employees. This

Figure 2: Standardized job satisfaction by level of education



Satisfaction measured between 1 (very dissatisfied) and 4 (very satisfied), standardized. Data sources: BIBB/BAuA. Own figure.

Figure 3: (Non-)Monetary compensation by level of education



Wage: hourly wage, balance: successful work-life balance, dream (2012): working in one's dream job, important: feel work is important, layoff: risk of being laid off soon, atypical: short-term or temporary contract, night/shift/weekend/standby: regularly occurring. Data sources: BIBB/BAuA. Own figure.

confirms the finding that physical health problems are less common, and suggests that there is at least some compensation.

Table 14 displays the results for other non-monetary and monetary compensation. All regressions control for age, gender, weekly hours, and experience, include a survey dummy and dummies for partner, children, supervisor status, and task independence. Compared to medium education, low education is associated with about 22% lower hourly wages. The wages for medium plus educated employees are 19% higher and the wages for higher educated employees are 32% higher. This suggest monetary compensation and is in line with an extensive literature on (causal) monetary returns to education. Low education is associated with lower work-life balance success (“balance”, 7.5 percentage points), lower probability to work in their dream job (14.4 percentage points), and to consider your work to be important (0.198 standard deviations). Subjective (thinking to be laid off soon) and objective job insecurity (atypical contract) are higher among low educated employees. Work times are more atypical (regular night, shift, weekend, and standby work). Medium plus and higher educated employees have a higher success of work-life balance and higher a probability to be in their dream job. The coefficient for “balance” is larger for medium educated employees; the increase in “dream” is larger for higher educated employees. Medium plus education is associated with an increase in feeling that work is important (0.072 standard deviations). Subjective and objective job insecurity are higher for higher educated employees compared to medium educated employees (1.4 and 2.7 percentage points which corresponds to 18% and 23%). Medium plus educated employees are less often in atypical contracts (3.7 percentage points or 31%). Regarding atypical working times, both medium and higher education are associated with less night (about 32%), shift (up to 58%), and weekend work (around 10%). Higher education is related to an increase in standby duties of 1.5 percentage points (9%).

All in all, there is monetary and some non-monetary compensation for the increase of work-related mental health problems with education. Non-monetary compensation comes from better work life balance, less atypical working times but not from lower perceived job insecurity or higher job satisfaction. With increasing education, workplaces become more psychologically demanding, while physical conditions improve. There is suggestive evidence that this could translate into worse work-related mental health, lower job satisfaction but better physical health.

Table 13: OLS estimates for job satisfaction

| | overall | income | tasks | skills | training | phys. cond. | career | atmosphere | supervisor | equipment | hours |
|------------------|----------------------|---------------------|-------------------|----------------------|-------------------|---------------------|----------------------|---------------------|----------------------|-------------------|----------------------|
| lower education | 0.083** (0.038) | 0.146*** (0.039) | 0.039 (0.039) | 0.007 (0.038) | 0.014 (0.039) | 0.011 (0.040) | 0.070* (0.040) | 0.080** (0.034) | 0.051 (0.033) | 0.004 (0.035) | -0.037 (0.037) |
| medium plus | -0.112*** (0.028) | 0.021 (0.030) | -0.041 (0.031) | -0.088*** (0.030) | -0.013 (0.029) | 0.158*** (0.028) | -0.084*** (0.030) | -0.048* (0.028) | -0.039 (0.027) | -0.018 (0.032) | -0.007 (0.028) |
| higher education | -0.107*** (0.021) | -0.050* (0.027) | -0.020 (0.023) | -0.096*** (0.022) | -0.018 (0.024) | 0.168*** (0.022) | -0.106*** (0.023) | -0.024 (0.021) | -0.070*** (0.021) | -0.037 (0.024) | -0.095*** (0.022) |
| constant | 0.062 (0.072) | -0.121 (0.081) | -0.088 (0.073) | -0.063 (0.074) | 0.013 (0.074) | 0.077 (0.070) | 0.055 (0.075) | 0.288*** (0.069) | 0.098 (0.068) | 0.007 (0.073) | 0.639*** (0.071) |
| N | 20120 | 20102 | 20120 | 20110 | 19861 | 20052 | 18441 | 20110 | 20031 | 20014 | 20111 |
| Adj. R^2 | 0.212 | 0.147 | 0.136 | 0.143 | 0.157 | 0.204 | 0.140 | 0.270 | 0.278 | 0.103 | 0.202 |

Standardized dependent variable given in column header. Phys. cond.: physical working conditions. Full model controlling for job demands and resources, sociodemographic and job covariates according to table A.2. Standard errors in parentheses. Significance levels * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Data sources: BIBB/BAuA. Own calculations.

Table 14: OLS estimates for (non-)monetary compensation

| | wage | balance | dream | important | layoff | atypical | night | shift | weekend | standby |
|------------------|----------------------|----------------------|----------------------|----------------------|---------------------|----------------------|----------------------|----------------------|----------------------|---------------------|
| lower education | -0.220*** (0.017) | -0.075*** (0.016) | -0.144*** (0.021) | -0.197*** (0.041) | 0.022** (0.010) | 0.083*** (0.015) | 0.068*** (0.015) | 0.029* (0.016) | 0.064*** (0.015) | 0.022* (0.012) |
| medium plus | 0.190*** (0.011) | 0.027* (0.014) | 0.041*** (0.015) | 0.072*** (0.025) | -0.011 (0.006) | -0.037*** (0.008) | -0.079*** (0.012) | -0.112*** (0.010) | -0.065*** (0.013) | 0.016 (0.013) |
| higher education | 0.318*** (0.009) | 0.019** (0.010) | 0.076*** (0.010) | -0.004 (0.019) | 0.014** (0.006) | 0.027*** (0.007) | -0.099*** (0.008) | -0.152*** (0.007) | -0.072*** (0.010) | 0.015* (0.008) |
| constant | 1.969*** (0.031) | 1.068*** (0.029) | 0.622*** (0.035) | -0.457*** (0.065) | 0.157*** (0.018) | 0.397*** (0.024) | 0.141*** (0.025) | 0.342*** (0.026) | 0.479*** (0.029) | 0.047*** (0.023) |
| N | 24956 | 24884 | 14795 | 24892 | 24684 | 23492 | 24920 | 24944 | 24953 | 24926 |
| Adj. R^2 | 0.275 | 0.062 | 0.042 | 0.035 | 0.018 | 0.074 | 0.039 | 0.049 | 0.060 | 0.037 |
| Mean | | 0.617 | 0.775 | -0.007 | 0.080 | 0.123 | 0.248 | 0.267 | 0.685 | 0.170 |

Binary dependent variable given in column header (wage: natural logarithm, important: standardized). Wage: hourly wage, balance: successful work-life balance, dream (2012): working in one's dream job, important: feel work is important (std.), layoff: risk of being laid off soon, atypical: short-term or temporary contract, night/shift/weekend/standby: regularly occurring. Model specification: sparse model (age, gender, survey dummy) plus dummies for partner, child, supervisor, independently performing tasks, plus weekly hours and experience. Standard errors in parentheses. Significance levels * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Data sources: BIBB/BAuA. Own calculations.

7 Conclusion

Education is associated with worse work-related mental health problems. Low compared to medium education is associated with lower emotional strain. Higher education is associated with higher strain, exhaustion, and burnout but also with higher wages and better physical health. The latter findings are in line with the literature, the ones regarding mental health are not. Instead of a protective effect, the opposite is the case: education but seems to be detrimental to work-related mental health. While no claim on causality can be made, this result stands in contrast to the economic literature so far, e.g. Kamhöfer et al. (2015) and Dahmann and Schnitzlein (2017). Both studies do not find a causal relationship between education and general mental health. The reason for this difference seems to come from a different measurement of mental health. Theoretically, education could impact both general mental health and work-related mental health but the mechanisms differ. Studies considering general mental health depart from the mechanism which is relevant for physical health and health behavior: health literacy. In essence, education improves the understanding of sources for health problems, their prevention, and consequences. This is true for physical health and behavior (e.g. smoking) but not for mental health.

The present study measures mental health differently by focusing exclusively on mental health problems arising at work. Departing from the burnout literature and the Job Demands and Resources model, it suggests a different mechanism through which education impacts mental health: the work environment composed of straining factors (job demands) and strain reducing factors (job resources). In this setting, education determines which jobs can be accessed. The job in turn comes with a certain environment. The findings presented here suggest that education is associated with higher job demands, higher job resources, and a different stress perception. High job demands are perceived as more stressful by higher compared to medium educated employees, while low educated employees do not perceive missing resources as more stressful than medium educated employees. Stress perception is relevant for the individual imbalance feeling: in the Job Demands and Resources model, an imbalance between job demands and resources can lead to work-related mental health problems.

This paper also contributes to the economic literature on mental health by documenting that mental health summary measures constructed from single items might – despite their theoretical and statistical justification – not always be the optimal unit of measurement. Significant relationships with some factors might pass unnoticed in combination with other factors' insignificant relationships. Education is insignificant for a mental health summary score consisting of night-time sleeping disorders, general tiredness, nervousness, and blues (all arising during or

immediately after work) but is significant for one single factor (sleeping disorders).

Despite its contributions, the analysis suffers from two limitations. First, no claims on causality can be made. Despite robustness and bias checks, the results could be driven by the endogeneity of education as long as there is no exogenous variation in educational attainment. Endogeneity could e.g. come from underlying and unobserved character traits that are correlated with educational choice and vulnerability in work-related mental health. The analyses are nevertheless useful because they provide insight on the working environment in which people, given their educational choice, end up. This is relevant for better understanding work-related mental health problems. Second, the focus on work-related mental health problems subjects the analysis to a survival bias. The data is representative of the German working population but excludes individuals who left the working population due to severe and persistent work-related mental health problems. Assuming that low and higher educated employees are equally likely to leave the working population when suffering from mental health problems, this should not bias the results.

In terms of policy recommendations, the findings suggest the job environment as a starting point to reduce work-related mental health problems. As these problems arise from an imbalance between job demands and job resources, reducing job demands and increasing job resources should be a promising but also difficult approach. Most demands and resources arise at a higher organizational level, e.g. hierarchy in a company. They can thus not be tackled on an individual level. Controversially, most burnout interventions focus on the individual. These interventions might still have some effect if they change individual stress perception. Nevertheless, the results presented here emphasize the need to consider environmental job factors in order to reduce work-related mental health problems. Prevention strategies, e.g. coping with high job demands, should specifically address higher educated employees who face more job demands and feel stressed by this.

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Tables

Table A.1: Descriptive statistics

| | mean | sd | min | max |
|-----------------------------------------------------------|--------|--------|------|---------|
| combined | 0.0 | 1.0 | -1.2 | 2.9 |
| emotional strain | 0.0 | 1.0 | -1.3 | 1.7 |
| emotional exhaustion | -0.0 | 1.0 | -0.5 | 3.0 |
| burnout | 0.0 | 1.0 | -0.3 | 5.3 |
| low education | 0.1 | 0.3 | 0.0 | 1.0 |
| medium education | 0.6 | 0.5 | 0.0 | 1.0 |
| medium+ education | 0.1 | 0.2 | 0.0 | 1.0 |
| higher education | 0.2 | 0.4 | 0.0 | 1.0 |
| years of education | 13.1 | 2.8 | 7.0 | 18.0 |
| age | 41.6 | 11.0 | 18.0 | 65.0 |
| men | 0.5 | 0.5 | 0.0 | 1.0 |
| deadline/performance pressure | -0.0 | 1.0 | -2.8 | 0.8 |
| reach limits of own capacity | 0.0 | 1.0 | -1.5 | 1.5 |
| do different things simultaneously | -0.0 | 1.0 | -2.6 | 0.7 |
| interrupted during work | -0.0 | 1.0 | -2.4 | 0.9 |
| overstrained | 0.2 | 0.4 | 0.0 | 1.0 |
| multitasking | -0.0 | 1.0 | -1.5 | 3.3 |
| no timely information about the future | -0.0 | 1.0 | -1.5 | 1.7 |
| working hours main job | 38.3 | 11.7 | 10.0 | 120.0 |
| details predetermined | -0.0 | 1.0 | -1.5 | 1.4 |
| repetition | -0.0 | 1.0 | -2.0 | 0.9 |
| risk of financial loss | -0.0 | 1.0 | -1.1 | 1.7 |
| do not receive all information necessary for correct work | -0.0 | 1.0 | -1.4 | 1.9 |
| work fast | 0.0 | 1.0 | -2.2 | 1.0 |
| minimum performance | 0.0 | 1.0 | -1.2 | 1.2 |
| plan/schedule own work | -0.0 | 1.0 | -2.7 | 0.6 |
| influence own workload | 0.0 | 1.0 | -1.4 | 1.1 |
| plan and schedule own breaks | 0.0 | 1.0 | -1.7 | 3.9 |
| good collaboration | -0.0 | 1.0 | -6.2 | 0.3 |
| feel as part of community | 0.0 | 1.0 | -4.0 | 0.4 |
| receive help from colleagues | -0.0 | 1.0 | -4.3 | 0.4 |
| receive help from supervisor | 0.0 | 1.0 | -2.6 | 0.7 |
| perform tasks independently | 0.7 | 0.5 | 0.0 | 1.0 |
| get familiar with tasks | 0.0 | 1.0 | -2.6 | 1.0 |
| improve methods | -0.0 | 1.0 | -2.2 | 1.2 |
| demanded unknown things | 0.0 | 1.0 | -1.2 | 1.9 |
| supervisor for somebody | 0.3 | 0.5 | 0.0 | 1.0 |
| married or registered partnership | 0.6 | 0.5 | 0.0 | 1.0 |
| having children | 0.6 | 0.5 | 0.0 | 1.0 |
| monthly income | 2602.9 | 1677.2 | 1.0 | 50000.0 |
| working hours main job | 38.3 | 11.7 | 10.0 | 120.0 |
| experience in years | 21.8 | 11.8 | 0.0 | 52.0 |
| high risk of layoff | 0.1 | 0.3 | 0.0 | 1.0 |
| work is important | 0.0 | 1.0 | -4.4 | 0.5 |

Table A.1 – continued on next page

Table A.1 – continued from previous page

| | | | | |
|------------------------------------------------------------------|-----|-----|------|-----|
| work life balance | 0.6 | 0.5 | 0.0 | 1.0 |
| perform tasks independently | 0.7 | 0.5 | 0.0 | 1.0 |
| atypical | 0.1 | 0.3 | 0.0 | 1.0 |
| night | 0.2 | 0.4 | 0.0 | 1.0 |
| shift | 0.2 | 0.4 | 0.0 | 1.0 |
| weekend | 0.7 | 0.5 | 0.0 | 1.0 |
| standby | 0.2 | 0.4 | 0.0 | 1.0 |
| A-C: Agriculture, fishery & mining | 0.0 | 0.1 | 0.0 | 1.0 |
| E: Energy & water supply | 0.0 | 0.1 | 0.0 | 1.0 |
| F: Construction | 0.1 | 0.2 | 0.0 | 1.0 |
| G&H: Commerce and hotels | 0.1 | 0.3 | 0.0 | 1.0 |
| I: Transport | 0.1 | 0.2 | 0.0 | 1.0 |
| J: Finance | 0.0 | 0.2 | 0.0 | 1.0 |
| K: Real estate etc. | 0.1 | 0.3 | 0.0 | 1.0 |
| L&Q: Public administration | 0.1 | 0.3 | 0.0 | 1.0 |
| M-P: Public & private services | 0.2 | 0.4 | 0.0 | 1.0 |
| not elsewhere allocated | 0.0 | 0.1 | 0.0 | 1.0 |
| mild strain (binary) | 0.1 | 0.3 | 0.0 | 1.0 |
| strain (binary) | 0.0 | 0.0 | 0.0 | 0.0 |
| exhaustion (binary) | 0.2 | 0.4 | 0.0 | 1.0 |
| burnout (binary) | 0.1 | 0.3 | 0.0 | 1.0 |
| depression | 0.0 | 0.2 | 0.0 | 1.0 |
| night-time sleeping disorder | 0.2 | 0.4 | 0.0 | 1.0 |
| general tiredness | 0.4 | 0.5 | 0.0 | 1.0 |
| nervousness or irritability | 0.3 | 0.4 | 0.0 | 1.0 |
| blues | 0.2 | 0.4 | 0.0 | 1.0 |
| mental health problem | 0.5 | 0.5 | 0.0 | 1.0 |
| physical health problem | 0.7 | 0.5 | 0.0 | 1.0 |
| bad health | 0.1 | 0.3 | 0.0 | 1.0 |
| stressful: deadline/performance pressure | 0.6 | 0.5 | 0.0 | 1.0 |
| stressful: reach limits of own capacity | 0.6 | 0.5 | 0.0 | 1.0 |
| stressful: different things simultaneously | 0.3 | 0.4 | 0.0 | 1.0 |
| stressful: interrupted during work | 0.5 | 0.5 | 0.0 | 1.0 |
| stressful: no timely info abt future | 0.6 | 0.5 | 0.0 | 1.0 |
| stressful: details predetermined | 0.3 | 0.4 | 0.0 | 1.0 |
| stressful: repetition | 0.1 | 0.3 | 0.0 | 1.0 |
| stressful: financial loss | 0.4 | 0.5 | 0.0 | 1.0 |
| stressful: don't receive all info for necessary for correct work | 0.7 | 0.4 | 0.0 | 1.0 |
| stressful: work fast | 0.4 | 0.5 | 0.0 | 1.0 |
| stressful: minimum performance | 0.4 | 0.5 | 0.0 | 1.0 |
| stressful: plan, schedule own work | 0.1 | 0.3 | 0.0 | 1.0 |
| stressful: influence own workload | 0.2 | 0.4 | 0.0 | 1.0 |
| stressful: decide when to break | 0.2 | 0.4 | 0.0 | 1.0 |
| stressful: good collaboration | 0.5 | 0.5 | 0.0 | 1.0 |
| stressful: feel as part of community | 0.3 | 0.4 | 0.0 | 1.0 |
| stressful: receive help, support from colleagues | 0.4 | 0.5 | 0.0 | 1.0 |
| stressful: receive help, support from supervisor | 0.4 | 0.5 | 0.0 | 1.0 |
| stressful: think through, get familiar w/ tasks | 0.1 | 0.3 | 0.0 | 1.0 |
| stressful: demanded unknown things | 0.4 | 0.5 | 0.0 | 1.0 |
| overall job satisfaction | 0.0 | 1.0 | -3.7 | 1.4 |
| satisfaction with income | 0.0 | 1.0 | -2.3 | 1.6 |

Table A.1 – continued on next page

Table A.1 – continued from previous page

| | | | | |
|-----------------------------------------------|------|-----|------|-----|
| satisfaction with tasks | -0.0 | 1.0 | -3.7 | 1.4 |
| satisfaction with application of skills | 0.0 | 1.0 | -3.2 | 1.3 |
| satisfaction with further training | 0.0 | 1.0 | -2.4 | 1.5 |
| satisfaction with physical working conditions | 0.0 | 1.0 | -3.0 | 1.5 |
| satisfaction with career opportunities | 0.0 | 1.0 | -2.0 | 1.8 |
| satisfaction with working atmosphere | -0.0 | 1.0 | -2.9 | 1.1 |
| satisfaction with supervisor | 0.0 | 1.0 | -2.8 | 1.2 |
| satisfaction with work equipment | 0.0 | 1.0 | -2.8 | 1.5 |
| satisfaction with hours | -0.0 | 1.0 | -2.7 | 1.5 |
| log of hourly income | 2.7 | 0.5 | -5.3 | 5.7 |
| work life balance | 0.6 | 0.5 | 0.0 | 1.0 |
| dream job | 0.8 | 0.4 | 0.0 | 1.0 |
| work is important | 0.0 | 1.0 | -4.4 | 0.5 |
| high risk of layoff | 0.1 | 0.3 | 0.0 | 1.0 |
| atypical | 0.1 | 0.3 | 0.0 | 1.0 |
| night | 0.2 | 0.4 | 0.0 | 1.0 |
| shift | 0.2 | 0.4 | 0.0 | 1.0 |
| weekend | 0.7 | 0.5 | 0.0 | 1.0 |
| standby | 0.2 | 0.4 | 0.0 | 1.0 |

Weighted according to census data. Data sources: BIBB/BAuA.

Table A.2: Model specifications

| sparse model | full model | | |
|------------------|------------------------------------------|-------------------|------------------------------|
| | job demands and resources | sociodemographics | job characteristics |
| education | job demands | having a partner | experience |
| low | reach limits of own capacity | having children | feel work is important |
| medium plus | interrupted during work | income | successful work life balance |
| higher | deadline/performance pressure | | atypical work |
| (base: medium) | work fast | | night work |
| | minimum performance | | shift work |
| age | overstrained | | work on weekends |
| gender | risk of financial loss | | standby duty |
| survey dummy | no timely information about future | | |
| | do not receive all necessary information | | |
| | details predetermined | | |
| | repetition | | |
| | multitasking | | |
| | working hours | | |
| | job resources | | |
| | plan/schedule own work | | |
| | influence own workload | | |
| | decide when to break | | |
| | good collaboration | | |
| | feel as part of community | | |
| | get help from colleagues | | |
| | get help from supervisor | | |
| | perform tasks independently | | |
| | ambiguous factors | | |
| | supervisor for somebody | | |
| | get familiar with tasks | | |
| | improve methods | | |
| | demanding unknown things | | |

Own table.

Table A.3: OLS estimates for work-related mental health outcomes – occupation controls

| | combined | | strain | | exhaustion | | burnout | |
|------------------|----------------------|----------------------|----------------------|---------------------|----------------------|----------------------|----------------------|-------------------|
| | (1) | (2) | (1) | (2) | (1) | (2) | (1) | (2) |
| low education | -0.159*** (0.037) | -0.068** (0.033) | -0.174*** (0.038) | -0.077** (0.035) | -0.032 (0.042) | -0.004 (0.040) | -0.060 (0.062) | -0.042 (0.061) |
| medium plus | 0.182*** (0.032) | 0.105*** (0.028) | 0.180*** (0.031) | 0.097*** (0.028) | 0.077* (0.043) | 0.054 (0.040) | 0.021 (0.058) | 0.020 (0.056) |
| higher education | 0.170*** (0.024) | 0.108*** (0.023) | 0.180*** (0.023) | 0.105*** (0.023) | 0.050 (0.035) | 0.045 (0.037) | 0.039 (0.039) | 0.058 (0.042) |
| constant | 0.059 (0.037) | -0.221*** (0.075) | -0.864* (0.502) | -0.557 (0.386) | -0.578*** (0.042) | -1.157*** (0.110) | -0.373*** (0.082) | -0.051 (0.152) |
| N | 18418 | 18418 | 18441 | 18441 | 12532 | 12532 | 5892 | 5892 |
| Adj. R^2 | 0.107 | 0.326 | 0.121 | 0.302 | 0.039 | 0.169 | 0.008 | 0.083 |

Standardized dependent variable given in column header. Combined: emotional exhaustion, burnout and/or emotional strain. Model specifications: (1) full model according to table A.2 and industry dummies, (2) full model and occupation dummies. Standard errors in parentheses. Significance levels * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Data sources: BIBB/BAuA. Own calculations.

Table A.4: OLS estimates for work-related mental health outcomes – one-digit occupation controls

| | combined | | strain | | exhaustion | | burnout | |
|------------------|----------------------|----------------------|----------------------|----------------------|----------------------|---------------------|-------------------|-------------------|
| | (1) | (2) | (1) | (2) | (1) | (2) | (1) | (2) |
| low education | -0.183*** (0.037) | -0.080** (0.034) | -0.204*** (0.038) | -0.092*** (0.035) | -0.037 (0.041) | -0.005 (0.040) | -0.032 (0.060) | -0.013 (0.058) |
| medium plus | 0.205*** (0.032) | 0.110*** (0.027) | 0.201*** (0.031) | 0.097*** (0.028) | 0.101** (0.042) | 0.067* (0.039) | 0.044 (0.057) | 0.045 (0.055) |
| higher education | 0.167*** (0.021) | 0.083*** (0.022) | 0.173*** (0.021) | 0.077*** (0.022) | 0.067** (0.029) | 0.043 (0.034) | 0.026 (0.036) | 0.064 (0.040) |
| constant | -0.341*** (0.042) | -0.288*** (0.071) | -0.247*** (0.042) | -0.206*** (0.071) | -0.174*** (0.047) | -0.199** (0.088) | -0.013 (0.062) | 0.217* (0.132) |
| N | 18418 | 18418 | 18441 | 18441 | 12532 | 12532 | 5892 | 5892 |
| Adj. R^2 | 0.083 | 0.311 | 0.095 | 0.285 | 0.027 | 0.160 | 0.002 | 0.081 |

Standardized dependent variable given in column header. Combined: emotional exhaustion, burnout and/or emotional strain. Model specifications: (1) full model according to table A.2 and industry dummies, (2) full model and occupation dummies. Standard errors in parentheses. Significance levels * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Data sources: BIBB/BAuA. Own calculations.

Table A.5: OLS estimates for work-related mental health outcomes – industry controls

| | combined | | strain | | exhaustion | | burnout | |
|------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|-------------------|
| | (1) | (2) | (1) | (2) | (1) | (2) | (1) | (2) |
| low education | -0.209*** (0.036) | -0.075** (0.033) | -0.230*** (0.037) | -0.087** (0.035) | -0.057 (0.042) | -0.016 (0.041) | -0.034 (0.052) | -0.009 (0.050) |
| medium plus | 0.197*** (0.031) | 0.106*** (0.027) | 0.197*** (0.030) | 0.096*** (0.027) | 0.100** (0.042) | 0.074* (0.039) | 0.028 (0.050) | 0.026 (0.048) |
| higher education | 0.216*** (0.020) | 0.096*** (0.021) | 0.222*** (0.019) | 0.089*** (0.021) | 0.092*** (0.028) | 0.059* (0.035) | 0.057* (0.031) | 0.051 (0.036) |
| constant | -0.419*** (0.040) | -0.540*** (0.067) | -0.316*** (0.040) | -0.461*** (0.068) | -0.186*** (0.050) | -0.268*** (0.091) | -0.163*** (0.053) | -0.052 (0.109) |
| N | 19651 | 19651 | 19674 | 19674 | 12135 | 12135 | 7522 | 7522 |
| Adj. R^2 | 0.085 | 0.312 | 0.100 | 0.289 | 0.023 | 0.157 | 0.004 | 0.086 |

Standardized dependent variable given in column header. Combined: emotional exhaustion, burnout and/or emotional strain. Model specifications: (1) full model according to table A.2 and industry dummies, (2) full model and occupation dummies. Standard errors in parentheses. Significance levels * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Data sources: BIBB/BAuA. Own calculations.