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**Working Paper**

## Health at work: Indicators and determinants. A revised literature and data review for Germany

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# IAB-Discussion Paper

17/2010

Articles on labour market issues

## Health at Work – Indicators and Determinants

A Revised Literature and Data Review for Germany

Julia Schneider  
Miriam Beblo

# Health at Work – Indicators and Determinants

## A Revised Literature and Data Review for Germany

Julia Schneider (IAB, Institute for Employment Research)

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Mit der Reihe „IAB-Discussion Paper“ will das Forschungsinstitut der Bundesagentur für Arbeit den Dialog mit der externen Wissenschaft intensivieren. Durch die rasche Verbreitung von Forschungsergebnissen über das Internet soll noch vor Drucklegung Kritik angeregt und Qualität gesichert werden.

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## Abstract

In this paper, the current knowledge and issues regarding the economic impact of health at work in Germany is reviewed as a part of the EU project “An inquiry into health and safety at work: a European Union perspective” (acronym: HEALTHatWORK). After a description of the German institutional framework for occupational safety and health (OSH), it presents indicators of health and safety at work – such as sickness absences, occupational accidents and diseases, disability rents, working conditions, and OSH policy. The paper’s major contribution is a review of economic research on the determinants of OSH indicators in Germany, and a review of the data sets that have been or may be used. The aim is to identify the main issues addressed in the literature, the approaches adopted, the data analyzed, and the research gaps that still exist with respect to analyzing health at work in Germany.

## Zusammenfassung

Die vorliegende Studie bietet einen Überblick über den Forschungsstand zu Sicherheit und Gesundheitsschutz am Arbeitsplatz (occupational safety and health, OSH) in Deutschland und dient damit als Grundlage für den deutschen Beitrag zum EU Koordinationsprojekt “An inquiry into health and safety at work: a European Union perspective“. Nach einer Beschreibung der in Deutschland für OSH verantwortlichen Institutionen präsentiert die Studie das in Deutschland erreichte Arbeitsschutzniveau durch einschlägige Indikatoren – wie krankheitsbedingten Fehlzeiten, Berufsunfällen und -krankheiten, Erwerbsunfähigkeitsrenten, Arbeitsbedingungen und OSH-Strategien. Der Hauptbeitrag dieser Studie liegt in der Darstellung des aktuellen ökonomischen Forschungsstandes zu Determinanten von OSH-Indikatoren sowie der verwendeten und verwendbaren Datenquellen für Deutschland. Ziel ist, die der Literatur inhärenten Fragestellungen, Methoden, Datengrundlagen und Ergebnisse aufzuzeigen und verbleibende Forschungslücken im Bereich Gesundheit und Arbeit zu identifizieren.

**JEL classification:** I18, J80

**Keywords:** occupational safety and health

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## 1 Introduction

In Germany, the implementation and monitoring of occupational safety and health at work is joint responsibility of the accident insurance funds and the federal authorities. In addition, various institutions of the German social security system may be involved with and interact in response to an occupational health and safety problem, since sick employees are not always able to return to their jobs and not all health problems are recognized as work-related.

According to a recent report on the state of occupational safety and health (BAMS and BAuA 2009), Germany has achieved a high level of safety and health at work, indicated e. g. by decreasing numbers of occupational diseases and accidents. At the same time, working conditions and the structure of the labour force have been subject to rapid changes which have come along with new challenges for safety and health at work.

In the German labour market, female participation and the proportion of older workers have increased, the share of manufacturing in employment has declined and job insecurity has risen. In 2007, the German labour force counted 39.7 million employees (BAMS and BAuA 2009).<sup>1</sup> Between 1995 and 2006, Germany's employment and participation rates have increased significantly (by 4.6 %points and 2.6 %points, respectively) (OECD 2008).

The increase in employment rates reflects higher participation of women and older workers. While the share of female employees was rising by 3.2 %points (OECD 2008), the average age increased from 39 to 41 between 1991 and 2003 (BKK 2005). This growth in participation was accompanied by an increase of the unemployment rate (by 2.2 %points).

In terms of the sector composition of employment, the share of workers employed in mining, manufacturing and construction has fallen, while the employment share in service industries has grown, particularly in real estate and business services as well as education, health and social work (OECD 2008). The share of workers employed in professional and technical occupations has grown strongly, while that of clerks and lower-skilled elementary occupations has fallen.

The percentage of workers with temporary contracts has risen by 3.7 %points, the share of involuntary part-time employment by even 11.7 %points, but job tenure data give a mixed picture on employment security: average job tenure has increased by 1.2 years, suggesting more job stability (OECD 2008). However, the share of employees with less than one year of tenure has also increased by 3.4 %points, indicating that total labour turnover has probably risen, but that this rise in turnover may be more concentrated among new entrants, rather than affecting the entire la-

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<sup>1</sup> The number of employed persons involves all employees, self-employed or family workers.

bour force (OECD 2008). In general, German employees report a better working atmosphere, work-life balance and job satisfaction than in earlier decades. At the same time they report their jobs to be more complex and demanding and working hours to be more irregular than in former times (OECD 2008).

Evidence provided by the OECD (2008) also suggests that these labour market changes affect the mental health of employees: mental illness in general is rising for older age groups and non-employed while work-related mental problems are often associated with poor working conditions and non-standard employment. We can conclude that on average, physical disability through work, as e. g. due to an occupational accident, is decreasing while mental diseases are increasing over time.

This review of the empirical evidence on health and safety at work in Germany is structured as follows: The second section gives a description of the German health and safety institutional framework. The third section presents indicators of health and safety at work in Germany. The fourth section reviews academic research on the determinants of health and safety at work in Germany (from an economic perspective). The fifth section provides information on German data sets and German subsets within European datasets that may be used to analyze health at work issues. Section six concludes.

## **2 The Health and Safety Institutional Framework<sup>2</sup>**

### **2.1 Health and Safety Legislation**

The German approach to "occupational safety and health" (OSH) is rather broad and involves the prevention of occupational accidents, occupational diseases and work-related health risks. It addresses questions of human-friendly work design, and working times (e. g. working on Sundays or public holidays) and includes the protection of people requiring a particularly high level of protection (e. g. underaged people and pregnant women).

The following laws and rule constitute the fundamental legislation in the field of OSH:

- "Arbeitsschutzgesetz" (Occupational Safety and Health Act),
- "Arbeitssicherheitsgesetz" (Occupational Safety Act), which deals with medical and safety personnel at work,
- "Siebtes Buch Sozialgesetzbuch" (Seventh Volume of the Social Code), which deals with statutory accident insurance, and
- "Gefahrstoffverordnung" (Ordinance on Dangerous Substances).

The key law for employers and employees is the Occupational Safety and Health Act from 1996. This law defines the obligations of employers to keep their employ-

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<sup>2</sup> Section 2 draws on European Agency for Safety and Health at Work (2009).

ees safe and healthy. This includes documentation of OSH at the workplace and informing the employees on how to take care of their own safety and health at work.

In accordance with the EU strategy on health and safety at work 2007 to 2012, the German government, federal states and accident insurance funds – in cooperation with health insurance funds, professional organizations and research institutions – developed the “Common German Strategy for Occupational Safety and Health (Gemeinsame Deutsche Arbeitsschutzstrategie, GDA)”.<sup>3</sup> This strategy involves the establishment of common OSH objectives (GDA 2009). The strategy is legally funded in Germany’s Social Code VII and implemented by a “National Occupational Safety Conference” (NAK), supported by the federal Government, the states and accident insurance institutions.

For the period 2008–12, the objectives are the (1) reduction in the frequency and severity of occupational accidents, (2) reduction in the frequency and severity of musculoskeletal stress and disorders and (3) reduction in the frequency and severity of skin diseases (Deutsche Gesetzliche Unfallversicherung 2007).

The targets imply specific areas of activity. Target (1) aims for an optimal arrangement of work, logistics, transport and traffic (including within companies) and employees and thorough information of new employees and subcontractors. Target (2) addresses health services and tasks involving imbalanced stress or a lack of movement, with special emphasis on the design of the workplace and mental strain. Target (3) is concerned with work with damp materials or in damp environments and contact with substances harmful to the skin.<sup>4</sup>

Since 1951, Germany is member of the International Labour Organisation (ILO) and ratified various ILO Occupational Safety and Health Conventions, particularly in the fields of OSH protection against specific risks and in specific branches of activity.<sup>5</sup> Furthermore, there exists a list of occupational diseases (CIS 83-1399) and national information centres for occupational safety and health. The German government also conducts awareness raising campaigns (ILO 2006).

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<sup>3</sup> For a detailed description of the social protection insurance schemes related to health and safety see section 2.3.

<sup>4</sup> For more details consult GDA (2009).

<sup>5</sup> **General OSH provisions:** *Ratified:* Occupational Health Services (C161). *Not ratified:* Occupational Safety and Health (C155), Promotional Framework for Occupational Safety and Health (C187). **Protection against specific OSH risks:** *Ratified:* Radiation Protection (C115), Occupational Cancer (C139), Working Environment (Air Pollution, Noise and Vibration) (C148), Asbestos (C162), Chemicals (C170). *Not ratified:* Prevention of Major Industrial Accidents (C174), White Lead (Painting) (C13), Guarding of Machinery (C119), Maximum Weight (C127). **OSH protection in specific branches of activity:** *Ratified:* Hygiene (Commerce and Offices) (C120), Occupational Safety and Health (Dock Work) (C152), Safety and Health in Construction (C167), Safety and Health in Mines (C176), Underground Work (Women) (C45). *Not ratified:* Safety and Health in Agriculture (C184). (state of April 2010). For more details consult ILO (2009).



## 2.2 Health and Safety Regulatory Bodies and Monitoring

Germany has a dual system for occupational safety and health, consisting of the accident insurance funds and the federal authorities.<sup>6</sup> The accident insurance funds' primary responsibility is the prevention of occupational accidents and diseases and job-related health hazard by means of monitoring, counselling, information and training. The accident insurance funds are entitled to inspect work places, working equipment and processes, and business documents in order to determine occupational health hazards and to investigate the causes of an occupational accident or disease. The accident insurance funds may order measures to be taken by the employer or the employees in order to meet their respective obligations. Moreover, the accident insurance funds pay (disability) benefits in case of accidents and diseases (see section 2.3).

The second pillar consists of the federal institutions for OSH. The federal government is responsible for the introduction of laws encouraging and enforcing OSH, for research on this issue and for monitoring and reporting on the current state of OSH. Germany's federal states and their OSH institutions are responsible for ensuring OSH at work in a comprehensive way, including the implementation of the OSH regulation and laws – by means of information, motivation, counselling, monitoring and sanctioning.

## 2.3 Social Protection Insurance Schemes related to Health and Safety

As described above, the implementation and monitoring of safety and health at work is joint responsibility of the accident insurance funds and the federal authorities. Depending on the individual and occupational circumstances of an employee with health problems, earnings replacements are available from either the employer or the health insurance, the unemployment insurance, the retirement insurance or the accident insurance.<sup>7</sup>

Table 1 shows the institutional features of the German Sick Pay and Accident Insurance Scheme. The replacement ratios vary between 100 % of former earnings during the first six weeks of an illness, paid by the employer, and the socio-cultural poverty level if the employee is laid off due to health reasons and eligible for means-tested welfare.

Germany's social security system is for the most part insurance-based. Earnings replacements are financed through contributions and taxes. Employers and employees pay compulsory contributions to three insurances: health including long-term nursing care, retirement and unemployment. These payments usually account for

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<sup>6</sup> See European Agency for Safety and Health at Work (2009) and Deutsche Gesetzliche Unfallversicherung (2009) for this subsection.

<sup>7</sup> This section draws on Deutsche Sozialversicherung (2009).

about 40 % of gross earnings, of which the employer pays half. Accident insurance is paid completely by the employers, and social indemnity is handled by the state.

In the following, the social protection insurance schemes related to health and safety will be explained in more detail.

**Table 1: Institutional Features of the German Sick Pay and Accident Insurance Scheme**

<b>Principle</b>	<ol style="list-style-type: none"> <li>1. Statutory sick pay paid by employer</li> <li>2. Statutory sick pay paid by health insurance</li> <li>3. Statutory incapacity benefits paid by the statutory retirement insurance</li> <li>4. Accident insurance benefits</li> </ol>
<b>Medical certificate</b>	Yes (from the fourth absent day)
<b>Qualifying characteristics</b>	<ol style="list-style-type: none"> <li>1. Employee</li> <li>2. Insured individuals</li> <li>3. Eligible workers for retirement pension who had an accident and are not able to work six/three hours per day under usual working conditions (partially/fully disabled)</li> <li>4. Insured individuals with accepted work-related accident or disease or disability</li> </ol>
<b>Maximum duration of benefits</b>	<ol style="list-style-type: none"> <li>1. Paid up to six weeks</li> <li>2. From week seven to week 78</li> <li>3. From week 79 on up to retirement age</li> <li>4. After work-related accident or disease or disability</li> </ol>
<b>Benefits level</b>	<ol style="list-style-type: none"> <li>1. 100 % of regular earnings</li> <li>2. 80 % of last net earnings (up to 2,200 €/month) (privately insured: up to 100 %)</li> <li>3. 60 % of last net earnings (incl. medical treatment and rehabilitation benefits); modifications for survivor benefits for spouses and children</li> <li>4. 80 % of last net earnings</li> </ol>

Note: State of 2009. Soldiers with service-related health problems receive social indemnity benefits paid by the state. Unemployed who are laid off due to health reasons can receive unemployment insurance benefits if eligible or means-tested welfare benefits.

Source: Deutsche Sozialversicherung (2009). Own compilation.

### *Health Insurance*

Health insurance is mandatory in Germany. Since 1st January 2009, every German resident has to be insured at least for hospital and out-patient medical treatment (Deutsche Sozialversicherung 2009). Since membership in the public health insurance is mandatory for almost all blue and white collar workers, approximately 85 % of the population are covered by the public health scheme while the remaining have private health insurance.

The public health insurance covers almost 100 % of medical expenses, though often with co-payments.<sup>8</sup> In 2010, the total insurance premium is 14.9 % of the gross salary up to a maximum monthly income of 3,750 Euros. Thereafter the premium remains constant. The employer pays slightly less than half of the premium (7 %), employees 7.9 %).<sup>9</sup>

All employees are automatically enrolled in the public long-term nursing care scheme (Pflegeversicherung). The present contribution rate is 1.95 % of gross salary (2.2 % for childless employees, up to a maximum of 82.50 Euros per month) of which the employer pays half. The scheme covers some of the costs for personal nursing needs.

#### *Sick Pay Insurance*

According to the German Law on sick leave benefits, an employee is covered by sick pay insurance if she or he falls sick and cannot show up for work (Deutsche Sozialversicherung 2009). To obtain sick leave benefits, employees are obliged to inform their employers immediately about both the incidence and duration of their sickness and submit a medical certificate not later than the fourth day of absence. Usually, employers have to pay 100 % of regular earnings for the first six weeks that an employee is unable to work. If the employee cannot return to work after six weeks, she or he needs a different medical certificate and statutory health insurance starts paying statutory sick pay amounting to 70 % of last gross earnings (but not exceeding 90 % of net earnings and a maximum of approximately 2,200 Euros per month) for up to 78 weeks.

Privately insured individuals can purchase coverage of their entire net salary. After this period, the statutory retirement insurance takes over and finances further medical treatment and/or disability benefits which come to about 60 % of last net earnings (see section on retirement insurance). The “Medical Service” of the statutory health insurance (Medizinischer Dienst der Krankenversicherung, MDK, see MDK 2009) monitors sickness absence in Germany, in case employers or insurance companies doubt the lawfulness of work absences. The Medical Service has the right to conduct a physical examination of the patient and to cut benefits. Currently, 2,100 doctors are working for the MDK (see MDK 2009). According to Ziebarth and Karlsson (2009), in 1997, about 2,000 doctors examined 1.7 million cases of sickness absence.

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<sup>8</sup> Since January 2004, every adult has to pay a flat rate of 10 Euros per quarter once she visits a doctor. Co-payments on medication depend on the cost of the medication.

<sup>9</sup> We provide further details on the health insurance system in Section 2.4.

### *Retirement insurance*

The German statutory retirement insurance provides broad mandatory coverage of employees; exceptions are self-employed, farmers, liberal professionals and civil servants.<sup>10</sup> Presently, the general earnings-related statutory retirement scheme covers about 80 % of the employed population in Germany (about 35 million people in 2008, see Deutsche Rentenversicherung 2010). Another 6 % of the employed population is covered by the (life time) civil servants pension scheme. Many employers provide additional firm schemes for their employees. Nearly half of all German employees are now covered by such schemes.

The statutory retirement insurance is financed by contributions that are split evenly between employees and employers, with rates rising steadily since the late 1960s (in 2010: 19.9 %). In 2010, the assessment ceiling for pension insurance contributions was 5,500 Euros per month (4,650 Euros in East Germany). Civil servants' pensions are paid directly from public budgets.

The current statutory retirement age is 65 years, but steadily increasing (from 2012) to 67 years in 2029. Entering retirement before reaching the statutory retirement age reduces pension payments (by 3.6 % for each year of earlier retirement). Consequently, later entry increases payments. Under special circumstances, people are able to retire at age 63 without reductions, for example severely handicapped workers.

Long-term unemployed are obliged to take the early retirement option but have to accept reduced pensions. The net replacement rate (NRR) is a measure of individual net pension entitlement divided by net pre-retirement earnings. In 2006, the average NRR in Germany is at 62 %, clearly lower than the OECD average of 72 % (OECD 2009a). The pensions are indexed to wages. Anyone not entitled to receive sufficient public pensions in Germany, enters the means-tested welfare system.

As mentioned above, the German retirement insurance also pays disability benefits to workers of all ages and survivor benefits to spouses and children. Contrary to disability pensions of the accident insurance funds, the retirement insurance also provides disability pensions for eligible workers who had an accident during their leisure time and are not able to work at least six/three hours per day under normal working conditions (partially/fully disabled).

Disability pensions are paid until retirement age when old-age pension takes over. Moreover, the retirement insurance funds supply rehabilitation benefits if the earning capacity of an eligible worker is significantly threatened because of ill-health or disability, or is already significantly reduced.

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<sup>10</sup> This subsection draws on Deutsche Rentenversicherung (2010).

### *Accident Insurance*

The accident insurance covers almost everybody: employees, trainees, disabled persons, farmers, children in care facilities, students and pupils, registered unemployed, individuals in rehabilitation, caring persons, and some self-employed (see Art. 2 Social Code VII) – with only a few exceptions (most notably, German civil servants and self-employed).<sup>11</sup> Insurance fees are paid by the employers or, for non-employed individuals, federal institutions.

The accident insurers provide benefits in case of work-related accidents and diseases (treatment, rehabilitation, and disability benefits afterwards if necessary). An accepted occupational disease has to be (i) reported as an occupational disease and (ii) defined as an occupational disease according to Art. 9 of the Social Code VII. Occupational diseases can be reported by doctors, employers, but also by health insurers or insured persons. The precondition for an occupational disease to be acknowledged as an insurance case is that it forces the sick worker to refrain from all activities that (could) cause the disease or make it worse.

The German Social Code VII defines the preconditions for disability rents due to occupational diseases or accidents (e. g. the employability of the insured and injured worker has to be reduced by at least 20 % even 26 weeks after the accident). The fact that an illness has been recognized as an occupational disease does not necessarily mean that a pension will be paid. There are three possibilities:

1) The occupational disease/accident is recognized, and benefits are paid but no pension:

The type of occupational disease/accident and the development of the illness are such that benefits are supplied in the form of occupational or medical rehabilitation. Once rehabilitation has been successfully completed, the treated person can return to work. When curative treatment is still necessary, the insured person is entitled to such treatment for an unlimited period.

2) The occupational disease/accident is recognized and a pension is paid:

Health disorders resulting from the occupational disease/accident are observed even after medical rehabilitation and cause a reduction of 20 % or more in earning capacity after the 26th week from the illness/accident.

3) The occupational disease/accident is recognized but no benefits are paid:

The insured person is recognized as suffering from an occupational disease/accident but there is no need (yet) for treatment and no pension is paid because a measurable reduction of earning capacity has not occurred (yet).

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<sup>11</sup> This subsection draws on Deutsche Gesetzliche Unfallversicherung (2009).

For eligible workers, the accident insurance payment amounts to 80 % of last net earnings, up to a maximum of his or her net wage. The accident insurance covers also accidents of children at school or on the way to or from school.

#### *Social Indemnity*

Social indemnity refers to people whose adverse health condition is considered the responsibility of the society, and is therefore paid by the state (see Deutsche Sozialversicherung 2009). Those covered include disabled war veterans, war widows and orphans, soldiers with service-incurred health problems and the victims of violent crime.

#### *Employment Protection and Unemployment Insurance*

The German layoff protection legislation (Kündigungsschutzgesetz) does not prohibit that workers are laid off for health reasons (see BMAS 2010). However, it mandates advance notice periods which vary based on workers' characteristics like tenure, age, and type of employment (i. e. full-time or part-time). In addition to federal law, the negotiated contracts between unions and employers determine industry-specific conditions for lawful layoff.

When someone becomes unemployed (for health or other reasons), she or he is eligible for unemployment benefits if she or he has been working for at least one year during the two years prior to filing the application (see Deutsche Sozialversicherung 2009). Unemployed have to register with the employment office, be available to its placement service and accept a job that matches with their training and experience. They have to check regularly with the employment office to receive 67 % of their recent net income if they have children and 60 % otherwise.

These payments will continue for a period of one year if the recipient is below 55 and 18 months otherwise. When unemployment benefits expire or are not available due to very short contribution periods, means-tested welfare benefits are available at a given socio-cultural poverty level (351 Euros per month plus allowances for housing and pre-specified other needs in 2009).

## **2.4 Health and Safety Reforms/Targets**

Until recently, the organization and financing of the German health insurance system has almost entirely been linked to labour market activity (Amelung et al. 2003). To some extent, reforms of the German health insurance system have started to decouple health insurance from employment. This decoupling is likely to continue as the labour market is getting more dynamic.

More than 200 different laws have been introduced since 1980 (see DICE report 2007). Recent health reforms were always controversial and attempted, for example, to reduce costs by making hospitals more competitive, reducing benefits for dental care, increasing out-of-pocket payments for those seeking treatment and introducing an additional 0.9 % insurance premium to be borne by the member alone.

Arguably one of the most decisive reforms was the 2007 health care reform which focused on four areas: (1) the introduction of a mandatory health insurance for every German resident from 1st January 2009, (2) the expansion of expenditures for terminally ill persons, parents and elderly persons (3) the intensification of competition within the statutory health insurance system and the introduction of an inexpensive basic tariff for private health insurers, and (4) a new financing scheme of the statutory health insurance system from 1st January 2009: the health fund (see Gesundheitsfonds 2010).

With the introduction of this health fund, all health insurance funds charge one single rate for the contributions by employers and employees.

The fund is filled up with tax revenues. To date (April 2010), this rate is 14.9 % of the gross salary up to a monthly income. For each insured person, the health insurance companies will receive a flat rate from the Health Fund. Public health insurers can, however, demand a much discussed “supplement” if the flat-rate funding from the federally-administered health fund proves insufficient for the insurers.

### **3 Indicators of Health and Safety at Work in Germany**

#### **3.1 Sickness Absence**

The incidence and average duration of sickness absence increased slightly between 2006 and 2007. In 2007, 103 days of sickness absence occurred per 100 insured workers (2006: 98). The average duration of each sickness absence was twelve days (2006: 11 days) (BMAS and BAuA 2009). Ortlieb (2003) shows that, between 1960 and 2000, an average of 5 % of employees was on sick leave if calculated with data from a household panel survey (GSOEP) or from the health insurers.

Companies report higher percentages between 1975 and 2000 (about 8 %). The difference between companies' and health insurers' numbers might be due to the fact that health insurers are not necessarily involved in cases of short sickness absence due to minor illnesses. Due to this difference, Germany takes a medium rank in the European list on sickness absence based on administrative data and a top rank based on company data. Since 1995, the number of sickness absences of statutorily insured have declined more or less steadily, reaching a minimum of 3.2 % in 2007 (Heyde, Macco and Vetter 2009).

In 2007, the three most common diseases that caused sickness absence were diseases of the musculoskeletal system and connective tissue (23.7 %), the respiratory system (13.4 %) and injuries/intoxications (12.4 %) (BMAS and BAuA 2009).

Sickness absence varies by industry and professional occupation: workers in metal working professions had more incidences (145), followed by chemical professions (136) and assembly workers (134); creative professions and natural scientists reported the fewest incidences (74 and 56) (BMAS and BAuA 2009). Most incidences

occurred in the public and private services (115), the fewest incidences happened in the agricultural and fishing industry (75).

While the duration of sickness absence does not vary much between branches of industry, it is related to age. Younger cohorts return to work faster than older cohorts: in 2004 e. g., the workers between 15 and 40 years stayed home seven to eleven days whereas workers aged 55 to 59 stayed home 24 days on average and workers aged 60 to 64 stayed home 26 days (BKK 2005).

Whereas for younger age groups, the most frequent diseases are respiratory diseases and injuries, for older workers these are cardiovascular diseases and diseases of the musculoskeletal system. Women, particularly older women, stayed home more often than men (105 vs. 102 incidents, women/men aged 45 and older: 109/102 incidents) (BKK 2005).

### 3.2 Occupational Accidents

The number of occupational accidents– both in absolute terms as well as per 1,000 full-time employed – has been decreasing over the last decades (see Table 2). 50 years ago, in 1960, in West Germany 110 occupational accidents were registered with the insurance funds<sup>12</sup> per 1,000 full-time employed<sup>13</sup>; in 1991 there were still more than 50 accidents registered in both West and East Germany. In the year 2007, this number has almost halved: only 28 accidents per 1,000 full-time employees were registered (BMAS and BAuA 2009).

**Table 2: Occupational Accidents**

	Year		
	West Germany	Germany	
	1960	1991	2007
<b>Occupational Accidents</b>	2,50 Mill.	2,00 Mill.	1,06 Mill.
<b>Fatal Occupational Accidents</b>	4900	1500	812

Source: BMAS and BAuA (2009). Own compilation.

The number of fatal occupational accidents has also dropped sharply: Whereas in 1960, 4,900 fatal accidents were counted in West Germany, in 2007, 812 cases were counted in both West and East Germany (215 outside the establishment and 595 within the establishment) (BMAS and BAuA 2009).

<sup>12</sup> By law, occupational accidents have to be registered if an insured person is killed by the accident or injured in such a way that he/she cannot work for more than three days (§ 193 Social Code VII).

<sup>13</sup> The number of full-time employed workers is a statistical operand to calculate frequencies of accidents. The different types of employment, unemployment and non-employment (minor and part-time employment, overtime, registered unemployed, volunteer work) are converted to full-time employment.



Naturally, the type of industry and occupation has an effect on the risk of an accident. In 2007, higher-than-average numbers per 1,000 full-time workers were reported in the following branches: mining (40), metalworking (44), woodworking (65), food industry (46), construction (67) and transportation (40) (BMAS and BAuA 2009).

### 3.3 Occupational Diseases

The number of occupational diseases in Germany remained more or less constant over time (BMAS and BAuA 2009). In 2007, the number of accepted occupational diseases was 13,932 (West Germany 1960: about 13,000; Germany: 1991: about 10,000; 2000: about 20,000) (BMAS and BAuA 2009). In 2007, the most often accepted occupational diseases were hearing loss (5,036), asbestosis (2,053), throat/lung cancer (831), infectious diseases (730) and skin diseases (626). In 2007, 2,347 individuals (-9 % compared to 2006) died as a consequence of an occupational disease – for the most part caused by asbestos.

It is important to note that in 2007 e. g., only 22 % of all reported cases of occupational diseases were finally accepted by the accident insurers as an occupational disease. The number of reported cases, however, is increasing steadily since 1960. In 1960, about 33,000 cases were reported per year, in 1990 about 59,000 and in 2007 64,257 (BMAS and BAuA 2009). While in 2007, for instance, 18,448 cases of skin diseases were reported as occupational diseases to the accident insurers, only 626 cases were accepted as occupational diseases.

Similarly, 9,663 cases of hearing loss were reported (accepted 5,036), 5,566 cases of diseases of the lumbar spine due to carrying and lifting (accepted 213), 3,728 cases of asbestosis (accepted 2,053), 3,628 cases of throat/lung cancer due to asbestos (accepted 831), 2,532 cases of allergic airway diseases (accepted 418), 2,466 cases of infectious diseases (accepted 730), 1,550 cases of toxic airway diseases (accepted 133), and 1,543 cases of meniscal damages (accepted 231) (BMAS and BAuA 2009).

### 3.4 Disability Rents

Similar to the accident numbers, the number of disability rents due to occupational accidents paid by the accident insurance funds has dropped sharply over time. In 2007, the accident insurance started paying 21,315 new rents (this corresponds to 0.6 per 1,000 full-time employed; compared with 3.9 per 1,000 full-time employed in 1960 in West Germany; in both East and West Germany it was 1.2 in 1991 and 0.9 in 2000) (BMAS and BAuA 2009).<sup>14</sup> The number of rents due to occupational dis-

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<sup>14</sup> The number of 'new' rents paid after occupational accidents involve all insurance cases where a rent has started to be paid to insured persons or their relatives in the year under review.

eases did not change much between 1991 and 2007 (1991: about 5,000, 2007: 4,306) (BMAS and BAuA 2009).

Disability benefits due to partial or full disability were paid to 160,005 persons in 2007; which is a 1 % increase compared to 2006 and 2 % less than in 2005 (BMAS and BAuA 2009). The maladies that led to disability pensions were mental diseases (34 %), diseases of the musculoskeletal system and connective tissue (16 %), neoplasms (15 %), diseases of the circulatory system (11 %) and other diseases (25 %).

Disability pensions due to mental diseases increased markedly between 2006 and 2007 (by 5 %). According to the OECD Structural Analysis (STAN) database, the share of inflows into disability due to mental diseases in Germany rose from 17 % in 1990 to 28 % in 1999 (OECD 2008). In 2007, men entered disability pension at an average age of 50.5 and women at age 49.4 (the entry age for regular old age pensions was 63.3 for men and 63.0 for women).

### **3.5 Working Conditions, Job Satisfaction and Health**

The section above shows that during the last decades, Germany has achieved a high level of health at work considering the steadily decreasing numbers of occupational accidents and diseases over time. Regarding working conditions, job satisfaction and health, employees complain more about mental working conditions than about physical working conditions (BMAS and BAuA 2009). If workers complain about physical conditions, they feel strained due to working in a standing position (14 %), due to noise (15 %) or other adverse conditions (cold, hot, wet, damp, windy, 13 %).

Regarding mental working conditions, we observe on the one hand, a reduction in the share of employees reporting three or more work-related mental problems in Germany (stress, sleeping problems, anxiety and irritability), the level of 2.7 % being clearly below OECD-average (OECD 2008). On the other hand, self-reported exposure to stressful working conditions suggests an increase in psychological demands: given e. g. a 5.3 %points' increase in the reporting of high intensity work (high speed and too tight deadlines) and an 11.0 %points' increase of employees reporting that their work involves complex tasks (OECD 2008). Accordingly, a rising share of employees has to work at night or weekends (nights +2.1 and weekends +5.2 %points), or does shift work (+5.9 %points) (OECD 2008).

Even though average annual hours per employee follow a downward pattern over time, the share of those reporting ten or more working hours a day on a regular base has increased (+3.6 %points) (OECD 2008). Other working conditions like the work atmosphere, work-life balance and job satisfaction seem to improve over time: The number of employees whose jobs do not match with their family life decreased by 1.2 %points during the observation period, the share of workers having low autonomy at work and experiencing discrimination has also declined (by 2.2 respectively 4.4 %points) as well as the percentage of workers reporting low job satisfaction (3.3 %points fall) (OECD 2008).

According to a study of a national health insurer (BKK 2005), 80 % of employed men and almost 90 % of employed women are convinced that their work keeps them healthy. While 25 % of respondents below age 20 agree fully with the statement, more than 50 % of the respondents older than 60 do so. The majority of the respondents of all industry sectors agree but almost one third of respondents working in the food, printing and education sector do not agree. 60 % of male and 50 % of female respondents agree that their firm cares for their health. Differences across age groups are neglectable and gender differences vary by occupational sector: in the health sector, 70 % of female respondents agree that their firm cares for their health, but only one third of male respondents. The lowest shares of male and female respondents who agree are in the educational and social sectors.

### **3.6 OSH Policy and Infrastructure/Measures of Prevention**

#### *The Size of Health Expenditures*

According to data from the German Federal Statistical Office, 253 billion Euros were spent on health in the year 2007 (see Table 3). Compared to 2006, this is an increase by 3.2 %. The largest part stemmed from statutory health insurance (57.5 % of total expenditures). According to the OECD (2009b), 77 % of 2007's health expenditures in Germany were financed by the public sector, which is above the OECD average of 73 %. Expenditures on prevention and safety increased more than other expenditures (by 8.9 % to 10 billion Euros, not shown in the table). This increase is mainly due to expenditures on vaccinations that are now mandatorily covered by the statutory health insurance.

In terms of GDP, health expenditures take up 10.4 % (OECD 2009b). This proportion is rather high in international comparison. According to the OECD health database 2009, however, health expenditures in Germany have only increased by 1.4 % per year between 2000 and 2007 (in real terms), which is the lowest growth rate of all OECD countries. Therefore, Germany now takes rank 10 in health expenditures per capita within the OECD.

**Table 3: German Health Expenditures 2007 by Payer**

Payer	Million EUR
Public households	13,077
Statutory health insurance	145,360
Statutory care insurance	18,382
Statutory disability retirement insurance	3,677
Accident insurance	4,056
Private health insurance	23,452
Employer	10,667
Private households, non-profit organizations	34,079
Total	252,751

Source: Federal Statistical Office (2009).

### 3.7 Enforcement and Compliance with OSH

Information on enforcement has been provided in section 2.1. Information on compliance with OSH is shown in Table 4. Over time, the monitoring institutions discovered fewer cases of non-compliance with OSH regulations (decreasing from more than one million cases in 1991 to less than 600,000 cases in 2007).

**Table 4: Discovered cases of non-compliance with OSH regulations**

	Year					
	1991	1995	2000	2005	2006	2007
Non-compliance with OSH	1,002,174	1,133,196	858,233	642,613	571,231	568,442

Source: Federal Statistical Office (2009).

### 3.8 OSH Training

The figures on OSH training of the Federal Statistical Office reveal that both the number of training courses and participants increased between 1991 and 2007 (see Table 5). In 2007, a total of about 25,000 training courses on OSH were given, with almost half a million participants. Not only OSH personnel participated in these courses but also managers and, in the majority, regular employees. The numbers of courses and participants for self-employed and managers showed the largest increase over time.

**Table 5: OSH Training 1995**

Training courses/Participants	Year					
	1991	1995	2000	2005	2006	2007
Courses total	17,334	21,568	24,488	24,935	23,937	24,847
Participants total	383,723	448,904	477,629	471,588	454,178	471,663
<i>For self-employed and managers</i>						
Courses	2,419	3,025	5,355	5,883	5,396	5,720
Participants	55,707	66,608	112,287	117,055	109,934	125,632
<i>For OSH personnel</i>						
Courses	2,073	3,004	2,989	3,529	3,555	3,605
Participants	46,427	65,078	60,668	69,791	71,773	71,412
<i>For OSH personnel (according to the OSH safety law)</i>						
Courses	1,159	1,585	1,781	1,745	1,556	1,497
Participants	23,036	31,562	36,234	34,935	29,322	28,616
<i>For other employees</i>						
Courses	10,891	13,954	14,363	13,778	13,430	14,025
Participants	241,567	285,656	268,440	249,807	243,149	246,003

Source: Federal Statistical Office (2009).

### 3.9 OSH Management

According to data from the Federal Statistical Office for the year 1995, only a small share of German firms had OSH manager (254,294 firms: 198,058 firms in the private sector, 53,692 in the public sector and 2,544 in the agricultural sector) (Federal Statistical Office 2009).<sup>15</sup> Private firms employed 333,862 OSH managers, public firms 142,492 OSH managers and agricultural firms 5,810.

### 3.10 OSH Costs

In 2007, the accident insurers spent 13.8 billion Euros – an equivalent of 209 million Euros per one million insured individuals (see Table 6, without expenditures for pupils). Expenditures per million insured individuals did not change much over time (1990: 190 million Euros and 2000: 210 million Euros, not explicitly shown in the table). The largest amounts were spent on rents for insured individuals and their surviving dependants, treatment and administrative costs. Revenues exceed expenditures in each year observed in the table.

<sup>15</sup> There are no official statistics on the total number of firms in the year 1995. In 2007, there were 3,591,265 firms (Federal Statistical Office 2009).

**Table 6: Expenditures of the Accident Insurance 2007 (without expenditures for pupils)**

	Year					
	1992	1995	2000	2005	2006	2007
Insured individuals (in 1,000)	52,514	55,055	57,960	57,761	59,157	59,929
Expenditures (in 1,000 EUR)	10,507,679	12,138,839	13,728,866	14,390,424	13,995,036	13,826,145
Treatment	1,680,216	1,456,738	2,483,834	2,552,508	2,599,609	2,589,191
Benefits for accidents/ special support	559,031	601,065	595,341	515,025	515,547	515,104
Rents	4,796,971	5,504,088	5,666,769	5,770,310	5,710,306	5,638,316
Administrative costs	1,017,446	1,199,040	1,304,744	1,380,340	1,357,012	1,320,366
Revenues in 1,000 EUR)	10,741,614	12,336,608	13,880,650	14,447,500	14,068,450	13,902,798

Source: Federal Statistical Office (2009).

According to data from the accident insurers, 882 million Euros were spent on prevention (15 million per million insured individuals) (BMAS and BAuA 2009). Compared to 2006, this amount did not increase substantially (+0.01 million Euros per million insured people). Among these expenditures, 519 million Euros were spent on monitoring and counselling of firms, 138 millions were spent on OSH training, 74 million Euros were paid to organizations for prevention measures, 43 million Euros were spent on services for occupational medicine and security, 26 million Euros were spent on first aid, four million Euros were spent on the creation of safety rules, and 65 million Euros were spent on other prevention costs.

### 3.11 Summarizing Health and Safety at Work

Over time, physical disability through work, as e. g. due to an occupational accident, is decreasing while mental diseases are increasing. Evidence by the OECD suggests that the incidence of mental illness is rising for older age groups and non-employed, and that work-related mental problems are often associated with poor working conditions. While German workers have experienced an overall rise of employment (until 2008) and report a better working atmosphere, work-life balance and job satisfaction in general, at the same time, they experience a higher risk of becoming unemployed and report more complex and demanding working conditions, more working hours and less job stability at the margin.

Rapidly changing employment relations add a further element of uncertainty. The percentage of workers in Germany who hold "traditional" jobs – continuing, full-time, and conventionally employed by the owner of the worksite – is declining, while subcontracting, teleworking, and quasi-self-employment are on the rise. Existing evidence on the health effects of marginal employment points to potentially adverse effects of these employment changes on workers' well-being (e.g. Rodriguez 2002). More comprehensive research should be undertaken to test if this relationship is

causal, and if so, this aspect of changing employment relations should be introduced into the policy debate.

## **4 Academic Research on Health and Safety at Work in Germany**

This section presents an overview of the state of the art in research on health and safety at work in Germany – mainly from an economic perspective. The economic perspective on occupational safety and health encompasses both causes and consequences: the role of economic factors for safety and health as well as the effects of health at work on the economic prospects of workers (Dorman 2000).

We therefore take a rather narrow and far from complete view, because we (i) concentrate on the one-way perspective, i. e. the determinants of OSH indicators, and (ii) of course neither the causes nor the individual consequences of OSH can be reduced to their economic aspects. As far as the scope of this overview allows, it will incorporate sociological, psychological and medical perspectives. To present the relevant information in an accessible and concise way, Table A 1 in the appendix provides a summary of the literature referred to with details on the data, observation period and methodologies used.

### **4.1 Income**

The main body of economic research on the relationship between health and work is focused on their indirect link via health and earned income. Indeed, this relationship is one of the most heavily investigated topics in economics and other social sciences. Whereas it seems reasonable to assume a positive relationship between health and income both within and across countries, the direction of causality is still open to debate. In the absence of randomized controlled experiments, which are rarely feasible in this context, the difficulty in disentangling cause-and-effect arises from endogeneity problems.

One exception may be Frijters et al. (2005b) who try to measure the causal impact of income on health satisfaction of East and West Germans in the years following reunification. The authors argue that reunification was completely unanticipated and therefore can be seen as a ‘natural experiment’, which resulted in a rapid and exogenous increase in household incomes due to higher wages and higher transfer payments in East Germany but not in West Germany. The results suggest a significant positive effect of income changes on health satisfaction, but the quantitative size of this effect is very small.

This is the case with respect to current income as well as a measure of ‘permanent’ income. In a paper with a similar research question, Frijters et al. (2005a) provide evidence on the role of income on longevity. According to their findings, a one-log point increase in monthly real household income leads to a 12 % decline in the probability of death.

Note that income-related health inequalities depend very much on the definition of both variables: Ziebarth and Frick (2010) study the sensitivity of income-related health inequalities with regard to various measures of income as well as different health indicators (based on the GSOEP). Their results show that poor health is more concentrated among the poor. However, the choice of the measure of both welfare and health has a substantial impact on the degree of this welfare-related health inequality: Subjective, dichotomized health measures are associated with much larger degrees of inequality than objective, continuous measures. One reason for this might be that the process of dichotomization leads to loss of information. Regarding the objective, continuous health measures, Ziebarth and Frick (2010) find that most of these variables are likewise sensitive to the underlying income concept – with the exception of mental health inequalities that are strikingly robust towards the income measure.

## 4.2 Sickness Absence

Sickness absence is one of the main OSH indicators subject to economic research in Germany, with an extensive body of literature. The following subsection highlights the main results.

Ortlieb (2003), based on Neuberger (1997), summarizes the research on sickness absence up to 2003. Accordingly, sickness absence is positively correlated with (i) the generosity of the social security system (e. g. sick pay); (ii) specific industries (production and public sector vs. services); (iii) higher job security; (iv) seasons (February/March, October/November); (v) urban versus rural populations; (vi) larger company or team size; (vii) working conditions like monotonous work, low responsibility, longer working hours, shift work or longer travels to work; (viii) harmful mental working conditions (like lack of cooperation in teams, frequent posting to other jobs, low work satisfaction, no social network); and (ix) with individual characteristics of the employees such as a lower job position (worker vs. civil servants and employees), lower formal qualification, migrant status, mothers of small children and old age.

Interestingly, sickness absences of women are more often explained by private responsibilities than by working conditions (e. g. Reinwald 1999 and Ehrenreich 2001). Ortlieb (2003) analyzes correlations between sickness absence and tenure, historical background, and cohorts of new entrants in the company while controlling for macroeconomic indicators. Ortlieb's results suggest that sickness absence is negatively correlated with tenure and the general state of the labour market, and positively related to the economic situation of the company.

Particularly the impact of the social security system on sickness absence is under vivid debate. Ziebarth and Karlsson (2009a) and Puhani and Sonderhof (2009) confirm a positive correlation between sickness absence and generosity of the social security system in a natural experiment setting, by evaluating the effects of a temporary reform of sick pay in Germany in 1996 that reduced the benefit from 100 to 80%



of the wage rate but that effectively applied mostly to private-sector employees (= treatment group of Ziebarth and Karlsson, 2009a) and those without a collective bargaining agreement (= treatment group of Puhani and Sonderhof, 2009).<sup>16</sup>

Both papers suggest a reduction in the number of days of absence due to the reduction of sick pay benefits: According to Ziebarth and Karlsson (2009a), the proportion of employees without absence increased by about 7.5 percent and the mean number of short-term absence days per year decreased by about 5 percent. The effects were more pronounced in East Germany due to stricter application of the new law.

Moreover, single people, middle-aged full-time employed, and those with low incomes revealed stronger behavioural reactions than the population average. Ziebarth and Karlsson (2009b) provide additional evidence for the withdrawal of the reform in 1999, i.e. a rise in the sick pay benefit from 80 to 100% of the wage rate after abolishment of the reform. Irrespective of the method chosen, the empirical findings show that the mean number of short-term absence days per year increased by about 10 percent.

In a corresponding study on long-term absenteeism, Ziebarth (2009a) considers the 1996's reduction in sick pay together with an increase of the replacement level for workers absent for a long-term period, i.e., from the seventh week onwards, from 80 to 70%. Ziebarth (2009a) does not find a significant effect of these reforms on long-term absenteeism in general, but a significant decrease in the duration of long-term absenteeism for poor and middle-aged full-time employees. He concludes that moral hazard and presenteeism are less common if workers are absent due to sickness for a long-term period.

Riphahn and Thalmaier (1999) provide evidence on the impact of job security on sickness absence by showing absence probabilities to increase after the end of probation periods, i. e. after the first six months of tenure in Germany. For white collar and public sector employees, for whom the six months probation period applies most reliably (blue collar workers at times have only one or three months of probation), results confirm the hypothesis of behavioural adjustments after the sixth tenure month. Particularly for public sector employees, the predicted probability of a work absence is significantly higher once the probation period has been completed.

These results are in favour of a 'moral hazard effect' where higher individual costs of sickness absence due to lower job security would cause fewer sickness absences. One limitation of the analysis lies in the small number of observations in each of the subsamples, another is that we do not know with certainty whether workers indeed underwent probation periods of six months. However, the results of Riphahn (2004) confirm previous findings on the 'moral hazard effect'. Results suggest that workers

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<sup>16</sup> In 1999, two years after implementation of the reform, a newly elected federal government repealed it.

who are better protected are significantly more absent than similar workers who are less well protected.

Fahr and Frick (2007) exploit the heterogeneity of the members of three German health insurance funds in a natural experiment setting to test for the presence of this 'moral hazard effect' and additionally for the 'selection effect' (where changes in the composition of the workforce over the business cycle lead to fewer sickness absences because workers with health problems are the first to lose their jobs in a recession). The authors do not find robust results regarding the 'selection effect' but clear evidence for the 'moral hazard effect': Sickness absences react immediately to changes in the unemployment rate. Moreover, sickness absences of workers with the highest opportunity costs of becoming unemployed are the ones that react stronger to changes in the labour market.

Pietzner's results (2007) are somewhat complementary when investigating whether employees who have longer average sickness absences experience a higher risk of becoming unemployed. Results suggest a highly significant and positive relationship between monthly sickness absence and the probability of becoming unemployed with a 0.28 %points marginal increase of this probability per absent day.

But contrary to Fahr and Frick (2007), Pietzner (2007) shows that while a former increase in the overall unemployment rate in the German economy coincided with a decrease in the average probability of sickness absence, there is no statistically significant relationship between sickness absence and perceived job security. Pietzner interprets these findings as an indication for the 'selection effect' and against the presence of a 'moral hazard effect'. As a consequence, the average sickness absence decreases in the resulting sample of employees. Thus, the hypothesis that workers are strategically less sick in times of economic pressure is not supported.

According to Pietzner's analyses (2007), sickness absence seems to be positively related to the following characteristics of workers: former unemployment, unlimited contracts, more working hours than desired, larger firm size, being a woman, disability, German nationality, less satisfied with one's health and no vocational training. Non-linear effects are found for age (first decreasing, and then increasing), tenure and wages (both first increasing, then decreasing).

The interactions between working conditions, household context and sickness absence have been substantiated in an analysis by Beblo and Ortlieb (2008). Estimation results suggest that for both sexes, working conditions have a statistically significant effect on sickness absences (Beblo and Ortlieb 2008). The authors aggregate various working conditions into three independent variables: autonomy (activities with a high degree of responsibility, variation and good for personal development), strain (external monitoring, shift work, physically demanding tasks and environmental strain) and supportive environment (social relationship to colleagues and boss).

Women seem to experience less autonomy, strain and a more supportive environment than men. More autonomy and a supportive environment at work are related to fewer absences, whereas physical or organizational strain is related to more absences. Strain and supportive environments seem to have relatively greater importance for women whereas autonomy seems to be more important for men.

Regarding the impact of the social security system on sickness absence, we finally refer to a cross-country study (including Germany): The importance of labour market institutions for employee absenteeism has been investigated by Frick and Malo (2008) for EU-12 countries. According to their results, employment protection and sickness benefits are both positively related to absenteeism but the impact of the institutional framework is smaller than that of employees' characteristics such as work related health problems and the type of working contract.

### **4.3 Presenteeism**

Augurzky et al. (2010) study the phenomenon of presenteeism – that is, sick employees avoiding absence from work because they are afraid of losing their jobs – by examining the effect of a decrease in self-perceived job security on the demand for medical rehabilitation. As an instrument for self-perceived job security, Augurzky et al. use the regional unemployment rate and how it changed compared to the previous year. Based on data of the GSOEP for the years 2003, 2004, and 2006, the authors find that the probability of participating in rehabilitation will rise by 0.015 ppoints if job security increases by 1 ppoint.

The authors believe that this finding – a positive effect of self-assessed job security on the demand for medical rehab – indicates that workers take into account their dispensability at the job, which is higher during an economic downturn (with increasing job insecurity) than during an upturn. Augurzky et al.'s analysis does not answer the question whether workers act this way voluntarily because of a sense of responsibility towards their employers or because employers make them come to work when they are needed, although being sick.

### **4.4 Occupational Accidents**

The fatal accident risk for men is about three to four times higher than that of women. Kluge and Schaffner (2007) list ten occupations with the highest risk of fatal occupational accidents: Inland waters navigator, scaffolders, deckhands, plasterers, building labourers, quarrymen, air traffic occupations, sundry civil engineering occupations, motor vehicle drivers, roofers and slaters – all of these occupations are typically filled by men. As a result, men and women experience substantially different mean fatal accident risks, simply because of different occupational choices. However, Kluge and Schaffner are only able to explain up to 3 %points of the gender wage gap by differences in accident risks.

Results from medical studies unambiguously indicate that working time affects the occupational accident risk (Hänecke et al. 1996). The findings suggest an exponentially increasing accident risk beyond the 9th hour at work. A highly significant interaction effect was found for the hour at work by time of day, the percentage of accidents at different hours at work varying according to the particular time of the day when work has been started. For three “traditional” shift starting times it was shown that the relative accident risk increased dramatically with later starting times, especially beyond the 8th hour spent at work.

However, another study on the occurrence of occupational accidents points at job strain to be the most important explanatory factor, not working time (Nolting et al. 2002). Data were collected by a cross-sectional survey of nurses personnel in German acute care hospitals. No association with accident risk was found for age, sex, professional status (supervising function) and hours of overtime work. High job strain turned out to be the most important risk factor for occupational accidents. Elevated risks were also found for those working full-time, with tenure less than three years and being a single parent. Having at least one child of less than three years of age was a protective factor.

#### **4.5 Disability Rents**

Riphahn (1997) studies the determinants of disability retirement and unemployment of older male workers. The German public discusses if disability retirement is overutilized through individuals who are unemployed but not truly disabled. This implies (i) that the risk of unemployment is borne by the retirement instead of the unemployment insurance and (ii) wrong labour market signals are generated since disability retirees do not show up in unemployment statistics. In the empirical analysis, the hypothesis is rejected that disability retirement and unemployment are substitutes.

#### **4.6 Vocational Rehabilitation**

There is scarce research on the effects of vocational rehabilitation on labour market integration for people with disabilities. Wuppinger and Rauch (2010) present first evidence on this subject and focus on the effects of three main rehabilitation measures in Germany: “orientation and training”, “further training and qualification” and “job creation measures”. They find that participation in these measures depends on age, schooling, vocational education, unemployment duration and the situation on the local labour market.

Participants rate the rehab measure “further training and qualification” positively, while “orientation and training” are valued more reluctantly and “job creation measures” are rated lowest. Six months after participation in a measure, some groups are more likely employed than others – those rehabilitants who are better educated, have more labour market experience and less unemployment periods and live in urban regions. Additionally, employment depends on the point in time when disability occurred: rehabilitants whose disability occurred in younger adulthood have a higher employment probability than those with congenital disabilities.

## 4.7 Working Conditions and Health

Evidence on the impact of job security on health is provided by Gash et al. (2006). The authors focus on those exiting unemployment in Spain and Germany. Results suggest that for German men, transitions from unemployment into employment have a significant and positive effect on the health status for both fixed-term and permanent contracts. For German women, only permanent contracts exert positive health effects. One of the possible explanations of the observed gender difference is that women work more in the household and thus are less likely to exhibit a positive health status change when entering paid employment.

If they are already engaged in unpaid work within the home, in fact, the positive effect of a job take-up might be cancelled out by the stressful effects of the double-burden of paid and unpaid work. Sensitivity checks reveal that German women who were engaged in intensive childcare (more than four hours per day) do not experience any significant effect on health when taking up a paid job (irrespective of contract type). However, women engaged in fewer hours of childcare do experience a significant and positive effect from starting a permanent job. Further sensitivity checks suggest that individuals with low health status are more likely to obtain fixed-term contracts and that they derive a positive effect from obtaining employment at all (Gash et al. 2006).

Rodriguez (2002) examines the possible health impact of marginal employment, including both temporary and part-time employment schemes. The study addresses three research questions: (1) Are employed people with either a fixed-term or no contract more likely to report poor health than those who hold permanent jobs? (2) Are part-time employed respondents (even on permanent contracts) more likely to report poor health than full-time workers? (3) Does a change in employment stability (i. e., from employment with permanent contract to fixed-term or no contract employment and vice-versa) have an impact on the health status? Findings suggest that working hours do not play a role: the health status of part-time workers with permanent contracts is not significantly different from those who are employed full-time. In contrast, permanent contracts make a difference: full-time employees with fixed-term contracts in Germany are about 42 % more likely to report poor health than those who have permanent work contracts. Rodriguez recommends monitoring the possible health effects of the increasing number of marginal employment arrangements.

Green and McIntosh (2001) show that throughout Europe, there has been an average increase in work pressure in the 1990s, but that Germany experienced very little intensification of work pressure compared to other European countries. Work pressure is higher in jobs that use computers more frequently, and it is higher in private sector than in public sector jobs. Work pressure has increased faster in countries where trade union density has declined most. Since Green and McIntosh cannot explain a significant share of the increase in work pressure with their explanatory variables they conjecture that the observed increase in work pressure is at least in part related to changing work organization.

## 4.8 Early Retirement

In the past, early retirement (i.e. retiring younger than 65 years) was not only a policy instrument to enable workers with health problems to leave the labour force but also a measure to decrease unemployment rates (Brussig and Wübbecke 2009). Up to date, the average German worker retires much earlier than the legal retirement age: in 2006, the actual average retirement age was 60.9 years. Only about 33 % of workers retire at age 65 or later (Hostenkamp and Stolpe 2006). Since early retirement leads to loss of income (pensions are lower than regular pensions due to less contributions and a discount on pension payments), this indicates that early retirement may increase well-being, especially of those who suffer from work-related health problems.

Börsch-Supan and Jürges (2007) investigate the relationship between early retirement and well-being. Findings suggest that early retirement due to disability increases subjective well-being significantly and, in fact, more so than regular retirement. Since early retirement is most probably a reaction to a health shock, individuals are less happy in the year of early retirement than in the years before and after – either because of the poor health status or the retirement. Once they are retired, individuals attain their pre-retirement satisfaction levels after a relatively short time period.

Like Börsch-Supan and Jürges (2007), Hostenkamp and Stolpe (2006) observe health improvements after early retirement that cannot be observed for workers retiring at the “normal” age. These health benefits and the implied mortality risk reduction seem to be especially important for the most unhealthy workers, often workers in manual jobs. Further, the authors address the social costs of health-related early retirement in Germany (almost 60 billion Euros per year in the period 1992–2005).

Findings of a calibrated intertemporal model show that eliminating the correlation between income and health decline would delay the average age of retirement by approximately half a year (Hostenkamp and Stolpe 2006). Hypothetically keeping all workers in the healthiest category would yield a further delay of up to three years. Hence, investments in new medical technology and better access to existing health services may help to curb the need for early retirement. Had this scenario been realized during the 1992–2005 sample period, the social costs of early retirement would have been more than 20 % lower, even without counting the direct social benefits from better health.

## 4.9 The Effect of Health on Macroeconomic and Labour Market Outcomes

A study by the company health insurance funds (BKK 2005) estimates occupational sickness costs of 39 billion Euros per year in Germany. For occupational early retirement, direct treatment costs are two billion Euro and indirect costs caused through destruction of productivity are nine billion Euro. For occupational temporal diseases, direct costs are calculated as 15 billion Euros and indirect costs as 13

billion Euros. Workplace health promotion and prevention in the firms decrease occupational costs of sick leaves by 34 %. However, these estimations remain questionable, since the study gives no details on the estimation techniques.

Typically, when calculating the economic costs of sickness absence, the average days of sickness absence per year are multiplied with the total number of employed workers and their average wage; sometimes the costs of treatment and rehabilitation and “downtime” in the private households are added (Ortlieb 2003). The authors of the BAMS/BAuA-study estimate the yearly loss of production in the German economy due to sickness absence with 40 billion Euros if measured in wages, and 73 billion Euros if measured in gross value added (BAMS and BAuA 2009).

Ortlieb (2003) outlines problems with these calculations, as there is (i) variation in days of sickness absence by several characteristics of workers (gender, industry, occupation, wage level), (ii) approximation of work days with calendar days, and (iii) no distinction of potential gains through sickness absence (benefits from treatment and rehabilitation and time spent at home). She further lists the issues of non-productive workers at work, positive impact of short-term absence on long-term productivity and hidden costs of sickness absence like planning costs, malfunctioning work processes or production at lower than full capacity.

## 5 Review on Datasets

The next section will focus on currently available datasets for research on health and safety at work in Germany. It will identify and briefly review the main features of the available datasets: indicators for health and safety at work, time period covered, the nature and the way of collecting information on the indicators, the size of the dataset and its regional variation. Data on occupational health and safety issues in Germany are available both at the national and at the European level. Information on German data sets is provided first, followed by German subsets within European datasets.

As for the literature review, we offer a table in the appendix summarizing the data review (Table A 2). A general recommendation is to pay attention to the collection and construction of health indicators: dichotomization of health indicators leads to loss of information, and reporting heterogeneity for health measures has been found to depend on socio-demographics like gender, age, income, the educational level, the labour market status and the marital status of the respondents (Ziebarth 2009b).

### 5.1 German Datasets

#### *German Socio-Economic Panel (GSOEP)*

The German Socio-Economic Panel (GSOEP) is the dataset most often used for economic research on OSH. The GSOEP is a representative annual survey of German households and their members aged 17 and over. It started in 1984 with about 12,300 West German individuals (2006: 6,200 left) and was enriched in 1990 with 4,500 East Germans (2006: 3,500 left). In the following years, a couple of enlargements followed (1994’s sample D, 1998’s to 2002’s sample G).

The GSOEP collects information on current living conditions in Germany and their development over time. Interviews are face-to-face and computer-based. Points of interest are questions on qualification, social capital, leisure time, labour market and employment and health. A comprehensive documentation on the GSOEP can be found on the website of the DIW Berlin (see DIW 2010 as well as Schupp and Grabka 2008).

The items on health are collected in four categories: general state of physical and mental health, health provision, health indicators and CNEF equivalent health indicators. Information on the health status is collected via questions on physical well-being, invalidity/severe disability, disability with respect to work, job related accidents as well as physical and mental health in general.

Information on health provision is collected via questions on hospital stays, doctor visits, stays at health spas and rehabilitation treatments. Information on general health indicators is collected via questions on consumption of tobacco and alcohol, sports and nutrition and the body mass index (BMI). Table A 3 in the appendix lists all health variables of the GSOEP and their availability in the different survey waves from 1984 up to the year 2007.

#### *Mikrozensus*

The Mikrozensus (microcensus) is a representative annual household panel of 1 % of all German households. One quarter of the households in each sample is exchanged every year; thus, every household stays in the sample during four years. It is the official German dataset on the population and the labour market and started in 1957 in West Germany and in 1991 in East Germany. Participation is compulsory except for specific topics. Interviews are face-to-face.

The Mikrozensus contains information on age, employment, household context and income. Apart from a standardized questionnaire, the Mikrozensus collects a set of questions on health every four years. In the year 2005, 390,000 households with 830,000 individuals were asked these questions; participation was voluntary. The EU LFS is conducted as part of the Mikrozensus survey (see below).

The health-questions include the categories health status, health risks (tobacco consumption) and physical features (height, weight). Questions on the health status cover all diseases and accidents from the four weeks prior to the interview, their duration, the medical treatment (doctors, hospital, rehab), the type of accident (job related accidents, accident on the streets including commuting accidents, accidents at home or in leisure time, others).

Questions on health risks and physical features are directed to adults. Note that the questionnaire allows only one answer on diseases and accidents; thus, in case of parallel occurrence, individuals have to choose the obstruction which is most severe.



### *BIBB/IAB-Survey and BIBB/BAuA-Survey*

The German Federal Institute for Vocational Training (BIBB) and the Institute for Employment Research (IAB) conducted a survey on acquisition and realization of occupational qualification (BIBB/IAB-Survey). The survey started in 1979 and ended with a fourth wave in 1998/99. The 1998/99 BIBB/IAB-Survey is a representative survey of 34,343 employees to gain insight in structural changes of work and their consequences on working conditions, workload and individual mobility.

As in the three previous BIBB/IAB surveys, this sample represents 0.1 % of all dependent employees in Germany. Each one of the four surveys treats a specific topic but each included questions related to occupational risk and occupational demands. The questionnaire contains detailed questions on qualification and employment history as well as working conditions.

More specifically, there are questions on occupational safety and health (OSH) management, design of work stations, exposure to physical agents (noise, radiation, vibration, etc.), exposure to chemical agents, exposure to biological agents, safety at the workplace, physical workload, mental strain, work organization issues, social environment (participation and consultation, equal opportunities, violence at work, etc.), occupational and health outcomes. Interviews are face-to-face and computer-based.

In order to include questions with respect to stress and strain at work, the Federal Institute of Occupational Safety and Health (BAuA) became project partner in 1998/99. The fifth and current survey (2005/2006) was implemented jointly by BIBB and BAuA. This BIBB/BAuA-Survey constitutes a representative sample of the working population, gathering information about strains, mental states and diseases with questions about the workplace (focus of activity, level of requirements regarding knowledge and job, demand for further training, working conditions, working strains, etc.), stresses and physical impairments and broader questions on education and occupation.

In the current survey, 20,000 employees as from 15 years of age with a weekly minimum of ten hours of work were interviewed in Germany. Employment here refers to remunerated activity. Therefore work on an honorary basis as well as employment relationships in the context of vocational training were excluded. Foreigners were only included if they had sufficient levels of German. Although without fixed remuneration, unpaid family workers and people with a maximum of three months of interruption were allowed to participate. The survey was carried out computer-assisted per telephone and not face to face like the former enquiries.

### *German National Health Interview and Examination Survey (BGS98)*

The German National Health Interview and Examination Survey (BGS98) is based on questionnaires and medical examinations of individuals of a representative sample of the German population. The BGS98 was conducted between 1997 and 1999

on behalf of the German ministry of health. The survey covers 7,124 individuals aged 18 to 79 who were interviewed and whose height, weight and blood pressure was taken and blood and urine was analyzed.

The survey has information on the frequency of diseases and respondents' assessments of their own health and quality of life, on health behaviour patterns and on healthcare. Additional modules collect information on dietary habits, psychological impairments and environmental stress factors. Further information is collected on work, family and housing conditions. Earlier national surveys on health are available for West Germany for the years 1984–1986, 1987–1989 and 1990–1991; for East Germany for the years 1991–1992.

#### *German Health Interview and Examination Survey for Adults (DEGS)*

The BGS98 is continued with the German Health Interview and Examination Survey for Adults (DEGS) by the Robert Koch Institute. Ten years after BGS98, the aim of the DEGS is to collect representative data on the health status, health-related behaviour, healthcare and living conditions of adult residents in Germany who are aged 18 and more. The data will provide information on the most widespread diseases, health risk factors and healthcare problems. Furthermore, comparisons between the latest data and the findings of BGS98 will indicate changes over time.

Since persons participating in BGS98 are expected to be participating again, it will be possible to determine causal relations and/or time sequences relating to health risks and health problems (e. g. diseases, need for nursing care). It will also be possible to describe typical health patterns with the help of comparative data over time. The surveys will be carried out from November 2008 till November 2011, collecting data on approximately 7,500 individuals.

#### *German Health Update (GEDA)*

In addition, the Robert Koch Institute conducts regular health surveys as part of the nationwide health monitoring since 2003. The most recent survey (German Health Update, Gesundheit in Deutschland Aktuell, GEDA) was finished in May 2009 and includes information of 21,000 individuals. The survey is conducted via phone and focuses on the following subjects: subjective feeling of health, health-related behaviour (e. g. physical exercise, diet, alcohol consumption, smoking), chronic diseases, gastrointestinal diseases, injuries, health consequences and disabilities, vaccinations, organ donation, health-related support and stress/strains, mental health, extent to which interviewees make use of healthcare services, and socio-demographic characteristics such as age, gender, education, occupational status, ethnic origin.

#### *IAB Employment Subsample (IABS)*

The IAB Employment Subsample (IABS) is a 2 % random sample of all employees registered by the German social insurance system since 1973. The data are stored by the IAB (Institute for labour market research), which is part of the German Federal Employment Service. Supplementary information on establishments and on unemployment spells during which a claimant received transfer payments were

added to the sample. The IABS contains daily flow information and covers roughly 200,000 individuals.

The data originate in corresponding notifications regarding individual worker status that each employer has to make available for the compulsory health, pension and unemployment insurances schemes. This leads to a rather high reliability of the stored information, especially concerning the data necessary for the social security system. The IABS does not record individuals who are self-employed, family workers, judges, civil servants, soldiers, conscripts, individuals in community service as an alternative to military service, individuals who are marginally employed (i. e. below a certain threshold income, see below), and students enrolled in higher education. The large majority of the working population, however, is covered by the data.

#### *Data from the German Federal Pension Insurance*

The Research Data Centre of the German Federal Pension Insurance (FDZ-RV) provides data as cross-sectional and longitudinal scientific use files. The scientific use files (SUF) are released on an annual basis and represent all individuals who are insured in the Federal Pension Insurance. To date, the SUFs offer information on retirement, disability and rehabilitation until 2008. The longitudinal SUF represents all insured individuals born between 1941 and 1978 in Germany and is drawn as a 25% subsample of the research panel data of the FDZ-RV (*Versicherungskontenstichprobe, VSKT*). It covers more than 60,000 individuals. The cross-sectional SUFs represent between 1 % and 10 % of the target group, and cover between 90,000 and 400,000 individuals.<sup>17</sup>

#### *Socio-Medical Labour Force Panel (SPE)*

The German Statutory Pension Insurance promotes the Socio-Medical Labour Force Panel (SPE) that aims at collecting longitudinal data on health and employment related processes relating to the insured of the German statutory pension scheme. The first wave (2007) covers 1,433 individuals of working age who voluntarily answered and sent back the questionnaire that collects information on employment conditions, health behaviour including prevention, treatment and rehabilitation, health risks, health state, and socio-demographics. The survey is merged with administrative data from the Statutory Pension Insurance.

#### *Federal Health Reporting service (IDG) and federal health monitoring system (GBE)*

Further information on German health data is available via the Federal Health Reporting service (IDG).<sup>18</sup> The IDG was set up at the national level as the information technology infrastructure of the federal health monitoring system (GBE). It is a service facility of the German Federal Statistical Office providing and preparing the informational basis, particularly for the GBE. It already contains numerous, varied data and information on the entire spectrum of GBE topics.

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<sup>17</sup> For more information consider [www.fdz-rv.de](http://www.fdz-rv.de) (download: 01.08.2010).

<sup>18</sup> For a thorough overview of the data sources see Federal Statistical Office (2009).

The IDG database includes a wide variety of data from, and information on, many official and non-official sources of data. Information is provided in the form of customizable tables, concise graphs, comprehensible descriptions and precise definitions. The information, which is constantly being expanded and currently comprises more than a hundred sources of data, may be downloaded from the database. In addition, the system provides access to the GBE booklets and other GBE publications.

#### *Data from the Accident Insurers*

All occupational accidents, travel accidents and occupational diseases that cause an individual to be absent from work for at least three days are reported to the accident insurance if the respective individual is insured. The insurance associations, association of commercial and industrial workers' compensation insurance carriers (HVBG), the Federal Association of Accident Insurers (BUK), and the association of agricultural workers' compensation insurance carriers (LSV) collect all these data (see Deutsche Gesetzliche Unfallversicherung 2010).

All employed individuals who are not insured with the LSV or BUK are insured at the HVBG. In addition, data from statutory health insurance institutions provide information on the duration of hospital stays, sickness absence, type of medical treatment and prescribed medication (see BMG 2010).

## **5.2 German Data in European Datasets**

At the European level, the Framework Directive on Health and Safety in the Workplace sets an obligation for employers to keep records of accidents at work resulting in more than three days' absence from work. The Commission Recommendation concerning the European Schedule on Occupational Diseases sets a list of occupational diseases to be reported. In this legal framework statistical data collections from administrative national sources have been developed for occupational accidents (European Statistics for Accidents at Work, ESAW) and occupational diseases (European Occupational Diseases Statistics, EODS). Apart from these surveys, the European Working Conditions Surveys (EWCS) contain various indicators on OSH.

#### *Community strategy on health and safety at work 2002–2006*

Within the community strategy on health and safety at work 2002–2006, the European member states are asked to provide statistical information on just recognized and emerging occupational accidents and illnesses, their causes and consequences, as well as on factors of the working environment which are likely to cause the problems.

#### *European Labour Force Survey (EU LFS)*

For the years 1999 and 2007, the European Labour Force Survey (EU LFS) contains a specific ad hoc module on accidents at work and work-related health problems to collect additional data on work-related health problems together with labour market related variables available only in the EU LFS, such as employment, unemployment, inactivity, hours of work, occupation, economic activity and much else as

well as important socio-demographic characteristics, such as gender, age, education, households and regions of residence.

In Germany, the EU LFS is conducted as part of the Mikrozensus survey, and thus, participation is compulsory. Whereas the ad hoc module of 2007 was conducted in all four quarters of 2007, the ad hoc module of 1999 was conducted in quarter two only.<sup>19</sup> As mentioned above, a sample of 1 % of all German households is drawn randomly for the Mikrozensus. A systematic subsample of this 1 %-sample is used for the EU LFS. The sample comprises about 380,000 individuals between 15 and 64, yielding an average sampling rate of 0.5 %. The interviews are mostly face-to-face and computer-based.

#### *European Statistics for Accidents at Work (ESAW)*

The European Statistics for Accidents at Work (ESAW) data are currently available for the years 1994 to 2004. The ESAW data are from the Member States' national registers or other national bodies responsible for the collection of data on accidents at work. For each participating country, the dataset contains indicators reporting the incidence rates of accidents at work by type of accident per 100 000 workers in general and differentiated by gender, age and economic activity (nine main branches).

The indicators are reported separately for serious and fatal accidents: A serious accident leads to more than three days' absence; a fatal accident leads to the death of the victim within a year of the accident.

The definition of accidents at work in the ESAW data includes accidents occurring in the course of work and outside the business premises (caused by a third party). It excludes accidents on the way to or from work. A subproject on commuting accidents is included in the ESAW from 1996 onwards. Germany sent data on commuting accidents for the period 1996 to 2001. The variables considered are the same as for accidents at work. The reference population for the ESAW data is gathered from the EU LFS.

#### *European Occupational Diseases Statistics*

The European Occupational Diseases Statistics data refer to incident occupation and diseases recognized for the first time during the reference year and to deaths due to occupational diseases. The deaths due to occupational disease are included if the individual dies because of an occupational disease during the reference years, regardless of when the occupational disease had been recognized for the first time.

The indicators used are the number and incidence rate of incident and fatal occupational diseases. The indicator for incidents of occupational diseases is the number of incident occupational diseases per 100,000 individuals in employment during the

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<sup>19</sup> Since 2005 the EU-LFS is conducted quarterly in Germany.

reference year. The national EODS sources are the recognitions of occupational diseases by the public or private specific insurance for occupational diseases; thus, the data do not cover all workers. For Germany, the data is only available for the 1995 pilot year.

The EODS covers 68 disease entities in a compulsory way and 41 entities in an optional way (infectious diseases and rare forms of occupational disease). The reference population used in the calculation of incidence rates is extracted from the EU LFS.

#### *European Working Conditions Survey*

Since 1990, the European Working Conditions Survey is conducted every five years to study working conditions in Europe. The most recent wave of EWCS was carried out in the EU-25 countries (plus Bulgaria, Romania, Turkey, Croatia, Norway and Switzerland) during autumn 2005. The survey provides an overview of the state of working conditions throughout Europe, and indicates the extent and type of changes affecting the workforce and the quality of work.

The survey questionnaire consists of detailed questions on working conditions including health risks at work, information on occupational health and safety risks, the perceived relation between health or safety risks and work, health problems caused by work, incidence and duration of sick leave. Note that the EWCS is not aimed at studying the situation in each country in depth. The German sample is small but representative for the employed population (size: about 1,000 respondents).

The EWCS applies the random walk procedure, a method of selecting a random sample in door to door surveys. The respondents (employees and self-employed people) are interviewed face-to-face in their own homes outside normal working hours.

#### *European Agency for Safety and Health at Work*

The European Agency for Safety and Health at Work provides national statistics (also for Germany) on issues like absenteeism, hearing loss, noise exposure, pace of work and working time, also by specific characteristics like gender, age or employment status on their website (<http://osha.europa.eu/en/riskobservatory/>, 25.02.2009).

## **6 Conclusion**

There is a large body of research on OSH in Germany. Most of the literature concentrates on descriptive evidence of occupational safety and health. Academic research on the determinants of OSH indicators focuses mainly on the indicators sickness absence and early retirement. Most studies are based on the GSOEP, a rich micro-data panel, albeit without information on health.

As a caveat, the empirical analyses are not always convincingly addressing or correcting for methodological problems such as reverse causality, unobserved heterogeneity or measurement error. These types of problems may cause standard regression methods to produce biased and/or inconsistent estimates that cannot be interpreted unambiguously.

Consider for example studies on the effects of working conditions on mental health: if a mentally depressed worker is offered a job with worse working conditions than the average worker, an observed negative correlation between working conditions and mental health will not correctly be interpreted as a causal impact of working conditions on depression (because of reverse causality). Consider another example: if family background has an influence on both the probability of being offered a nice job and of having a good health status and if we cannot fully take the family background into account with our methodology (i. e. due to unobserved heterogeneity or omitted variables), we cannot conclude on a causal impact of working conditions on health outcomes. Finally, measurement error is likely to occur with items such as working conditions.

Nonetheless, our diagnosis for Germany is rather optimistic. Many datasets of high quality with a large number of health-related indicators are available. It seems that at least economic research has not yet exploited them to their full potential.

Among other issues, the phenomena of increasing mental diseases and of presenteeism call for further investigation. Whereas physical disability through work, as e. g. due to an occupational accident, is decreasing for German workers, mental diseases are increasing over time. Evidence provided by the OECD (2008) suggests that recent labour market changes such as more complex and demanding job tasks and irregular working hours might be responsible for the latter: mental illnesses in general are rising for older age groups and non-employed while work-related mental problems are often associated with poor working conditions and non-standard employment.

Working conditions might also be related to presenteeism (i. e. employees showing up for work while being sick). After all, the costs of presenteeism, resulting from lower productivity, are estimated to be higher than the direct costs of absenteeism and medical treatment (Baase 2007). According to a 2007-survey run among employees covered by the German statutory health insurance, 62 % reported to have gone to work being ill, one third even against doctoral advice (Zok 2009). Presenteeism is more prevalent among female employees, among those who have experienced layoffs in their firms and in firms without health management measures.

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# Appendix

**Table A 1: Literature Review**

Authors	Indicators	Findings	Data	Observations Period	Methodology	Limits of Research
Changes of working conditions						
Green and McIntosh 2001	Effort determination	Germany experienced very little effort intensification compared to other European countries.	ESWC data	1991 and 1996	Reduced form ordered probit model	Mixed definitions of effort variable
Impact of work on health						
Elkeles and Seifert 1996	Health satisfaction	No difference between West German and migrant workers regarding health satisfaction but unemployed foreign workers report less satisfaction with their health than unemployed Germans.	GSOEP	1984–1989 and 1989–1992	Logistic regression analysis	No self-selectivity correction
Frijters et al. 2005b	Health satisfaction	Very small, significant positive effect of income changes on health satisfaction with respect to current income and a measure of 'permanent' income.	GSOEP	1984–2002	Fixed-effects ordered logit model and a decomposition technique to account for panel attrition	No correction for time-varying unobserved heterogeneity
Rodriguez 2002	Perceived health status	Full-time employees with fixed-term contracts in Germany are about 42 per cent more likely to report poor health than those who have permanent work contracts.	Household panel comparability project data base	1991–1993	Logistic regression models	No self-selectivity correction
Gash et al. 2006	Changes in self-reported health after the transition from unemployment to (fixed-term or permanent) employment	Positive health effect of permanent employment for men and women (but not for women); positive effects of fixed-term employment (also over time) for men.	GSOEP	1984–2004	OLS and random effects regression	No self-selectivity correction
Frijters et al. 2005a	Longevity	One-log point increase in real household monthly income leads to a 12% decline in the probability of death.	GSOEP	1984–2002	Duration model that allows for unobserved persistent individual-specific health shocks	No correction for time-varying unobserved heterogeneity
Dormann and Zapf 1999	Depressive symptoms	Moderating effect for supervisor support relative to social stressors at work and depressive symptoms; no moderating effect for colleague support.	3-wave over 1 year; 543 citizens (aged 16-63) in the area around Dresden	1995	Longitudinal qualitative study	No self-selectivity correction
Zapf et al. 1996	Psychological ill-health	Mobbing is associated with poor mental health.	Two small samples of mobbing victims (n = 50 and n = 99)	1994	Logistic regression analysis	No self-selectivity correction; larger sample size
Impact of retirement on health						
Börsch-Supan and Jürges 2007	Subjective well-being	Early retirement because of disability increases subjective well-being, significantly and in fact more so than regular retirement.	GSOEP	1984–2002	Difference-in-difference methods.	No correction for time-varying unobserved heterogeneity

Authors	Indicators	Findings	Data	Observations Period	Methodology	Limits of Research
Siegrist et al. 2007	Intended early retirement	Association of poor mental working conditions (e.g. high work pressure) with intended early retirement among older employees.	Survey of health, ageing and retirement in Europe	2004	Logistic regression analysis	Small sample size; no self-selectivity correction
Riphahn 1997	Disability retirement and unemployment	Disability retirement and unemployment are no substitutes.	GSOEP	1984–1991	Discrete time competing risks hazard model for the transitions from employment is estimated using a multinomial logit estimator; calculation of transition rates	No self-selectivity correction
Hostenkamp and Stolpe 2006	Social costs of health-related early retirement	Social costs of 60 billion Euros/year; keeping all workers in the highest of five self assessed health categories would delay early retirement by up to three years; health improvements within two to three years after early retirement, especially important in unhealthy jobs.	GSOEP	1992–2005	Calibrates an intertemporal model based on ex post predictions from stratified duration regressions for individual retirement timing	Strict model assumptions
<b>Determinants of occupational accidents</b>						
Hänecke et al. 1996	Occupational accident risk	Exponentially increasing accident risk beyond the 9th hour at work; highly significant interaction effect for hour at work by time of day.	Accident insurance data on more than 1.2 million accidents (all listed according to the time of day and hour at work),	1994	Risk of having an accident measured as relative accident risk from the ratio of accident frequency to exposure	No self-selectivity correction
Nolting et al. 2002	Occupational accidents	High job strain turned out to be the most important risk factor for occupational accidents (odds ratio: 2.4, 95 % C.I.: 1.7-3.3). Significantly elevated risks were found for full-time work, less than 3 years of occupation in the present department and being a single parent (odds ratios between 1.5 and 1.8). Having at least one child of less than 3 years of age was a protective factor (odds ratio 0.5, 95-% C.I.: 0.4-0.8).	Cross-sectional survey of nursing personnel in German acute care hospitals (n=874).	2000	Multivariate logit analyses	No self-selectivity correction; no representative sample
Kluve and Schaffner 2007	Impact of fatal accident risk on gender wage gap	Highest fatal accident risk is by occupation; women have lower fatal accident risk; fatal accident risk explains up to 3%points of the gender wage gap.	GSOEP and IABS merged with data on fatal accident risks from accident insurers	1995–2001	Descriptive evidence; OLS wage equations	Lack of causal analysis of impacts on fatal accident risks

Authors	Indicators	Findings	Data	Observations Period	Methodology	Limits of Research
Determinants of sickness absence						
Beblo and Ortlieb 2009	Sickness absence	Absences and gender differences in absences are related to working conditions, household structure, and time spent with household activities.	GSOEP	1985, 1987, 1995, 2001	Ordered probit model separately by gender for the pooled sample and separate years (1985, 1995 and 2001)	No self-selectivity correction; shortcomings of the data (self-reported, retrospective information on absences, no distinction possible between frequency and duration of absence)
Fahr and Frick 2007	Sickness absence	'Moral hazard effect': Workers seem to react immediately to changes in the unemployment rate. Workers with rather poor exit options (i. e. those with the highest opportunity costs of losing their jobs) adjust faster to changes in the labour market.	1. Monthly time series on registered unemployment from the Federal Employment Agency 2. Time series on absenteeism of three sickness insurance funds from the Federal Ministry of Health	1. 1991–2004 2. 1993–2004	1. Changes in legislation as "natural experiments" 2. OLS, accounting for heterogeneity of fund members (less qualified, workers in large firms, craftsmen)	Identification problems with selection effect (weak instrument)
Ortlieb 2003	Sickness absence	Sickness absence correlates with generosity of social security system (e.g. sick pay); specific industries (production and public sector vs. services); higher job security; seasons (February/March, October/November); urban populations; company or team size; working conditions like monotonous work, lower responsibility, longer working hours, shift work, longer travels to work; harmful mental working conditions (e.g. lack of cooperation in teams, frequent posting to other jobs, low work satisfaction, no social network); and with certain characteristics of workers such as lower work position (worker vs. Civil servants and employees), lower formal qualification, ethnic origin, mothers of small children and older age; Sickness absence varies with tenure, historical situation and entrance cohort into labour market.	Daily data of 624 employees of a German middle-sized company merged with macro-economic indicators	1962–1998	Regression analysis	No self-selectivity correction

Authors	Indicators	Findings	Data	Observations Period	Methodology	Limits of Research
Pietzner 2007	Sickness absence	Sickness absence seems to be related to a higher risk of unemployment; workers' characteristics related to sickness absence; differences between West and East German labour market.	GSOEP	1985/1992–2001 (West/East Germany)	Probit model, Negbin-II-model, Zero-Inflated-Negbin-model, pooled sample for all years, and West and East Germany separately	No self-selectivity correction; employer-employee-data to identify impact of sickness absences on hiring/firing behaviour of employers; panel survey data with information on warnings of firing
Puhani and Sonderhof 2010	Sickness absence	1996-sick pay reform as natural experiment: two-day reduction in the number of days of absence - almost a quarter of the pre-reform mean - reduced average days spent in hospital by almost half a day; no effect on subjective health outcomes; higher point estimates at higher quantile (i. e. long durations were mainly reduced).	GSOEP	1994–2000	Difference-in-differences; fixed effect model; quantile regression	Identification strategy: representative treatment and control group?; No correction for time-varying unobserved heterogeneity
Riphahn and Thalmaier 1999	Sickness absence	Absence probabilities increase after the end of probation periods, i. e. after the first six months of tenure in Germany.	GSOEP	1984–1997	Probit models	No self-selectivity correction
Ziebarth 2009a	Sickness absence	1996-sick pay reform as natural experiment: Reductions in replacement levels did not affect average long-term-absenteeism significantly. Heterogeneous effects: Small and significant decrease in long-term absence duration for poor and middle-aged full-time employees.	GSOEP	1996–2007	Difference-in-differences	Identification strategy: representative treatment and control group?
Ziebarth and Karlsson 2009a	Sickness absence	1996-sick pay reform as natural experiment: Proportion of employees without absence increased by about 7.5 %, mean number of short-term absence days per year decreased by about 5 %. Effects more pronounced in East Germany due to stricter application of the new law. Heterogeneous effects: single people, middle-aged full-time employed, and the poor revealed stronger reactions than the population average.	GSOEP	1995–1999	Difference-in-differences	Identification strategy: representative treatment and control group?
Ziebarth and Karlsson 2009b	Sickness absence	Withdrawal of the 1996-sick pay reform (increase of sick pay benefit from 80 to 100% of wage rate): mean number of short-term absence days per year increased by about 10 %.	GSOEP	1997–2000	Parametric regression, matching, combined matching/regression	Identification strategy: representative treatment and control group?
<b>Determinants of presenteeism</b>						
Augurzky et al. (2010)	Demand for medical rehab	Probability of participating in rehab rises by 0.015 ppoints if job security increases by 1 ppoint.	GSOEP	2003, 2004, 2006	IV	Causal relation of presenteeism and medical rehab?
<b>Vocational rehabilitation</b>						
Wuppinger and Rauch (2010)	Rehab measures	Participants rate rehab measure "further training and qualification" positively, while "orientation and training" are valued more reluctantly and "job creation measures" are rated lowest. Six months after participation in a measure, rehabilitants who are better educated, have more labour market experience and less unemployment periods and live in urban regions and whose disability occurred in younger adulthood are more likely employed.	First wave of IAB-survey with information on 2,096 vocational rehabilitants with disabilities (2006)	2006	Logit models	No self-selectivity correction

**Table A 2: Data Review**

Dataset	Period of Time	Target Population	Indicators	Way of collecting data
<b>German Level</b>				
GSOEP	Since 1984 in West Germany and since 1990 in East Germany	German households and their members aged 17 and above	See Table A 3	Face-to-face and computer-based interviews
Mikrozensus	Since 1957 in West Germany and since 1991 in East Germany	1% sample of households in Germany	State of health (all diseases and accidents from the four weeks prior to the interview, their duration, the way of treatment (doctors, hospital, rehab), the type of accident (job related accidents, accident on the streets including commuting accidents, accidents at home or in leisure time, others)), health risks (tobacco consumption) and physical features (height, weight and BMI)	Face-to-face interviews
BIBB/IAB-Survey Now: BIBB/BAuA-survey	BIBB/IAB-survey: four waves between 1979 and 1999 BIBB/BAuA-survey: 2005/2006	Working population – BIBB/IAB-survey: 1% of employees; BIBB/BAuA: 20,000 employees with 10+hours/week	BIBB/IAB-survey: detailed questions on qualification and employment history as well as working conditions (occupational safety and health management, design of work stations, exposure to physical, biological or chemical agents, safety at the workplace, physical workload, mental strain, work organisation issues, social environment (participation and consultation, equal opportunities, violence at work, etc.) BIBB/BAuA: strains, mental states, diseases with questions about the workplace (focus of activity, level of requirements regarding knowledge and job, demand for further training, working conditions, working strains, etc.), physical impairments; education and occupation	BIBB/IAB-survey: computer-assisted face-to-face interviews; BIBB/BAuA: computer-assisted telephone interviews
BGS98 Now: DEGS	West Germany for the years 1984 - 1986, 1987-1989 and 1990-1991; for East Germany 1991-1992; both 1997/1999; coming: 2008/2011	Adult residents in Germany	Height, weight and blood pressure; urine; frequency of diseases and complaints on subjective health and the quality of life, on health behaviour patterns and on healthcare. Additional modules collect information on dietary habits, psychological impairments and environmental stress factors; work, family and housing conditions	Face-to-face interviews plus medical examination
GEDA	Since 2003; coming: 2009	21,000 adult residents in Germany	Subjective feeling of health, health-related behaviour (e.g. physical exercise, diet, alcohol consumption, smoking), chronic diseases, gastrointestinal diseases, injuries, health consequences and disabilities, vaccinations, organ donation, health-related support and stress/strains, mental health, extent to which interviewees make use of healthcare services, and socio-demographic characteristics such as age, gender, education, occupational status, ethnic origin/ethnicity	Telephone interviews
IABS	since 1973	Employees	Notifications regarding individual workers' status that each employer has to make available for the compulsory health, pension and unemployment insurances schemes	Register data
Data from accident insurers (HVBG, BUK, LSV)	All years	All cases	Occupational diseases and accidents per year per occupational group that lead to more than three days of sickness absence; duration of hospital stays, sickness absence, ordered medical devices and prescribed medication	Register data
Data from the German Federal Pension Insurance	Longitudinal: 2004-2008 cross-sectional: 2003-2008	Individuals insured under the statutory pension insurance scheme	Information on retirement, disability and rehabilitation	Register data
SPE	2007	Working-age population	Employment conditions, health behaviour including prevention, treatment and rehabilitation, health risks, health state, and socio-demographics; merged with administrative data from the Statutory Pension Insurance.	Voluntary responses with letters



Dataset	Period of Time	Target Population	Indicators	Way of collecting data
European Level				
EU LFS ad hoc module on "Accidents at work and work-related health problems"	1999: Q2; 2007: Q1-Q4 (not available yet)	380,000 individuals between 15 and 64 years	Accidents at work: number of injuries, type of injuries, duration of absence from work Work-related health problems: illnesses caused by work, complaint caused by work, number of days off, job that caused complaint; by se, diagnosis group, activity status, age and severity. Duration of absence from work for each accident and occupational illness Prevalence rates as well as incidence rates are available for occupational illnesses.	Part of the German Mikrozensus
ESAW	1994 to 2004	Reference population as for EU LFS	Accidents at work: incidence rates of accidents at work by type of accident per 100 000 workers in general, by gender, by age and by economic activity (9 main branches).	National register data
EODS	1995	Reference population as for EU LFS	Incident of occupational disease: number of incident occupational diseases per 100,000 persons in employment during the reference year. Deaths due to occupational disease: included if the person dies because of an occupational disease during the reference years, regardless of when the occupational disease had been recognized for the first time; indicators: number and incidence rate of incident and fatal occupational diseases.	Accident insurer data
EWCS	Since 1990 every 5 years	Employees and self-employed individuals in the EU 25	Working conditions: Health risks at work, OSH risks, relation between OSH risks and work, occupational health problems, incidence and duration of sickness absence	Face-to-face interviews

**Table A 3: Health-related Questions in the GSOEP (1984 to 2007)**

	Availability over the survey years																							
	'84	'85	'86	'87	'88	'89	'90	'91	'92	'93	'94	'95	'96	'97	'98	'99	'00	'01	'02	'03	'04	'05	'06	'07
State of health																								
Employment status last year																x	x	x	x	x	x	x	x	x
Current health status									x		x	x	x	x	x	x	x	x	x	x	x	x	x	x
Handicap due to poor health	x	x	x	x					x			x	x	x	x	x	x	x						
Suffer from chronic illness	x	x	x	x	x	x			x															
During the past four weeks...																								
Pressed for time																				x		x		x
Run-down, melancholy																				x		x		x
Well-balanced																				x		x		x
Used lot of energy																				x		x		x
Strong physical pain																				x		x		x
Achieved less due to health																				x		x		x
Limited due to health																				x		x		x
Achieved less due to mental health																				x		x		x
Less thorough due to mental health																				x		x		x
Limited socially due to health																				x		x		x
Height and weight																				x		x		x
State of health affects ascending stairs																				x		x		x
State of health affects tiring tasks																						x		x
Invalidity/severe disability																								
Handicap / physically challenged	x	x	x	x	x	x			x	x		x	x	x	x	x	x	x	x	x	x	x	x	x
Degree of handicap	x	x	x	x	x	x			x	x		x	x	x	x	x	x	x	x	x	x	x	x	x
Application for job disability made												x												
Disability to work																								
Disability to work more than 6 weeks		x	x	x	x	x			x	x		x	x	x	x	x	x	x	x	x	x	x	x	x
Frequency of longer periods of work disability		x	x	x	x	x			x	x		x	x	x	x	x	x	x	x	x	x	x	x	x
Unable to work last year (yes/no)		x	x	x	x	x			x	x		x	x	x	x	x	x	x	x	x	x	x	x	x
Length of work disability (days)		x	x	x	x	x			x	x		x	x	x	x	x	x	x	x	x	x	x	x	x
Occupational accident																								

	Availability over the survey years																							
	'84	'85	'86	'87	'88	'89	'90	'91	'92	'93	'94	'95	'96	'97	'98	'99	'00	'01	'02	'03	'04	'05	'06	'07
Treatment because of work accident in last year				x	x	x		x	x		x	x	x	x	x	x								
Physical and mental health																								
Bodily pain (NBS)																			x		x		x	
General health (NBS)																			x		x		x	
MCS: Summary scale Mental (NBS)																			x		x		x	
Mental health (NBS)																			x		x		x	
PCS: Summary scale Physical (NBS)																			x		x		x	
Role emotional (NBS)																			x		x		x	
Role physical (NBS)																			x		x		x	
Social functioning (NBS)																			x		x		x	
Vitality (NBS)																			x		x		x	
Health Provision																								
Was in Hospital	x	x	x	x	x	x		x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x
Number Nights in Hospital	x	x	x	x	x	x		x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x
Number Times in Hospital	x	x	x	x				x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x
Total Number Of Doctor Visits	x	x	x	x							x													
Number Visits: General Doctor	x	x	x	x							x													
Number Visits: Internist	x	x	x	x							x													
Number Visits: Dentist	x	x	x	x							x													
Number Visits: Gynaecologist	x	x	x	x							x													
Number Visits: Throat/Nose/Ear Doctor	x	x	x	x							x													
Number Visits: Orthopaedist	x	x	x	x							x													
Number Visits: Dermatologist	x	x	x	x							x													
Number Visits: Urologist	x	x	x	x							x													
Number Visits: Eye Doctor	x	x	x	x							x													
Number Visits: Radiologist	x	x	x	x							x													
Number Visits: Other Doctor	x	x	x	x							x													
Self-paid medical services					x	x										x			x					
Number Doctor Visits Last 3 Months	x	x	x	x	x	x		x	x			x	x	x	x	x	x	x	x	x	x	x	x	x
Did Not Go to Doctor				x				x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x

	Availability over the survey years																								
	'84	'85	'86	'87	'88	'89	'90	'91	'92	'93	'94	'95	'96	'97	'98	'99	'00	'01	'02	'03	'04	'05	'06	'07	
Therapeutic Treatment: Year When Last Received				x	x	x																			
Payer of Therapeutic Treatment				x	x	x		x	x		x	x	x	x	x										
Received Therapeutic Treatment Last Year								x	x		x	x	x	x	x	x									
State specific medical rehab treatment:																						x			
Medical rehab treatment in last year																						x	x		x
Occupational rehab treatment in last year																						x	x		x
Health Indicators																									
Tobacco consumption / kind															x	x									
Smoker (Yes/No)																x		x	x						
Age When Started To Smoke																		x	x						
Smoker (Yes/No)																x		x	x						
When Gave Up Smoking, Year																		x	x						
When Gave Up Smoking, Month																		x	x						
Smoker (Yes/No)																x		x	x		x		x		
Tobacco consumption / quantity															x			x	x		x		x		
Smoking: Total no answer																							x		
Consume alcohol: Beer																							x		
Consume alcohol: Wine, Champagne																							x		
Consume alcohol: Spirits, hard liquor																							x		
Consume alcohol: Mixed drinks																							x		
Frequency of sports, fitness, gymnastics																						x			
Healthy diet																						x		x	
Body-Mass-Index																			x		x		x		
Body Height in cm																			x		x		x		
Imputation Flag for Height																			x		x		x		
Weight in kg																			x		x		x		
Imputation Flag for Weight																			x		x		x		
Overnight hosp stay																			x		x		x		

	Availability over the survey years																							
	'84	'85	'86	'87	'88	'89	'90	'91	'92	'93	'94	'95	'96	'97	'98	'99	'00	'01	'02	'03	'04	'05	'06	'07
Inpatient nights in hosp																			x		x		x	
Work accident required treatment																			x		x		x	
Frequency of sport or exercise																			x		x		x	
Have had stroke																			x		x		x	
High blood pressure /circulation problems																			x		x		x	
Have or had diabetes																			x		x		x	

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