Official title:

The RISMUS cohort study: Risk among Music Students. A study protocol

A longitudinal investigation of the factors associated with increased risk of playing-related musculoskeletal disorders among music students

Date of the protocol:

30.07.2018

Abstract/Summary of the research

Professional musicians are exposed to chronic high volume of continuous and repeated physical movements, sometimes in challenging and ergonomically unfavourable anatomical body positions, in order to acquire and improve technical playing skills. As a consequence, musicians are vulnerable to developing adverse playing-related musculoskeletal disorders (PRMDs) that may affect the manner in which and the extent to which music can be practised and performed.

In order to find out effective solutions for PRMDs and to develop future preventive measures, it is fundamental to firstly identify the main risk factors that play a significant role in the development of adverse musculoskeletal (MSK) conditions and symptoms.

The aim of the study will be to identify those factors associated with increased risk of PRMDs among music students. A further goal is to characterise and describe the clinical features of PRMDs, as well as determine the evolving course of PRMD's in music students during their professional training.

All pre-college and university-level students from several European music academies will receive an invitation to complete a web-based questionnaire survey at each of three occasions (baseline; 6-months follow-up; 12-months follow-up).

The web-based survey will include questions about any pain, PRMD and/or MSK problem they may have due to their musical practice, and different outcome measures (i.e. lifestyle and physical activity, practice habits, behaviour toward prevention and health history, level of stress, perfectionism, fatigue and disability).

To the best of our knowledge, no other longitudinal studies on risk factors for PRMDs have been conducted so far. Therefore, the study can be considered as an opportunity to fill the gaps of current research on PRMDs and generate new knowledge in educational and employment musical contexts.

Background/Rationale of the project

It has been shown that professions with high physical demands and/or frequently repeated movements like computer use are associated with a higher prevalence of MSK problems (Roquelaure et al. 2006; Sim et al. 2006; Cote et al. 2008). Similarly, professional musicians are exposed to chronic high volume of continuous and repeated physical movements and are vulnerable to developing adverse MSK conditions and symptoms (Kok et al. 2013; Chan and Ackermann 2014), that may affect the manner in which and the extent to which music can be practised and performed (Kok et al. 2013; Chan and Ackermann 2014). Indeed, this phenomenon was described by Zaza et al. (1998) as playing-related musculoskeletal disorders (PRMDs) and includes "any pain, weakness, numbness, tingling, or other physical symptoms that affect a musicians' capacity to sing or to play their instruments at the level they are accustomed to". This definition does not include mild transient aches or pains. In fact, according to Zaza et al. (1998), musicians use the words mild, just, slightest, normal and little to describe such aches and pains that would not be considered to be related to PRMD, because they don't affect the ability to play the musical instrument and are considered as "normal" as every-day pain (Zaza et al. 1998).

Current literature suggests that PRMDs do not only occur when entering the professional world, but are already present at the very beginning of musicians' professional education. A study reported that 25% of music students at university level, admitted that they had suffered from PRMDs, before starting their degree course (Spahn et al. 2004). Other cross-sectional studies have indicated that 43% of university-level students of music experienced a health problem related with their activity as musicians during the early stages of their education (Zaza 1992). Brandfonbrener

(2009) reported a playing-related pain prevalence between 84% and 87% among first year music students at university level and found that the majority had already suffered from PRMDs as pre-college students or even younger. Moreover, it has been shown that at least 45% of university-level students of music seek help from clinical professionals during their training because of PRMDs (Spahn et al. 2004; Williamon and Thompson 2006).
In order to find effective solutions to prevent or minimise the development of PRMDs and consequences for music students, it is fundamental to firstly identify the main risk factors that contribute to the development of PRMDs.
Among the performing arts literature, the most reported common factors for the development of PRMDs in musicians include: type of instrument, muscle fatigue, the use of repetitive movements during long hours of practice, poor posture (body position demanded by the shape and weight of the instrument), poor physical condition, overuse, insufficient rest breaks, difficult repertoire, change of instrument and poor technique (Wynn Parry 2004; Guptill and Zaza 2010; Paarup et al. 2011; Ackermann et al. 2012).
Furthermore, several studies revealed that there were positive associations between developing a PRMD and psychological stressors (i.e. performance anxiety, depression, personality traits and stress) (Guptill et al. 2012; Kenny and Ackermann 2015; Berque et al. 2016).
In fact, music students have to be prepared to work in an environment with high psychological demands (Holst et al. 2012; Paarup et al. 2012), having to perform efficiently and effectively with an excellent preparation and a deep awareness of audiences' expectations (Wynn Parry 2004).

Moreover, the first year of a degree course in music is particularly demanding (Zander and Spahn 2006) and the transition between pre-college- and university-level requires intensified practice. This is indispensable primarily because students need to familiarise themselves with the higher instrumental performance demands of a different and more competitive psychosocial environment involving different approaches related to technique and performance, introduced by new professors and teachers. In fact, previous research showed that the first onset of psychological and physical symptoms among university-level students of music at early stages are strongly correlated with the increase of practice time (Fry 1987).
However, students can be trained by their teachers on how to improve technique and playing habits. For instance, mental practicing (i.e. without the instrument) can help diminish repetition and may increase the learning process (Bandura 1986).
A proper prevention and health awareness could be a potential contribution to psychosocial and physical factors in the performing art field (Chan and Ackermann 2014) and may address physical and psychological issues of health prevention. In fact, it has been frequently shown that a fundamental element in the prevention and management of MSK disorders is correct health education and medical advice (Silverstein and Clark 2004; Chan and Ackermann 2014).

Unfortunately, due to a lack of longitudinal studies, low methodological quality (i.e. high measurement bias, inappropriate statistical analysis) and large heterogeneity of assessment approaches and outcomes (Berque et al. 2016), currently available studies are capable of only offering a limited appraisal of possible relationships between the activity of musicians and the development of a PRMD.
The existing literature on risk factors among musicians cannot be considered acceptable in order to establish definitive links between the physical activity characteristics of musicians and their risks of developing PRMDs. This is because the available studies are predominantly cross-sectional, often based on a retrospective design and terms

such as prognostic facts or predictor are inappropriately used to indicate associations (Baadjou et al. 2016; Berque et al. 2016).

In fact, cross-sectional studies cannot be considered appropriate to research risk factors (Baadjou et al. 2016). In the interpretation of associations from cross-sectional studies, the direction of cause and effect it is extremely difficult to establish (Croft et al. 2001), because the presence of risk factors and the occurrence of an outcome (i.e. PRMDs) are assessed simultaneously. For example, anxiety or distress may be a risk factor for the development of PRMDs, but it is equally possible that PRMDs might contribute to increased anxiety or distress.

Currently, although there is a robust conceptual and physiological framework to expect a linkage between the physical activity characteristics of musicians and their risks of developing PRMDs, there is neither sufficient scientific evidence for this linkage nor the basis on which clinical prevention of PRMD can be developed (Rickert et al. 2015; Baadjou et al. 2016; Berque et al. 2016;).

Several recent studies and reviews strongly recommended developing a longitudinal study with a combination of biological, psychological and social potential factors that contribute to the development of PRMDs (Kaufman-Cohen and Ratzon 2011; Leaver et al. 2011; Kenny and Ackermann 2013; Rickert et al. 2015; Baadjou et al. 2016; Berque et al. 2016).

It is plausible that with more evidence relating to the modifiable factors that may increase the risk of adverse outcomes, targeted behaviour-modification and health-promotion might be ultimately designed to counteract the risk of developing PRMDs. Relevant targeted interventions could be implemented then either at the initiation of a career in music, or more effectively delivered as intermediate or ongoing intervention during, or in the transition towards, professional musicianship.

Aims/objectives

The aim of the study will be to identify those factors associated with increased risk of PRMDs among music students. A further goal is to characterise this novel population of study and describe the clinical features of PRMDs, as well as determine the evolving course of PRMD's in music students during their professional training.

Research questions and hypotheses

Primary research question:

What are the main factors associated with increased risk of PRMDs in music students undertaking professional training?

Secondary research questions/objectives:

1. What is the prevalence of musculoskeletal disorders among university-level students in comparison with pre-college students?
2. Monitor and characterise the impact of the transition between pre-college and university-level music training on the development of PRMDs.
3. (Are there any differences in the severity and symptoms associated with PRMDs among music student groups at different levels of music training?)
4. Monitor and characterise the time course of PRMD development

5. (Are there significant differences in PRMD incidence between university-level students and pre-college students?
6. During training, do music students develop any type of musculoskeletal disorder that doesn't affect their ability to play at the level to which they are accustomed to?
7. Characterise health related quality of life and outcomes in music students at different stages of professional training.

Considering the aims and the research questions of the programme, the following hypotheses are formulated:

H1: The development of PRMDs is associated with a multitude of risk factors (i.e. age, gender, number of hours of practice, previous history of injury, poor physical status, psychological stress, perfectionism, fatigue) among music students.

H2: There is a higher prevalence of PRMDs among university-level students in comparison with pre-college students.

H3: There is a higher prevalence of PRMDs among university-level students in the early stages of their training (transition between university-level and pre-college).

H4: University-level students develop more PRMDs over the years of their training than pre-college students.

H5: During their training, music students of both levels develop MSK disorders that affect their ability to play at the level they are accustomed to.

H6: Health and quality of life among music students is progressively poorer over the years of training (from the last two years of pre-college to the last years of Master-level)

Methodology

Study Design

This prospective longitudinal cohort study will be conducted through the following three phases (Figure 1):

(1) A baseline cross-sectional survey to characterise the study population and subgroups, and form the basis for the evaluation of associated factors and relationships with the development of PRMDs;
(2) A 6-months follow-up survey, and
(3) A 12-months follow-up survey.

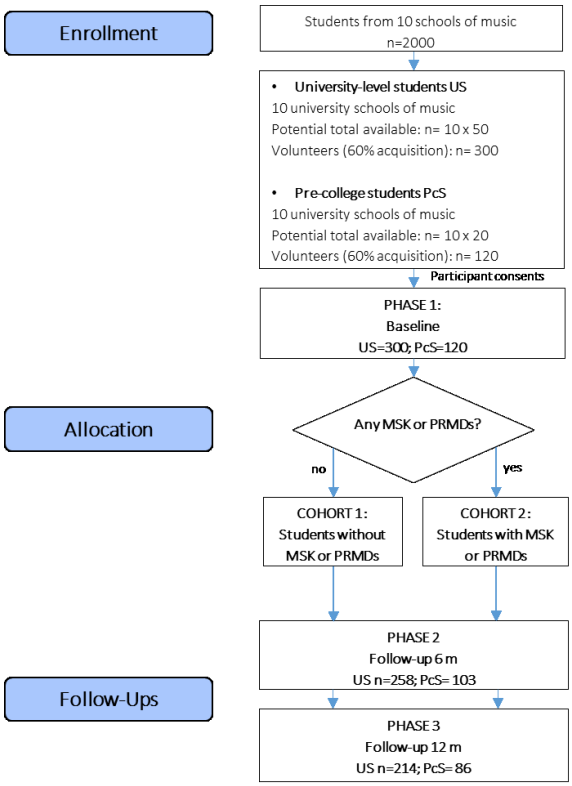

Figure 1 Research planning chart including main features of the cohort study

The study protocol has been approved by the Research Ethics Panel of the Queen Margaret University, Edinburgh (REP 0177).

After the first baseline data collection (Phase 1), the cohort of students will be broken down into:

- Cohort 1: music students (both pre-college and university-level) who are free of pain, PRMDs and/or MSK problems at baseline data collection
- Cohort 2: music students (both pre-college and university-level) who aren't free of pain, PRMDs and/or MSK problems at baseline data collection

Afterwards, the two cohorts will be followed and invited for reassessment at 6 months (Phase 2) and 12 months (Phase 3).

The 6-months and 12-months follow-ups for the Cohort 1 will be essential to monitor and record the development of new incidents of invasive pain, PRMDs and/or MSK problems within a period of a year and to enable characterisation of the nature and time course of developing pain, PRMDs and/or MSK problems.

The analysis of the results will attempt to answer primary research question and secondary research question 3 and 4, addressing the lack of any similar type of data in the current literature.

Similarly, the follow-ups for the Cohort 2 will be important in order to characterise the impact and time course of changes in any pain, PRMD and/or MSK problem within a 12-month period.

Participants

All pre-college and university-level students from all European music academies will receive an invitation to complete a web-based questionnaire survey.

Pre-college will include third-year and fourth-year students (age: 18 and 19 years old). University-level will include students enrolled in the first, second and third year of the Bachelor degree course (age: between 19, 20 and 22, 23 years old), as well as students enrolled in the first, second and third year of Master degree course (age: between 22, 23 and 35 years old).
Inclusion criteria will be music students, men and women, aged 18 to 35 years old with a classical instrument as main subject (composers and conductors will be excluded).
Exclusion criteria will be composers and conductors, positive history for neurological, rheumatic, psychological disorders or emotional distress, as well as surgery of the upper limbs and/or the spine in the last year.
Blind recruitment will be used. The researcher will contact the student registries of the centres with an invitation e-mail that will be addressed to their student body.
The e-mail will contain information on the study, an information sheet and the link for the online survey. Once opened the link, students will be directed to the electronic consent form, which must be completed and signed before initiating any study procedure. Afterwards, once they have completed and signed the consent, they will be directed to the online-survey.
Questionnaire data and personal information provided through participant informed consents will be stored separately.

Study procedure

The student registries of the ten centres will be used to recruit participants. The researcher will contact the relevant school offices with an invitation e-mail what will be addressed to their student body.
The e-mail will contain information on the study, an information sheet and the link for the online survey. Once opened the link, students will be directed to the electronic consent form, which must be completed and signed before initiating any study procedure. Afterwards, once they have completed and signed the consent, they will be directed to the online-survey.
Questionnaire data and personal information provided through participant informed consents will be stored separately.

The baseline online-survey will be conducted to investigate the prevalence of PRMDs of pre-college and university-level students of music. It aims to maximise sample size and to indirectly examine the influence of intensified music practice as expected at advancing levels of professional training.
Phase 1 will address secondary research questions 1, 2 and 5.

The web-based survey

The web-based survey will include different outcome measures, which have been selected according to the relevant findings of previous cross-sectional studies and systematic reviews among the performing arts literature (Figure 2).
Each outcome measure correspond to a suspected factor that may be associated with the development of PRMDs.
The survey will start with questions about personal background and lifestyle (i.e. age, gender, self-reported weight and height, nationality, smoking status and sleeping habits), as well as practice habits (i.e. number of

hours of practice and years of experience) health history (i.e. major past injuries/accident/disorders and current medication) and health status (Self-Related Health - SRH).

Afterwards, in order to divide the cohorts, the presence of pain and/or MSK problems will be assessed through the following question: “When did you last experience a bout of significant pain and/or musculoskeletal problem?” with the following list of possible answers:

1. I currently have pain and/or a musculoskeletal problem (up to one month)
2. 2-3 months ago
3. 4-6 months ago
4. Up to 12 months ago
5. More than 12 months ago
6. I have never had any pain and/or musculoskeletal problem

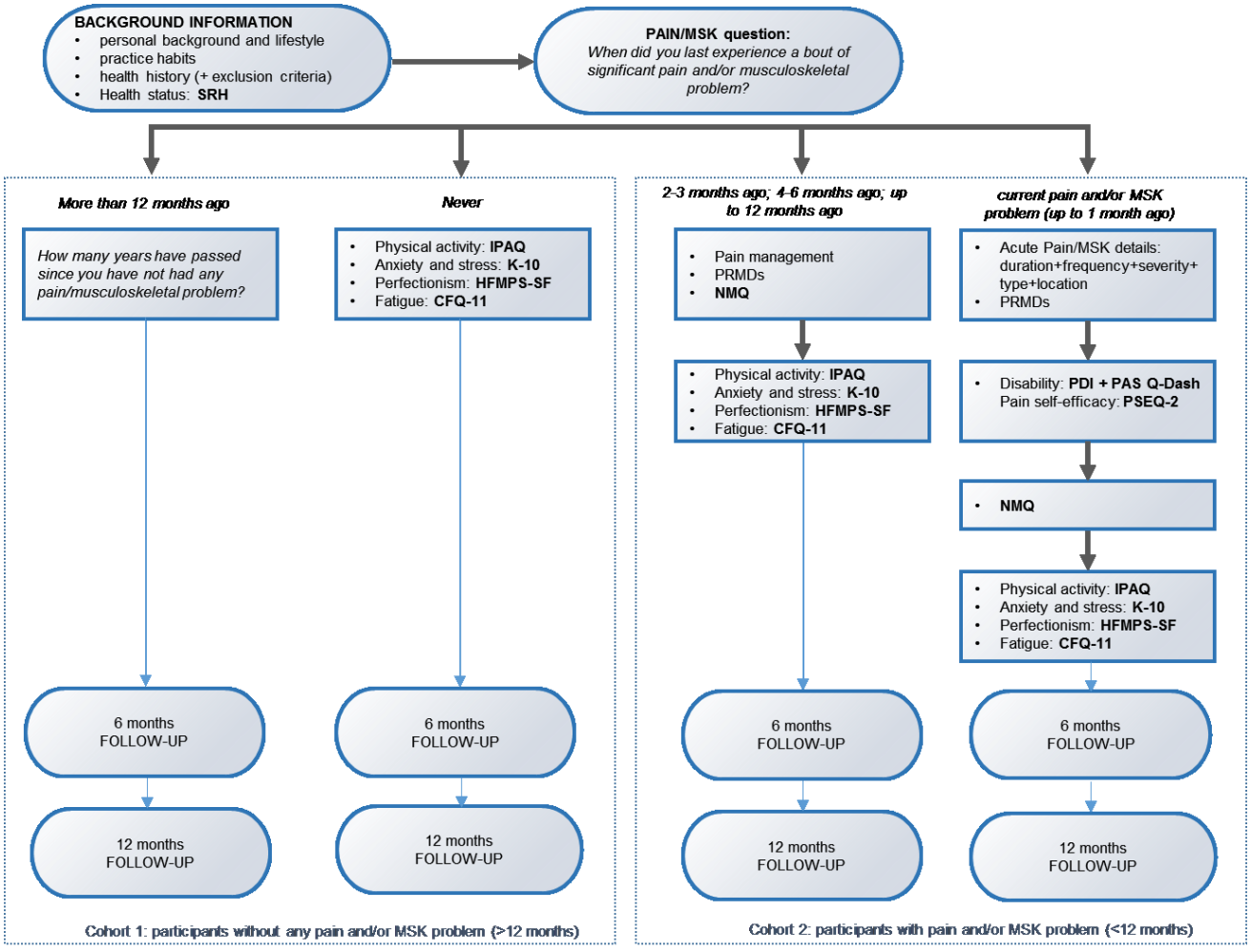

Figure 2 Procedure of the web-based survey

According to the answer to this question, students will be addressed to different web pages throughout the survey (Figure 2):

- Respondents with a current pain and/or MSK problem (up to one month) will be asked questions to describe their current pain, to report their disability with Pain Disability Index (PDI), the Performing Arts

Section of Quick Disabilities of the Arm, Shoulder and Hand Outcome Measure (PAS –Quick DASH) and their pain self-efficacy with 2-item short form of the Pain Self-efficacy Questionnaire (PSEQ-2), as well as the Nordic Musculoskeletal Questionnaire (NMQ) for the assessment of musculoskeletal pain in the last 12 months

- Respondents without a current pain and/or MSK problem but a positive history of pain and/or MSK problem in the last 12 months (2-3 months ago, 4-6 months ago or up to 12 months ago) will be asked to answer the NMQ and questions on pain management to investigate how their pain and/or MSK problem has been treated
- Respondents without pain or with pain and/or MSK more than 12 months ago will be directly addressed to the next section

All respondents will be addressed to the next section, including the outcome measures:
International Physical Activity Questionnaire – short form (IPAQ-SF) for the assessment of physical status
Kessler Psychological Distress Scale (K-10) for the assessment of anxiety and stress
Multidimensional Perfectionism Scale – short form (HFMPS-SF) for the assessment of perfectionism
The Chalder Fatigue Scale (CFQ-11) for the assessment of fatigue

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Afterwards, all students (including those who will choose the sixth option) will be addressed to:

- International Physical Activity Questionnaire – short form (IPAQ-SF) for the assessment of physical status
- Kessler Psychological Distress Scale (K-10) for the assessment of anxiety and stress
- Multidimensional Perfectionism Scale – short form (HFMPS-SF) for the assessment of perfectionism
- The Chalder Fatigue Scale (CFQ-11) for the assessment of fatigue

Data analysis

Descriptive statistics will be used to investigate all the outcomes after the baseline data collection.
Furthermore, comparisons of gender, study, prevalence rate and hours of practice between pre-college and university-level students of music will be performed.
Baseline variables will be categorized to permit the calculation of risk ratios and the 95% confidence intervals (CI) for the development of PRMDs. Tests for trend of relative risk across categories will be carried out using the chi-square test. In order to check for confounders, logistic regression will be performed, adjusting for age, gender and different musical instrument.
Sample size estimation is reported in Figure 1.
Both the follow-ups will permit longitudinal change in outcome scores to be generated and compared (longitudinal comparisons) for strength and progression of association, alongside those from absolute outcome scores at several cross-sectional analyses.
For the evaluation of the association between the variables (gender, instrument group, age, years of playing, hours of practice, and questionnaires' scores) and pain, PRMD and/or MSK problem incidence, univariate analysis will be performed. Afterwards, all predictor variables that are significantly associated with the

occurrence of PRMDs will be included in a multivariate regression model to estimate the mutually adjusted effect of predictors on PRMDs.

Data management

The answers to outcome measures will be recorded and collected using different databases according to the university in which the participants are enrolled. Data will be organised in spreadsheet (excel file) and named as follows: rismus_cruder_20181001-CODE.xls, with a specific code to ensure anonymity and confidentiality. The data will be accompanied by the following contextual documentation, according to standard practice for synthetic methodology projects:

1. Spreadsheet documents which detail the variables
2. Text files which detail the procedures

The final dataset as deposited in the chosen data repository will also be accompanied by a README file listing the contents of the other files and outlining the file-naming convention used.

Row data with all participants' responses will be transformed to processed data in order to find out a possible association between the variables (i.e. gender, instrument group, age, years of playing, hours of practice, and questionnaires' scores) and PRMDs' incidence. All variable names will be explained in the spreadsheet.

Storage and back up will be in three places:

• On Laptop of Cinzia Cruder, PhD student
• On a portable storage device (hard drive)
• On institutional collaborative storage (QMU software)

Cinzia Cruder will be responsible for the storage and back up of data.

Data generation, transmission, storage and analysis of health-related personal data within this project will follow strictly the current legal requirements for data protection, which will be guaranteed by handling with uttermost discretion and only be accessible to authorised personnel (i.e. PhD student and supervisors).

Data will be stored electronically in a security server of the Queen Margaret University after they are extracted from the Surveymonkey® servers.

Datasets from this work, which underpin a publication, will be deposited in the QMU Research Collection, and made public at the time of publication.

Details of the main research products will appear in text, tables, plots, and images in peer-reviewed journal articles and/or conference proceedings. Anonymity of the participants will be guaranteed when collecting information, analysing and publishing in scientific journals.

Files deposited in the Research Collection will be given a Digital Object Identifier (DOI). The retention schedule for data will be set to 4 years from date of deposition in the first instance, with possible extension for datasets which remain in regular use.

The DOI issued to datasets in the repository can be included as part of a data citation in publications, allowing the datasets underpinning a publication to be identified and accessed.

Metadata about datasets held in the Research Collection will be publicly searchable and discoverable and will indicate how and on what terms the dataset can be accessed.

Ethical considerations

The study will be carried out using self-reported evaluations and will involve human beings. Furthermore, anonymity of the participants will be guaranteed when collecting information, analysing or publishing in scientific journals. Individual participant's information obtained as a result of this research project will be considered confidential and disclosure to third parties will be prohibited. Participant's confidentiality will be further ensured by utilising identification code numbers to correspond to participants' information in the Surveymonkey® software and the computer files.

All participants will be informed that the participation in the study is voluntary and that they may withdraw from the study at any time.

An electronic consent of a participant will be obtained before the participant is submitted to any study procedure.

If a medical condition is discovered or suspected, respondents will be suggested to visit a medical doctor.

Moreover, at the end of the questionnaire all respondents will be provided with detailed information about all local medical doctors, physiotherapists and clinics, as well as research initiatives, and providers of medical support.

Resources and costs

Item	Quantity	Cost/Unit (£)	Cost (£)
Equipment/consumables			
Surveymonkey tool	2	367	734
Incentives for participating in the study (i.e. Amazon gift cards)	4	50	200
Subtotal			**934**
Travel			
Conference attendance			4'000
Subtotal			**4'000**
		Total	4'934

Project time plan

The project has three interrelated work packages (WP):

WP 1: Data collection

		Year 1				Year 2			
Activity	Milestones	T1	T2	T3	T4	T1	T2	T3	T4
Data collection	Participants' recruitment								
	First data collection (baseline)								
	1st follow-up								
	2nd follow-up								

WP 2: Data analysis and interpretation of the findings

		Year 1				Year 2			
Activity	Milestones	T1	T2	T3	T4	T1	T2	T3	T4
Data analysis and interpretation of the findings	Cross-sectional baseline analysis								
	Preliminary analysis of the results								
	Analysis of the results								
	Assessing and discussing the findings								
	Individuating possible trends								

WP 3: Dissemination

		Year 1				Year 2			
Activity	Milestones	T1	T2	T3	T4	T1	T2	T3	T4
Data dissemination	Preparing articles for publication								
	Participating in international conferences								
	Developing follow-up studies								
	Developing new preventive strategies								

Description:

T1 = September, October, November **T2** = December, January, February

T3 = March, April, May **T4** = June, July, August

Dissemination

To ensure that dissemination is one of the key targets in the project, a specific work package will be developed on dissemination (see WP3: Data dissemination). In this occasion, the objectives, work description and deliverables attached to the dissemination work package will be elaborated, and the variety of communication means and relevant target groups will be taken into consideration.

The objectives for the dissemination of the project are:

- to guarantee that research findings will be communicated to relevant target groups, both in the academic as in the scientific field;
- to develop a dissemination strategy, including dialogue with stakeholders form civic organizations, labour organizations, educational institutions and policy makers in each country.