Joint research project proposal

Project Title

PEPPA - **P**EROSH **E**xchange **P**latform for Measurements of Occupational **P**hysical **A**ctivity and Physical Workload – a Feasibility Study

Project main aim

The main aim of the project is to do a feasibility study on a data exchange platform that is used to collect, analyze and share measurements of occupational physical activity and workload based on PEROSH recommendations how to objectively assess physical (in)-activity or arm elevation at work with technical measurement systems (Holtermann et al., 2017; Weber et al., 2018). In the foreground is the development of a standardized data documentation as a prerequisite for the joint analysis of data sets. This includes the definition of common criteria for documentation of data and the structure within. These findings can be used to draft a database for the collection of data, recorded with different measurement systems and test its actual functioning Thereupon, occupational physical activity and workload can be compared and assessed using defined criteria and parameters like body posture, behavior (standing still or walking), biomechanical load and parameters of physical activity like energy expenditure and heart rate.

Depending on the resources, each participant within the project group can describe and collect a various number of datasets, containing the parameters described above. In order to generate meaningful results on the relation between occupational physical activity and physical workload and these outcomes, as many data sets per outcome as possible should be available for the comparison and analysis. Therefore, within this project, the PEROSH group strives to

- Gather and exchange all knowledge and expertise available to develop a standardized data documentation and a functioning database under consideration of costs and benefits
- Define the common characteristics of data acquired to compare and harmonize / process
- Develop a prototype for data collection and processing infrastructure
- Identify procedures for internal and external use of the database
- Develop a first searchable, joint database with exemplary measurements of sedentary behaviour and arm elevation, generated by simple sensor systems

Following the project phase, these aims will be expanded

- Develop a searchable, joint database with measurements of occupational workloads of different use cases, generated by systems of various complexity
- Construct a web portal allowing easy sharing of data between the participating institutes

Outline of the project idea

Occupational physical activity and workloads can have a two-way effect on health of the workers. On one hand, high occupational physical activity and workloads are generally acknowledged as main risk factors for the development of musculoskeletal disorders (van der Beek et al., 2017). On the other hand, physical inactivity at work has been identified as a main determinant for "lifestyle" diseases such as overweight, diabetes type II and hypertension (Biddle et al., 2016, Lakerveld et al., 2017). Both sides are associated with sickness absence and early exit from labor market, imposing an enormous burden on the individual and the society (Gregg and Shaw, 2017).

These results are generally based on self-reported measurements of occupational physical activity and workload that are prone to information and recall bias (Gupta et al., 2016). In addition, these data are often incomplete and do not provide sufficient information about the actual occupation, physical activity levels while working and the extent and intensity of workload. Therefore the existing knowledge, recommendations and legislation about the prevention of occupational diseases, symptoms and work-related issues may not be optimal or, in worst case, incorrect. There is thus a great need for technical measurements capable of providing this information in a valid way.

In line with this need, several research institutes in PEROSH have already started/developed different measurement systems and use them in their scientific research. To achieve consensus on measurement procedures and methods a PEROSH work group developed PEROSH recommendations in previous projects (PEROSH reports 1 "sedentary work" and 2 "arm elevation at work"). These recommendations for procedures to measure occupational physical activity and workload for researchers and practitioners may improve the fundament for high-quality research and workplace preventive measures. Additionally, there is also a great need for the exchange and aggregation of common data. This allows the analysis of these data to be carried out on the basis of the largest possible number of cases, which contributes significantly to the scientific quality and thus to the evidence of the findings thus obtained.

However, common measurement data based on the recommended procedures and a database infrastructure to exchange data easily between different research institutes are lacking. Therefore, there is a great need to build up such an infrastructure that supports each institute to collect common measurement data and to share them with other research partners. This PEROSH work group will work on closing this gap, by developing a standardized data documentation and building a web portal for the collection, analysis and exchange of data, assessed according to the recommended procedures for measuring occupational physical activity and workload.

To achieve this main aim, a stepwise approach is considered. As the first step, standardized criteria for the data documentation and data structure will be defined. The participating institutes will prepare the documentation of datasets generated by sensor systems of various complexity to compare them to each other and find matches and mismatches regarding the documentation. The main outcome of this step will be a uniform description of data sets to generate a consistent coding of the physical activities and workload in individual occupational groups in general and specifically of different activities

within these occupations. Additionally, in this step it will be identified which data is of relevance to store in the database.

As a second step, this "feasibility study" will be carried out to test the technical compatibility and practicability of joint datasets. The participating institutes will contribute anonymized datasets, which are then available to the other project members. These datasets will contain data assessed with measurement systems from the category 1 (see PEROSH reports; one sensor attached to one part of the body). Thus, data assessed by different types of sensors which were produced by different vendors, will be combined. Ongoing, these datasets will be analysed regarding parameters describing the amount and kind of physical activity and workload.

Following the project phase, the type of data being brought and stored together in the database will be more complex regarding the number of sensors and attachment on the body (category 2 systems, see PEROSH report). Therefore, tools for cleaning and analysis of complex data should be developed, to generate the same output parameter from data that were collected in a slightly different way. Furthermore the uniformly coded (and anonymized) data sets could be brought together for large pooled data analyses ("big data") using for example Artificial Intelligence (AI) evaluation algorithms.

Importance of PEROSH for the delivery of this project

Valid information of occupational physical activity and workload on job group level is important to develop recommendations and legislations for the effective prevention of costly diseases and symptoms and work-related issues (sickness absence and early exit from labor market). As the existing knowledge is mostly based on self-reported exposure measurements, the relationship between health and physical work demands is still unclear. Therefore, both researchers and practitioners are developing and using different measures not relying on self-report to assess occupational physical activity and workload. PEROSH is a natural central actor in developing, recommending and communicating procedures for high-quality collection, processing and interpretation of valid information of occupational physical activity and workload of individual workers and job groups. By developing and implementing a PEROSH web portal as a data exchange platform to collect, analyze and share measurements, PEROSH will contribute to creating the necessary database of occupational physical activity and workload measurements that will serve as a basis for high-quality research and workplace prevention initiatives, leading to improved levels of occupational physical activity and workload for European workers.

Anticipated project outputs in the project period from 2019-2021
1. A protocol for standardized data documentation as a prerequisite for joint data analysis
2. A test version of a PEROSH web portal as a data exchange platform to collect, analyze and share data of occupational physical activity and workload (sedentary behavior and arm elevation) or researchers.
3. An infrastructure as a basis to obtain big data for further research projects
4. Grant applications to obtain funding for the following project period (2022 and beyond).

Project objectives

Within the project period (2019-2021):

1) Define a simple use case which refer to the previous PEROSH reports 1 ("sedentary work") and 2 ("arm elevation at work") and do a requirement analysis
2) Define work packages and responsibilities. For example:
   a) Develop a platform to exchange source code between the developers
   b) Develop a database to store and manage measurement data on a server
      i) Definition of additional information stored in the database besides the measurement data (information about the workers' occupation, MSD, health data etc.)
      ii) Prepare a uniform description of data sets to generate a consistent coding of individual occupational groups in general and specifically of different activities within these occupations
   c) Develop a data processing infrastructure to analyze single measurements and compare whole projects on the server side
      i) Map existing and develop new algorithms for data processing
      ii) Import and harmonize data from different measurement systems (at different institutes)
   d) Data protection and privacy – comply with the new EU General Data Protection Regulation
   e) User management, identification, administration; User groups
   f) Data access by different users and user groups
   g) Data acquisition by the researcher
   h) Data transfer to and from the Database;
   i) Data security and reliability; data backup, intrusion protection, encrypted data transfer, server availability
3) Implementation of the work packages and testing
4) Test and optimization of the exchange platform with sample data from the involved institutes
5) Preparation for a "working" exchange platform
   a) Estimation of effort and costs
   b) Preparation of a continuous administration and user support of the exchange platform
   c) Prepare documentation, tutorials and user guides.

Objectives in a progression of the project (2022 and beyond):

   I. To collect reference data on the selected types of occupational physical activity and workload, using the exchange platform and the recommended procedures by researchers and practitioners through a PEROSH web portal

   II. To generate and publish results based on "big-data" uploaded to the PEROSH web portal from researchers and practitioners in PEROSH reports and international peer-reviewed journals and on the website

Participating institutes in the project

Institute	Contact person (email address)
Developer group	
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The future „users" (researchers or practitioners) and developers are welcome to participate and contribute to the project.

Distribution of project responsibilities and work tasks

IFA is overall responsible for:

- Overall planning and administration of the project
  - o Official form for project proposal for the PEROSH steering committee
- Communication with the project partners and PEROSH
- Planning, administrating and follow-up on the workshops
- Generating project reports to PEROSH

Participating institutes of the developer group:

- Attending 2-3 workshops per year
- Hosting one workshop during the project period
- Taking responsibility for the development of the assigned work packages
- Contributing to the project work packages in accordance with the milestone plan
- Allocating resources in accordance to the milestone plan

All participating institutes (developer and user group):
- Attending at least workshops 1, 5 and 6
- (Hosting one workshop during the project period)
- Contributing to the project work packages in accordance with the milestone plan - especially in the test phase
- Allocating resources in accordance to the milestone plan

Project phases, workshops and time expenditure

Phase I,

Spring 2019: Finalization of project description, define a simple use case in the context of the previous PEROSH reports 1 ("sedentary work") or 2 ("arm elevation at work") and the project requirements

- Workshop 1: Project startup with discussion of project description and knowledge exchange – Overview on existing and required infrastructure
- State of the art at the involved institutes:
    o Which kind of projects are available.
    o Which kind of infrastructure is available at the institutes.
    o Which kind of data should be used in the "feasibility study"
    o How to support the project.
- 2 days at IFA in May or June

Phase II,

- *Summer 2019 (*option to meet @ PREMUS conference in September)*: Define work packages and responsibilities*

Workshop 2 (developer group): Define and coordinate work packages within the project group depending on the WS 1 results. *The following work packages are proposed:*

- Build a platform to exchange source code between the developers
    o All participants should be able to contribute to the software development and generate their own plugins, as requirements on data processing could differ between the institutes.
- Build a database to store and manage measurement data on a server
    o Definition of the data and information that is to be stored
    o Development of an unique data format / representation
    o Estimation of server requirements in the test phase.
- Build up data processing infrastructure to do analysis on single measurements and compare whole projects on the server side
    o Definition of the required preprocessing on the client side
    o Definition of the data processing for analysis on the server side
- Data protection and privacy – comply with the EU General Data Protection Regulation
- User management, identification, administration; User groups
- Data access by different users and user groups
- Data acquisition by the researcher
- Data transfer to and from the Database;
- Data security and reliability; data backup, intrusion protection, encrypted data transfer, server availability

Phase III,

Autumn 2019: Start implementation of the work packages

Workshop 3 (developer group - early spring 2020):

- Exchange on the current state of implementation.
- Coordination of the work packages.

Phase IV,

2020: Test and optimization of the exchange platform with sample data from the involved institutes

Workshop 4 (developer group):

- Exchange of experiences about the first application of the exchange platform with sample data.
- Identification of further implementation and optimization needs.
- Estimation of the performance requirements for server, data transfer and other infrastructure.
- Detailed cost estimate for the intended infrastructure solution.

Phase V,

2021: Extended test and optimization phase

Workshop 5 (developer and user group):

- Go Live for the test exchange platform.
- Presentation of the exchange platform to the "user" project group and introduction to its use.
    - The involved institutes should be able to load sample data to the exchange platform, do analyzes with those data and share the results with the partners on the platform.
- Identification of further implementation and optimization needs.

Phase VI,

2021: Preparation for a "working" exchange platform -> following project*.*

Workshop 6 (developer and user group):

- Exchange of experiences on using the exchange platform.
- Identification of further implementation and optimization needs.
- Estimation of effort and costs of a "working" platform;
    - How to finance or sponsor it.
    - How to provide administration and user support.
- Planning and writing grant applications to attend funding for the following project period