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Cohort Profile

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Cohort profile: The lidA Cohort Study—a German Cohort Study on Work, Age, Health and Work Participation

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Abstract

The lidA Cohort Study (German Cohort Study on Work, Age, Health and Work Participation) was set up to investigate and follow the effects of work and work context on the physical and psychological health of the ageing workforce in Germany and subsequently on work participation. Cohort participants are initially employed people subject to social security contributions and born in either 1959 ($n = 2909$) or 1965 ($n = 3676$). They were personally interviewed in their homes in 2011 and will be visited every 3 years. Data collection comprises socio-demographic data, work and private exposures, work ability, work and work participation attitudes, health, health-related behaviour, personality and attitudinal indicators. Employment biographies are assessed using register data. Subjective health reports and physical strength measures are complemented by health insurance claims data, where permission was given. A conceptual framework has been developed for the lidA Cohort Study within which three confirmatory sub-models assess the interdependencies of work and health considering age, gender and socioeconomic status. The first set of the data will be available to the scientific community by 2015. Access will be given by the Research Data Centre of the German Federal Employment Agency at the Institute for Employment Research (http://fdz.iab.de/en.aspx).

Key words: Older workers, working conditions, health, retirement, cohort

Key Messages

- The lidA Cohort Study is the first representative prospective study in Germany focusing on the investigation of the influence of work and work environment on health and labour market participation of older employees.
- The application of Schaie's 'Most Efficient Design' allows for a tri-factor model that isolates the impact of age, cohort and time when investigating the influence of work on health and work participation.
- The data linkage of (i) individual survey data, (ii) employment register data and (iii) health insurance claims data at the national level represents a new methodological approach in Germany.
- Findings suggest cohort differences in the work-health association between two middle-aged groups 6 years of age apart: the association between (low) education and the (higher) risk for depression observed in the younger cohort was absent in the older cohort. Whether this difference in association may be explained by an ageing effect, by a selection process or by intrinsic differences between the two cohorts can be clarified when longitudinal data are available.

Why was the cohort set up?

Current changes in working life reflect the effects of globalized economies and of rapid advancements in information and communication technologies, developments that contribute to increasing work intensity, greater flexibility in working time and work arrangements, more interpersonal work and increasing rates of change.[1,2] Simultaneously, future working life will be characterized by an ageing work force because demographic changes will increasingly prohibit the early exit of labour. For two reasons, Germany is particularly affected: first, until 2050 Germany will continue to exhibit the highest old-age dependency ratio in the European Union (EU).[3] The old-age dependency ratio is the projected number of people aged 65+ years, expressed as percentage of the projected number of people aged between 15 and 64 years. Second, the number of people available to the labour market ('labour force potential') in Germany has now reached its maximum of 45 million people and is estimated to—from now onwards—decrease linearly to 41.3 million in 2025 and 32.7 million in 2050 (estimates by Fuchs 2013[4] taking into account a net in-migration of 100 000 people per annum). Accompanying this downward trend, estimates show that the German economy will continue to need the current number of about 40 million people for many years to come.[4]

The impact of the anticipated work and labour force changes on the health of the future older workforce remains unknown. Yet, the health of the older working population is regarded as vital for the future socioeconomic development of ageing European countries.[5]

Older workers are different from younger workers as a group. They may be assumed to be more physically vulnerable; the natural direction of health in response to ageing and the consequences of long-term exposure to working conditions may increasingly become visible and influence work and labour market participation.[6] In most scientific publications on work and health, neither age-specific work exposure nor age-specific vulnerability has been considered, and 'age' has merely been regarded as a confounder to be adjusted for (see the discussion in de Lange *et al.*[7]). Few socio-epidemiological investigations have considered the notion that the association between 'work' and 'health' may different between younger workers and older workers;[6] the same holds true for labour market studies (cf. de Lange *et al.*[7] and Zoer *et al.*,[8] as examples of empirical studies on the age-specific effect of social support).

As the workforce ages, the health of older workers will attract increasing societal attention. The concept of 'work ability' will become increasingly relevant; for example, being able to cope with functional limitations and disability at work.[9] Finally, the individual's 'willingness to work' will be a key concept to be considered for ensuring the work participation and productivity of older workers.[10]

The employment dynamic of an ageing population will be a key issue in future political debates. Policy makers, the economy and the public need a reliable knowledge base concerning working conditions, the framework within which work is performed and the effects on both physical and psychological health of the ageing workforce, on work ability, willingness to work and, finally, on work participation. Scientific investigation of this subject has high methodological demands. To detect and interpret developments, the effects of age, cohort (year of birth) and time of measurement (period) need to be distinguishable. For this reason, we set up the prospective lidA Cohort Study (German Cohort Study on Work, Age, Health and Work Participation, www.lida-studie.de), with the overall aim of assessing the interdependencies of work, health and work participation in the ageing working population, while work and society are experiencing profound changes. Using Schaie's 'Most Efficient Design',[11] (see below) we are able to distinguish between age, cohort and time (period) effects.

lidA was established in 2009 by researchers at the German Universities of Wuppertal, Magdeburg and Ulm, the Institute for Employment Research (IAB, Nuremberg) and the Institute for Applied Social Sciences (infas, Bonn). The study group reflects an interdisciplinary research collaboration between the fields of occupational health, sociology, psychology, economics and epidemiology. The study consortium was joined by the German Federal Institute for Occupational Safety and Health (BAuA), as an associated partner in 2011.

The survey comprises a computer-assisted personal interview (CAPI) covering work, work history, individual factors and health, assessed by both self-report and by collecting objective health data. The survey data are linked with register data from the Federal Employment Agency (i.e. employment history records) and individuals' health insurance claims data (both if written consent was obtained).

The underlying theoretical framework of the lidA Cohort Study is to understand employment participation of older workers as the result of complex associations between work, socioeconomic status and lifestyle, and the interactions of these factors with health. According to the framework developed, two mediating factors that determine work participation are 'motivation to work' and 'work ability'.[10]

Three initial confirmatory sub-models were conceptualized. The first sub-model investigates whether labour market status is associated with depressive symptoms among middle-aged German employees and whether this association is explained by working conditions, family status or previous labour market experience. The effect of socioeconomic status on health among ageing workers and potential mediators and moderators of this association (e.g. work and non-work factors) will be estimated using the second sub-model. In a third sub-model, gender-specific aspects of ageing at work will be analysed. In all models, age-dependent differences in associations are treated as being of specific interest. Additional exploratory models and hypotheses will be conceptualized and investigated.

Who is in the cohort?

All participants are employees subject to social security contributions and born in either 1959 or 1965. The cohorts are currently on the threshold of older working age, constituting part of the German 'baby boom' generation, and thus represent substantial parts of the workforce in the coming decade;[12] these cohorts have substantially less access to early retirement schemes than older age groups and have been shown to differ with respect to labour market conditions when entering working life.[12] A 6-year age difference between cohorts was chosen as it has been found to result in cohort effects in terms of differential health status (both subjective health and number of conditions) in the longitudinal German Ageing Survey, starting with age groups 40–45 years of life.[13] Follow-up studies of the initial 2011 investigation will occur at 3-year intervals for at least three waves of assessment (Figure 1). In 2017 (second funding period), a third cohort of people born in 1971 may be added.

The study design utilized in lidA is known as Schaie's 'Most Efficient Design'.[11] It combines sequences of cross-sectional and longitudinal studies in a systematic way. Individuals from selected cohorts (here the birth years 1959 and 1965, Figure 1) are sampled at Time 1. As Schaie and Caskie[11] stated: 'At Time 2, previous participants from the Time 1 data collection are retrieved and restudied, providing short-term longitudinal studies of as many cohorts as there were age intervals at Time 1. The whole process can be repeated multiple times with retesting of previous subjects (adding to the longitudinal data) and initial testing of new samples (adding to the cross-sectional data)'. The design enables the application

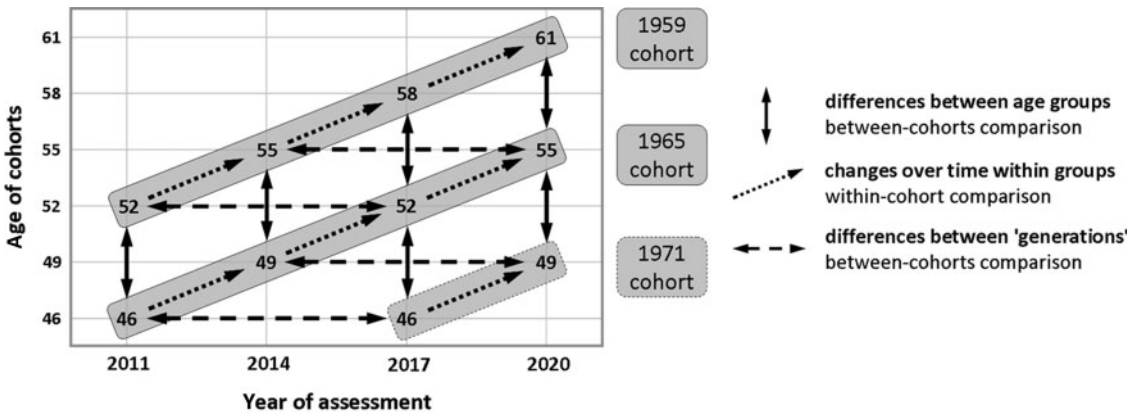

Figure 1. Cohort design of the lidA Cohort Study (1971 cohort not included in the first funding period).

of cohort-sequential, cross-sequential and time-sequential analyses to distinguish the impact of the factors of age, cohort and time (period) in the ageing process with a tri-factor model.[11] When factors which could trigger the decision for retirement are investigated, lidA's design allows for conducting analyses not only between several age cohorts at the same time (e.g. age differences in health or work motivation) but also within a single cohort over time (e.g. changes in health or work motivation within an age cohort across time). Furthermore, 'generation' effects on health and work motivation can be explored by comparing different cohorts at the same age at different points of time (Figure 1).

The study sample was drawn from the 'Integrated Employment Biographies' (IEB) dataset, held at the IAB.[14] This dataset includes all employees in Germany subject to social security. This excludes civil servants and the self-employed, whose employment is not subject to social security and who thus do not belong to the study population. According to the German Microcensus,[15] the IEB dataset covers more than 80% of the German working population.

The final dataset of wave 1 comprises personal interviews with 6585 respondents. The survey data of 74.7% of all respondents (all those who have provided respective written informed consent) was linked to the IEB data and to the Establishment History Panel (BHP) at IAB. This opens up the possibility of tracing the participant's entire employment biography and information about the respondent's employer from 1975 to the present and beyond. In addition, 55.2% of the participants provided informed consent to link individual health insurance data. It is, therefore, possible to supplement the health-related self-report survey data with objective observations on morbidity and its related endpoints. This individual data linkage of survey and health data represents a new and thus far unique methodical approach at the national level in Germany;[16,17] the rarity of this approach is most likely due to the sophisticated legal, organizational and technical requirements.[18]

Sampling process

A two-stage random sample was drawn from the IEB registry. At the first stage, 222 municipalities were drawn with probabilities proportional to size (i.e. the number of persons who are employed in a job that is subject to social security notifications in the selected cohorts on the reference date for sampling, 31 December 2009).[19,20] This selection was proportionately stratified by state and municipal size to reduce sampling variance. At the second stage, a simple random sample of all employees born in 1959 or 1965 and subject to social security contributions was drawn for each sample point. The result is a self-weighting sample which allows for depicting a proportional and representative image of the population (see Lohr[21]).

The IEB is an unusually rich sampling frame that enables comparison of sample information at every stage of the draw to the target population with respect to numerous structural characteristics.

Recruitment process/field phase

Infas conducted the main survey from March to October 2011.[22] The sample size was based on power calculations considering multilevel design, anticipated loss to follow-up and multiple testing. The younger cohort was oversampled to compensate for future loss-to follow-up. In the first wave of the study, 6585 interviews were conducted among: Cohort 1 (born in 1959), 2909 people (44%); and Cohort 2 (born in 1965), 3676 people (56%).

The response rate was 27.3% and the cooperation rate was 32.6% (RR5/COOP3 according to the American Association for Public Opinion Research (AAPOR) standards[23]); 55.6% of the sample refused to participate in the survey. For the remaining 17%, no interview could be conducted for various reasons (such as illness, scheduling problems or relocation).[22] This outcome is consistent with the observed decline in willingness to participate in surveys in Germany.[24,25] However, the response rate is acceptable because the representativeness of the sample was found to be very high. A comparison between the population and the realized sample shows for both cohorts only minor deviations on observed variables (Table 1). Also, multivariate selectivity analyses show that the net sample bias with respect to socioeconomic and socio-demographic variables available on the sampling frame is minimal (not shown).[22] While controlling for 16 known population parameters, the logistic regression model displays a Pseudo-R^2 of only .02. Only four dimensions showed some minor effects: slightly lower participation probabilities were found for (i) non-Germans, (ii) people born in 1965, (iii) people with low or intermediate school leaving certificate and without vocational training and (iv) people living in smaller cities or rural environments.[22] Also multivariate tests for selectivity of panel willingness and linkage consent show minor effects only: non-Germans and marginal workers were less willing to join the panel or to consent to data linkage (not shown).

At the time of interview, 246 out of the 6585 interviewees were no longer working. These cases do not belong to the baseline sample documentation presented here.

Table 1. Comparison of study base population (socially insured population of birth year[a]) with the realized sample

Characteristics	Study base and sample populations born in 1959 -proportions					Study base and sample populations born in 1965 -proportions				
	Study base population[a]	Realized sample[b]				Study base population[a]	Realized sample[b]			
		Sample	Standard error	Confidence interval (95%)			Sample	Standard error	Confidence interval (95%)	
Sex										
male	0.49	0.46	0.011	0.44	0.48	0.5	0.47	0.009	0.45	0.49
female	0.51	0.54	0.011	0.52	0.56	0.5	0.53	0.009	0.51	0.55
Region										
East Germany (incl. East-Berlin)	0.17	0.17	0.009	0.15	0.18	0.15	0.16	0.008	0.14	0.17
West Germany (incl. West-Berlin)	0.83	0.83	0.009	0.82	0.85	0.85	0.84	0.008	0.83	0.86
Educational level										
Elementary school for pupils aged 6 to 14, secondary modern school without professional education	0.1	0.08	0.006	0.07	0.09	0.08	0.06	0.004	0.05	0.07
Elementary school for pupils aged 6 to 14, secondary modern school with professional education	0.56	0.57	0.011	0.55	0.59	0.54	0.53	0.009	0.51	0.55
University entrance diploma without professional education	0.01	0.01	0.002	0	0.01	0.01	0.01	0.002	0.01	0.01
University entrance diploma with professional education	0.04	0.04	0.004	0.03	0.05	0.05	0.07	0.005	0.06	0.08
Technical college degree	0.04	0.04	0.004	0.03	0.05	0.04	0.05	0.004	0.04	0.06
University degree	0.06	0.07	0.005	0.06	0.08	0.06	0.07	0.004	0.06	0.08
Educational level unknown	0.21	0.19	0.008	0.18	0.21	0.22	0.21	0.008	0.2	0.23
Employment group										
Employed and being subject to social insurance contribution	0.86	0.87	0.007	0.86	0.89	0.86	0.87	0.006	0.86	0.88
Marginally employed	0.14	0.13	0.007	0.11	0.14	0.14	0.13	0.006	0.12	0.14
Employment										
Full time	0.67	0.65	0.01	0.63	0.67	0.68	0.65	0.009	0.64	0.67
Part time	0.33	0.34	0.01	0.32	0.36	0.32	0.34	0.009	0.33	0.36
Others, homemaker, trainee	0	0	0.001	0	0	0	0	0.001	0	0
Nationality										
German	0.95	0.97	0.003	0.97	0.98	0.94	0.95	0.004	0.95	0.96
Not German	0.05	0.03	0.003	0.02	0.03	0.06	0.05	0.004	0.04	0.05
Daily rate of pay										
Less than 50 €	0.32	0.3	0.01	0.28	0.32	0.32	0.3	0.009	0.29	0.32
50 up to less than 85 €	0.25	0.24	0.01	0.22	0.26	0.24	0.26	0.009	0.24	0.28
85 up to less than 120 €	0.22	0.23	0.009	0.21	0.25	0.22	0.21	0.007	0.2	0.23
120 € and more	0.22	0.23	0.009	0.21	0.25	0.23	0.22	0.008	0.21	0.24

(Continued)

Table 1. Continued

Characteristics	Study base and sample populations born in 1959 -proportions					Study base and sample populations born in 1965 -proportions				
	Study base population[a]	Realized sample[b]				Study base population[a]	Realized sample[b]			
		Sample	Standard error	Confidence interval (95%)			Sample	Standard error	Confidence interval (95%)	
Occupation										
Agricultural occupation	0.01	0.02	0.004	0.01	0.02	0.01	0.01	0.002	0.01	0.01
Simple manual occupation	0.12	0.09	0.007	0.08	0.1	0.12	0.1	0.006	0.09	0.11
Qualified manual occupation	0.11	0.1	0.007	0.09	0.12	0.11	0.1	0.006	0.09	0.11
Technician	0.05	0.05	0.004	0.04	0.06	0.05	0.07	0.005	0.06	0.08
Engineer	0.03	0.03	0.005	0.02	0.04	0.03	0.04	0.003	0.03	0.04
Simple services	0.18	0.15	0.007	0.13	0.16	0.16	0.14	0.006	0.13	0.15
Qualified services	0.05	0.05	0.004	0.04	0.06	0.05	0.05	0.004	0.04	0.06
Semi-professions	0.09	0.13	0.007	0.12	0.15	0.08	0.13	0.007	0.12	0.14
Professions	0.02	0.02	0.003	0.02	0.03	0.02	0.02	0.002	0.01	0.02
Simple commercial and administrative occupation	0.1	0.1	0.006	0.09	0.11	0.1	0.09	0.005	0.08	0.1
Qualified commercial and administrative occupation	0.2	0.21	0.009	0.2	0.23	0.22	0.22	0.008	0.21	0.24
Manager	0.03	0.04	0.004	0.03	0.04	0.03	0.03	0.003	0.02	0.04
Other status	0	0	0.001	0	0.01	0	0	0.001	0	0
Others, without answer, e.g. student, apprentice	0.01					0.01	0	0.001	0	0.01
N	805 997	2871				920 527	3629			

[a]IAB, Beschäftigtenhistorik (BeH, IAB employment history data set); Reference date for sampling: 31 December 2009.

[b]Interviews, weighted for inverse selection probability; data from 85 participants not included in analysis because of missing variable information in the BeH study sample dataset.

How often will the participants be followed up?

A follow-up assessment of the survey will take place in 2014. A second funding period is expected to cover follow-up assessments in 2017 and 2020 and may include an additional 1971 cohort. Future IEB and individual health insurance data will be linked subsequently to the survey data. Due to strict German data protection rules, we will only be able to follow up the 85.2% of wave 1 respondents who have provided written consent to store their address. The lidA Cohort Study implements a dual strategy to counter any biasing effects of attrition. We aim to minimize attrition by paying a cash incentive of €10 per respondent per wave and by implementing a thorough panel maintenance including regular contact with respondents between waves (e.g. through study brochures) and by searching for addresses in miscellaneous directories. We will also adjust for bias using propensity-weighting models.[26] This will enable us not only to use information from the previous wave interview and fieldwork together with information from the subsequent wave fieldwork, but also to use the register data from the sampling frame that remain available for the entire wave 1 gross sample over the period of the study. Register data as well as non-response follow-ups with short questionnaires will be used to additionally enable detailed research on non-responses and to correct for attrition that is related to events between waves (e.g. to health deterioration[27]).

What has been measured?

Box 1 specifies the measurements included in the first wave, which comprised demographic and socioeconomic data, work history, work and private exposures, work ability, work attitudes, work participation attitudes, subjective and objective health, health-related behaviour, personality and attitudinal indicators. The employment biographies are assessed using register data.

An explicit basic assumption of this study is that the use of information from different data sources is a timely and quality-enhancing approach to assessing work, age, health and work participation. A second assumption is that the assessment of work exposures and attitudes towards work and work participation is crucial.

Although acknowledging the high validity of many subjective health indicators, the third explicit assumption is that health should not be measured by self-report alone, to avoid measurement bias. This has led to the inclusion of health insurance claims data (see above).

Finally, the lidA Cohort Study attempted to achieve good internal validity and international comparability by including as many internationally used, well-tested and valid instruments and indicators as possible.

What was found in the study? Key findings and publications

A sample overview exemplifying some of the exposure and outcome data between the cohorts is shown in Table 2. Notable differences between the 1959 and 1965 cohorts are observed for socio-demographic variables (e.g., education and nationality) and in the expected direction for health outcomes such as physical health and hand-grip strength. Apart from the mean variable differences between the two cohorts, it is of specific interest whether associations between exposure and outcome differ between the cohorts. One analysis example will be used to elucidate this.

Within Germany, work stress is currently reported by employees at least as often as adverse physical work exposure.[35] Earlier investigations have shown associations between work stress and certain physical and mental health indicators, such as symptoms and risk factors for coronary heart disease[36,37] and depression.[38] In Germany, depression is a leading reason for disability-related early retirement.[39] Thus far, the association between work stress as measured using the effort-reward imbalance (ERI) model[28] and depression has been shown mainly for health professionals.[40–42] In contrast, lidA allows investigation of ERI and depression (Beck Depression Inventory-V, BDI-V) in a general working population and in relation to age.[43,44] Our baseline data analyses confirm a strong association between ERI and depression and an even more pronounced association in the younger than in the older age group (Table 3). Our data suggest that variations in the association between work stress and depression can be observed between two middle-aged groups 6 years apart, regardless of the covariate adjustment and missing data treatment used. The cohort difference found in the association between (low) education and the (higher) risk for depression is striking: a higher risk for depression was observed for the younger cohort with low educational status [risk ratio (RR) = 1.56, 95% confidence interval (CI) 1.12-2.18] but was absent for the older cohort (Table 3). However, we cannot say whether the cohort differences are related to ageing effects, cohort effects or to selection processes such as the healthy worker effect. Disentangling this is important when determining preventive action. In the long term, the lidA cohort design will allow investigation of these effects and thereby contribute new knowledge that is relevant for work, health and work participation in ageing societies.

Box 1. Summary of measurements collected during the baseline assessment

Demographic data

Computer-assisted personal interview (CAPI)

- Sex
- Family status
- Nationality

Health insurance data

- Age
- Sex
- Zip-code
- Insuree's status and length of time with insurance

Socioeconomic data

Computer-assisted personal interview (CAPI)

- Education
- Household composition
- Income
- Profession

Data from the Federal Employment Agency (Integrated Employment Biographies, IEB)

- Employment and unemployment biography
- Employment changes
- Unemployment, job seeking
- Participation in employment and training measures
- Daily wage, occupation, education and job characteristics

Health insurance data

- Job title
- Education
- Employer's branch of industry

Employer information

Data from the Federal Employment Agency (Establishment History Panel, BHP)

- Size of enterprise
- Employer's branch of industry
- Distribution of employees by gender, age, educational and vocational qualification and wage structure of full-time employees
- Turnover by sub-groups

Area-level indicators

Data from the Federal Employment Agency (aggregated data)

- Regional unemployment rate
- Regional comparison types

Psychosocial work environment

Computer-assisted personal interview (CAPI)

- Efforts, rewards (Effort-Reward Imbalance questionnaire, ERI)[28]
- Demand, control, influence, possibilities for development (COPSOQ)[29]
- Support, quality of leadership, social network (COPSOQ)[29]
- Organisational change, job insecurity (COPSOQ)[29]
- Age discrimination, harassment and working hours

Physical work exposure

Computer-assisted personal interview (CAPI)

- Standing, sitting, kneeling, lying, overhead lifting, carrying
- Cold, heat, moisture, dampness, draughts, noise, stooping and squatting

Individual work and non-work factors

Computer-assisted personal interview (CAPI)

- Work ability (Work Ability Index item 2, WAI)[30]
- (Over)commitment (Effort-Reward Imbalance questionnaire, ERI)[28]
- Work motivation and meaning of work (Job Diagnostic Survey, JDS)[31]
- Intent to leave (employer, profession or work)
- Relevance of status maintenance (loss-work trade-off)

(Continued)

Box 1. Continued

Health-related behaviour

Computer-assisted personal interview (CAPI)

- Smoking
- Physical activities during leisure time

Other exposure

Computer-assisted personal interview (CAPI)

- Household liabilities
- Household chores

Biometric information

Computer-assisted personal interview (CAPI)

- Height and weight

Health and morbidity data

Computer-assisted personal interview (CAPI)

- Self-rated health (Short Form-12 Health Survey, SF-12)[32]
- Functional ability
- Health promotion activities and rehabilitation
- Depression (Beck Depression Inventory-V, BDI-V,[33] paper & pencil drop-off questionnaire)
- List of disease groups
- Pain (Nordic Musculoskeletal Questionnaire)[34]
- Sleep quality
- Sickness absence
- Objective indicator: hand grip strength

Health insurance data

- Outpatient and inpatient treatments (OPS and DRG coded)
- Medical diagnoses (inpatient and outpatient, ICD coded)
- Sickness absence (spells and days/year)
- Outpatient drug prescription (ATC coded)
- Treatments/remedies received

ATC, Anatomic Therapeutical Chemical classification system; DRG, Diagnosed Related Groups; ICD, International Classification of Diseases; OPS, Operationen- und Prozeduren-Schlüssel (German adaption of the International Classification of Procedures in Medicine, ICPM).

What are the main strengths and weaknesses?

A major strength of the lidA Cohort Study is that it applies a challenging design to overcome the traditional measurement and conceptual limitations in work and health research. This study has the aim—in consistency with other longitudinal but not age cohort studies in this field, such as ELSA in the UK,[46] SLOSH in Sweden[47] and LASA[48] and STREAM[49] in The Netherlands—to contribute new research findings on work, age, health and work participation, and also to add methodological implications for this research field. Another strength of this study is the interdisciplinary research cooperation, which combines work epidemiology and labour market research with a broad conceptual approach.

This study is characterized by high external validity for a large part of the German working population in the two age groups under study, achieved using a two-stage random sampling process. The availability of the basic sample allows the assessment of selectivity.

Yet another strength is the careful power analysis that considered variation between and within different regions according to associations between work stress and health-related outcomes. We most likely have sufficient power to detect associations in hierarchical and other complex models.

The high internal validity of the measures, the combination of different subjective and objective data sources (data linkage at individual level) and hypothesis-based confirmatory testing are further strengths of the present investigation.

Potential weaknesses of our study include the limited generalizability of the study data because it includes only two age cohorts and excludes the self-employed and civil servants. Our response rate was relatively low, as is typical for German surveys. Nevertheless, the comparison of our sample with the excellent register data available for selectivity analysis and non-response correction indicates almost no selection bias with respect to the 16 socio-demographic observables. In addition, no indication of selection by incomplete individual data linkage was observed.

Table 2. Characteristics of the lidA Cohort Study cohort at baseline[a]

Variables		Birth cohort 1959		Birth cohort 1965		Tests of significance	
		n (%)		*n* (%)		1959 vs 1965	
		Males	Females	Males	Females	Males	Females
		1286 (46.2 %)	1499 (53.8 %)	1685 (47.4 %)	1869 (52.6 %)		
Sociodemographic variables							
Highest school-leaving qualification	without graduation	§)	§)	§)	§)	9.72	30.76
	low graduation	427 (33.2 %)	356 (23.7 %)	490 (29.1 %)	320 (17.1 %)	χ^2	χ^2
	middle graduation	442 (34.4 %)	705 (47.0 %)	590 (35.0 %)	890 (47.6 %)	$P = 0.45$	$P < 0.001$
	high graduation	381 (29.6 %)	409 (27.3 %)	570 (33.8 %)	630 (33.7 %)		
	other	§)	§)	§)	§)		
	missing data	0	0	0	0		
Occupational status	unskilled/semiskilled worker	155 (12.1 %)	170 (11.3 %)	187 (11.1 %)	188 (10.1 %)	3.55	10.99
	skilled worker	242 (18.8 %)	24 (1.6 %)	301 (17.9 %)	50 (2.7 %)	χ^2	χ^2
	foreman / master craftsman	66 (5.1 %)	§)	78 (4.6 %)	§)	$P = 0.737$	$P = 0.090$
	employee without staff responsibilities	256 (19.9 %)	753 (50.2 %)	373 (22.1 %)	920 (49.2 %)		
	employee with staff responsibilities	524 (40.7 %)	503 (33.6 %)	702 (41.7 %)	634 (33.9 %)		
	official	§)	§)	§)	§)		
	self-employed person/freelancer	§)	§)	§)	37 (2.0 %)		
	other	§)	§)	§)	§)		
	missing data	§)	§)	§)	§)		
Nationality	German	1242 (96.6 %)	1459 (97.3 %)	1588 (94.2 %)	1784 (95.4 %)	9.43	7.84
	other	§)	40 (2.7 %)	97 (5.8 %)	§)	χ^2	χ^2
	missing data	§)	0	0	§)	$P = 0.002$	$P = 0.006$
Employment specific variables							
Weekly working hours	full time	1207 (93.9 %)	655 (43.7 %)	1597 (94.8 %)	790 (42.3 %)	1.67	2.47
	part time	47 (3.7 %)	670 (44.7 %)	57 (3.4 %)	882 (47.2 %)	χ^2	χ^2
	other	32 (2.5 %)	174 (11.6 %)	31 (1.8 %)	197 (10.5 %)	$P = 0.435$	$P = 0.291$
Years of employment with current employer	M (SD)	18.69 (10.90)	16.36 (10.53)	15.24 (8.86)	13.40 (8.80)	9.42	8.80
						t-statistics	t-statistics
						$P < 0.001$	$P < 0.001$
Personal net income	<1000 Euro	68 (5.3 %)	552 (36.8 %)	70 (4.2 %)	748 (40.0 %)	6.52	5.46
	1000–<2000 Euro	493 (38.3 %)	658 (43.9 %)	629 (37.3 %)	781 (41.8 %)	χ^2	χ^2
	2000–<3000 Euro	393 (30.6 %)	165 (11.0 %)	553 (32.8 %)	187 (10.0 %)	$P = 0.163$	$P = 0.244$
	3000–<4000 Euro	127 (9.9 %)	§)	187 (11.1 %)	§)		
	≥4000 Euro	131 (10.2 %)	§)	144 (8.5 %)	§)		
	missing data	74 (5.8 %)	92 (6.1 %)	102 (6.1 %)	101 (5.4 %)		

(Continued)

Table 2. Continued

Variables		Birth cohort 1959		Birth cohort 1965		Tests of significance	
		n (%)		*n* (%)		1959 vs 1965	
		Males	Females	Males	Females	Males	Females
Work exposure (selection)							
ERI (effort-reward imbalance)	M (SD)	0.56 (0.26)	0.57 (0.29)	0.58 (0.27)	0.57 (0.29)	−1.58	0.42
	missing data	235 (18.3 %)	348 (23.2 %)	279 (16.6 %)	430 (23.0 %)	t-statistic	t-statistic
						$P = 0.115$	$P = 0.671$
Over-commitment	M (SD)	13.20 (4.29)	13.65 (4.49)	13.36 (4.20)	13.29 (4.36)	−1.04	2.39
	missing data	§)	§)	§)	§)	t-statistic	t-statistic
						$P = 0.298$	$P = 0.017$
Primary health outcomes at baseline							
Subjective health status (SF-12)	very good/good/fair	1123 (87.3 %)	1251 (83.5 %)	1504 (89.2 %)	1639 (87.7 %)	2.82	12.27
	bad/ very bad	163 (12.7 %)	248 (16.5 %)	§)	230 (12.3 %)	χ^2	χ^2
	missing data	0	0	§)	0	$P = 0.105$	$P = 0.001$
Physical health (SF-12)	M (SD)	48.88 (9.11)	48.46 (9.54)	50.89 (8.71)	50.08 (8.98)	−6.08	−5.04
						t-statistic	t-statistic
						$P < 0.001$	$P < 0.001$
Mental health (SF-12)	M (SD)	52.74 (9.30)	51.01(10.26)	52.08(9.48)	50.84 (10.15)	1.88	0.50
						t-statistic	t-statistic
						$P = 0.060$	$P = 0.620$
Depression (BDI-V)	no clinically relevant depression (BDI-V <35)	987 (76.7 %)	1038 (69.2 %)	1298 (77.0 %)	1340 (71.7 %)	0.55	0.52
	clinically relevant depression (BDV-V ≥35)	109 (8.5 %)	219 (14.6 %)	158 (9.4 %)	263 (14.1 %)	χ^2	χ^2
	missing data	190 (14.8 %)	242 (16.1 %)	229 (13.6 %)	266 (14.2 %)	$P = 0.473$	$P = 0.481$
Grip strength, right hand	median (IQR)	49.0 (43.0–54.5)	29.5 (25.5–33.5)	50.0 (44.0–46.0)	31.5 (27.5–35.5)	$P = 0.018$	$P < 0.001$
	missing data	38 (3.0 %)	63 (4.2 %)	35 (2.1 %)	58 (3.1 %)	NP test	NP test
Grip strength, left hand	median (IQR)	46.0 (40.0–51.5)	27.0 (23.0–30.5)	47.5 (41.5–53.0)	29.0 (25.0–32.5)	$P < 0.001$	$P < 0.001$
	missing data	35 (2.7 %)	61 (4.1 %)	34 (2.0 %)	54 (2.8 %)	NP test	NP test
Employment attitudinal outcomes at baseline							
Considering leaving employer	never/several times a year	1111 (86.4 %)	1267 (84.5 %)	1406 (83.4 %)	1569 (83.9 %)	4.94	0.04, ns
	at least several times a month	§)	§)	§)	§)	χ^2	χ^2
	missing data	§)	§)	§)	§)	$P = 0.029$	$P = 0.847$
Considering leaving profession	never/several times a year	1162 (90.4 %)	1316 (87.8 %)	1473 (87.4 %)	1625 (86.9 %)	5.97	0.39, ns
	at least several times a month	§)	§)	§)	§)	χ^2	χ^2
	missing data	§)	§)	§)	§)	$P = 0.015$	$P = 0.565$
Considering leaving working	never/several times a year	1220 (94.9 %)	1428 (95.3 %)	1635 (97.0 %)	1808 (96.7 %)	9.12	5.56
	at least several times a month	§)	§)	§)	§)	χ^2	χ^2
	missing data	§)	§)	§)	§)	$P = 0.003$	$P = 0.023$

Tests of significance compare means/frequencies between the 1959 and 1965 cohorts separately for males and females. Tests of the frequencies were conducted using χ^2-tests; tests of the means were conducted using *t*-tests for independent samples. NP test indicates a nonparametric median test for independent samples.

M, arithmetic mean; SD, standard deviation; IQR, interquartile range; §, no data because less than 20 cases were available; ns, not significant.

[a]The database consists of $n = 6339$ employed persons (ILO-Definition); 246 not employed interviewees were excluded from further analysis (see text).

Table 3. Work stress[a] and depression[b] in employees belonging to two age cohorts (1959 and 1965) using different imputation methods; each variable was adjusted for all other variables

Birth year	1959 OR (95% CI)			1965 OR (95% CI)		
Respondents' characteristics	CC ($n = 1938$)	MIS ($n = 2384$)	MI ($n = 2785$)	CC ($n = 2540$)	MIS ($n = 3077$)	MI ($n = 3554$)
Work stress[a]						
Low	1.0	1.0	1.0	1.0	1.0	1.0
Middle	1.01 (0.67–1.52)	1.17 (0.81–1.70)	1.19 (0.79–1.77)	1.82 (1.21–2.75)	1.48 (1.03–2.12)	1.50 (1.01–2.22)
High	2.06 (1.38–3.07)	2.19 (1.53–3.13)	2.21 (1.53–3.17)	3.13 (2.08–4.70)	2.45 (1.72–3.50)	2.51 (1.77–3.55)
Gender						
Male	1.0	1.0	1.0	1.0	1.0	1.0
Female	1.64 (1.22–2.21)	1.63 (1.25–2.13)	1.65 (1.26–2.16)	1.70 (1.30–2.22)	1.67 (1.31–2.13)	1.61 (1.28–2.03)
Education[c]						
High	1.0	1.0	1.0	1.0	1.0	1.0
Middle	0.84 (0.60–1.18)	0.89 (0.65–1.20)	0.94 (0.70–1.26)	1.26 (0.93–1.70)	1.34 (1.02–1.76)	1.26 (0.96–1.67)
Low	0.92 (0.63–1.32)	0.95 (0.68–1.33)	1.03 (0.74–1.43)	1.55 (1.10–2.19)	1.58 (1.15–2.15)	1.56 (1.12–2.18)
Over-commitment	1.05 (1.01–1.09)	1.05 (1.02–1.09)	1.06 (1.03–1.10)	1.11 (1.07–1.15)	1.12 (1.08–1.15)	1.11 (1.07–1.14)
Negative affect[d]	1.41 (1.33–1.50)	1.43 (1.36–1.52)	1.43 (1.35–1.52)	1.44 (1.36–1.52)	1.48 (1.40–1.55)	1.47 (1.39–1.55)

CC, complete case analysis; MIS, mean imputation of scales; MI, MIS+multiple imputation of missing data with the MCMC (FCS)-algorithm; ERI, effort-reward imbalance; BDI-V, simplified Beck Depression Inventory; PANAS, Positive and Negative Affect Schedule; MCMC, Markov Chain Monte Carlo method; FCS, fully conditional specification (Raghunathan *et al.*[45]).

[a]Work stress as measured by effort-reward imbalance (ERI) tertiles.

[b]As measured by BDI-V.

[c]Education: high, higher secondary; middle, secondary; low, primary or less.

[d]As measured by PANAS.

Another limitation is the fact that only 55.2% of the participants provided consent to their interview data being linked to their individual health insurance data. As previously mentioned, this combination of nationwide CAPI with individual health insurance data is a new approach in Germany and our activities may be regarded as feasibility tests for this approach. Initial analysis does not indicate any relevant differences between consenters and non-consenters. Although the linkage rate may be too low to allow for representative data analysis—specific analyses of generalizability remain to be done—it may well be used for cross-validating self-reported health in the study. During the follow-up visits in 2014, those not consenting will again be asked for linkage permission to increase the permission rate.

Can I get hold of the data? Where can I find more information?

The survey data are expected to be available to the scientific community at the latest by 2015. For cooperation based on single research issues, the lidA Cohort Study can be contacted even before this (project coordinator: lidabuw@uni-wuppertal.de). Given that the use of health-related data is subject to German data protection legislation restrictions, the data presumably will only be available for analysis on site or via remote execution. Access will be given by the Research Data Centre of the German Federal Employment Agency at the IAB (FDZ, http://fdz.iab.de/en.aspx) for non-commercial empirical research via all sites of the FDZ in Germany and outside Germany (Ann Arbor, Berkeley, Cornell, Harvard and possibly at new sites such as Essex, Paris and Los Angeles).

Currently, scientific use of the health insurance claims data requires an individual contract with the data owner and permission from a data protection officer.[18,50]

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