

## **The OMEGA-Database “Strains on the Spinal Column”**

### **Application in Handling of Occupational Diseases and Prevention**

#### **Abstract**

The OMEGA-database was developed in the BG Institute for Occupational Safety and Health (BIA) and is used within the German Berufsgenossenschaften (the institutions for statutory accident insurance and prevention, or BGs) for two different purposes. On the one hand, it provides an instrument for the uniform handling of the occupational disease No. 2108; on the other, it aids in collecting stress and strain data from occupational practice for evaluating workplaces and developing suitable preventive measures.

#### **Introduction**

Strains placed on the human musculoskeletal system, especially on the spinal column, have become more and more important to occupational life. With the incorporation of three new occupational diseases related to damage caused to the spinal column in the German Ordinance on Occupational Diseases in 1993, the BGs were obliged to provide compensation for damage to the spinal column caused by professional activities and to step up preventive measures taken in this area.

In response to this, the BG Institute for Occupational Safety and Health (BIA), the central institute for research and testing for the German BGs, in co-operation with several BGs, decided to develop a database for musculoskeletal strains based on the already existing OMEGA database system.

There are two main intentions in developing this kind of database. On the one hand, the enlarged OMEGA database is planned to provide a standardised instrument for the 27 German industrial BGs in the adjudication process of occupational disc-related diseases of the lumbar spine. The most significant in this regard is occupational disease No. 2108 (“Intervertebral disc-related diseases of the lumbar spine caused by the long-term lifting or carrying of heavy objects or caused by long-term activities in extreme trunk-flexed postures”, or BK 2108).

On the other hand, the enlarged OMEGA database is also meant to be used for prevention purposes. To do so, strain data from a number of occupational situations are to be archived in the database and then prepared in a manner to enable industry-specific prevention concepts to be developed.

The quality of these data can range from simple questionnaire data to sophisticated measuring data, e. g. from the CUELA system (Computer-assisted recording and long-term analysis of musculoskeletal load) – a person-centred measuring system developed at BIA to establish the extent of strain placed on the spinal column at the workplace [1].



This huge data pool will help to develop new registers and methods for assessing occupational strain in the future.

## Methods

For conceiving the database, the so-called OMEGA system was used. It is based on the Delphi programming language and has been in use within the BGs for several years now. This OMEGA system has already proven its suitability in the risk categories “hazardous substances” and “noise”, and it already contains some 1.4 million data sets in these fields. Decentralised data input and data query are possible for different users with this system, while central management of the software is also ensured by the developers.

A team of experts from several BGs was assembled to conceive the contents of the spinal column databank.

### *Software “Anamnesis of occupational disease No. 2108”*

In order to achieve uniform processing of the anamnesis in the procedure to BK 2108, a program was developed for calculating the “total occupational dosage” using different steps to describe one’s “occupational life” (see Figure 1). This program is oriented to the standardised exposure assessment procedure based on the so-called Mainz-Dortmunder Dose Model (MDD) as published by Jäger, et al. [2] and Hartung, et al. [3].

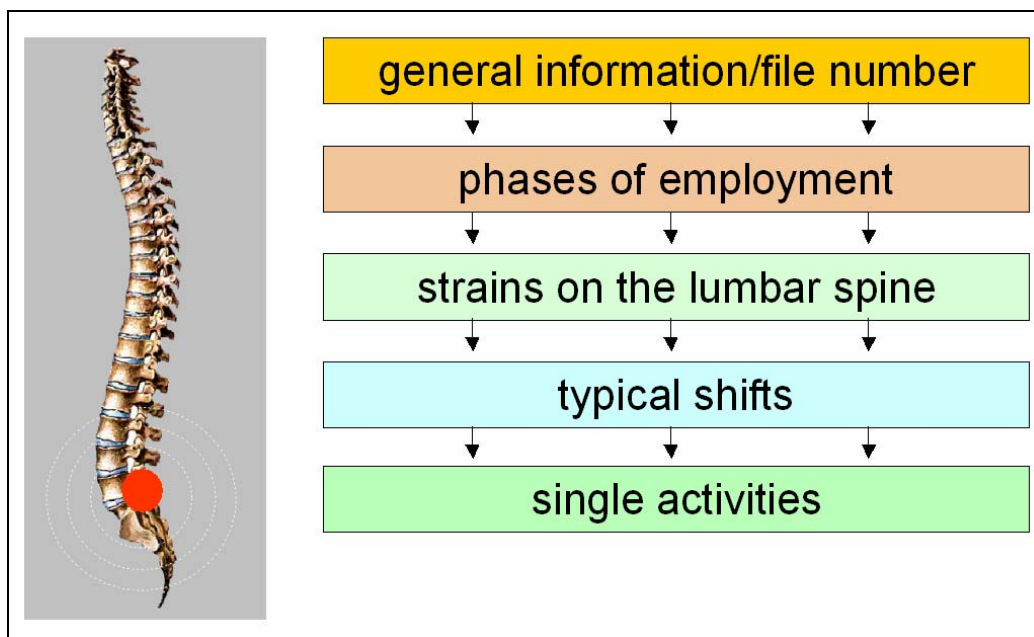


Figure 1: Base structure of the program

The program simplifies and improves occupational anamnesis in many various ways. Aside from automated dosage calculation, the software offers research into different library data compiled by the BGs over the years. These library data depict typical work situations, each including the load weights handled, the frequency, and the respective periods of time per work shift for various tasks. This method allows jobs performed many years ago to be reconstructed and included in the calculation of the total occupational dosage.



In this respect the function for researching within different load weights is a helpful option, too. Those load weights are stored as measured values in the database to provide valid information on the masses dealt with.

Sketches, photos, or videos can be added to depict specific load handling or postures, and these illustrations can partly be printed in the anamnesis report also.

Finally, the software provides the option of archiving the data electronically and exchanging the data with other researchers.

### *Prevention database*

The much greater portion of the database is dedicated for use as a database on measurement and prevention data. Here, the database is intended to serve in creating a large data pool where strain data from various occupations and different musculoskeletal risk factors can be brought together. Aside from the data required in determining the occupational disease on the manipulation of heavy objects (lifting and carrying) or working in extreme trunk-flexed postures, other factors are also to be considered here. This means, for instance, that load handling, such as by way of pulling and pushing, are described and evaluated. The different postures assumed for a specific task can also be depicted and evaluated with fine differentiation, just as is the case for working in static postures or under highly dynamic conditions.

Two different levels are considered when depicting these strains. On the one hand, individual tasks can be documented in the database (e. g.: load handling); on the other hand, entire work shifts should be depicted where possible in order to evaluate the total strain on a particular worker. This implicates not only the actual physical strain factors but also aspects of the workplace environment and work organisation (e. g.: break rules).

In order to meet these different requirements, different computer screen forms are used to enter data into a database assigned to a specific evaluation procedure. Table 1 shows the different evaluation procedures currently integrated into the program.

Table 1: Integrated evaluation procedures

Procedure	Description	Authors
LMM	<b>Leit-Merkmal Methode</b>	Steinberg and Windberg [4]
MDD	<b>Mainz-Dortmunder Dose Model</b>	Jäger, et al. [2], Hartung, et al. [3]
NIOSH	<b>National Institute for Occupational Safety and Health</b>	Waters, et al. [5]
OWAS	<b>Ovako Working Posture Analysing System</b>	Karhu, et al. [6]



In addition to these procedures which each produce special data sets that often diverge from one another, it is also possible to produce a pure description of tasks and work shifts.

### *CUELA measuring system*

The data sets discussed so far – as has already been mentioned – each require manual entry using computer screen forms. As a rule the data here are either from questionnaires or from workplace observations. Yet the OMEGA database “Spinal column strain” also provides the option of importing measurement data automatically through an appropriate interface. For this reason, a special measuring system – the CUELA system (see Figure 2) – was distributed among users along with the creation of the database.

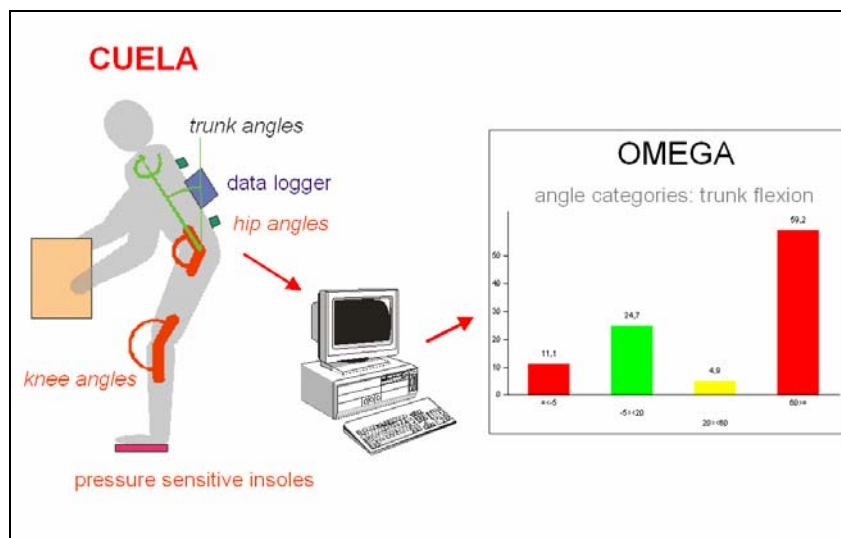


Figure 2: Data transfer CUELA – OMEGA

The CUELA measuring system was developed by BIA to enable measurements of the strains on the musculoskeletal system that are so common to numerous occupational tasks. CUELA is a person-centred measurement system composed of modern sensor technology that can be worn directly on the body. Therefore it can be applied at the workplace under real working conditions. The corresponding WIDAAN software allows for an automated evaluation of the measurement data according to occupational science and biomechanical evaluation criteria along with the automated data transfer to the OMEGA database. On this basis, it is possible to make statements on the measures needed for avoiding occupation-related health risks.

## **First Results**

The anamnesis software is now used by some 80 users at 22 different BGs, and the system has proved itself.

The CUELA measuring system has been continuously refined by BIA since 1995, and it is now used in the different branches. It is presently being distributed within the BGs, so that the first measurement data sets are expected here at the end of 2004.



## Future Implications

The uniform application of the OMEGA database system in collecting data from different risk areas (hazardous substances, noise, vibration, spinal strain) will make it possible to assure the provision of task- and occupation-related compilations of stress and strain data in terms of holistic strain profiles. The long-term aim of the project is a holistic risk assessment of workplaces.

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