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Work organization and mental health problems in PhD students

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ABSTRACT

Research policy observers are increasingly concerned about the potential impact of current academic working conditions on mental health, particularly in PhD students. The aim of the current study is threefold. First, we assess the prevalence of mental health problems in a representative sample of PhD students in Flanders, Belgium ($N = 3659$). Second, we compare PhD students to three other samples: (1) highly educated in the general population ($N = 769$); (2) highly educated employees ($N = 592$); and (3) higher education students ($N = 333$). Third, we assess those organizational factors relating to the role of PhD students that predict mental health status. Results based on 12 mental health symptoms (GHQ-12) showed that 32% of PhD students are at risk of having or developing a common psychiatric disorder, especially depression. This estimate was significantly higher than those obtained in the comparison groups. Organizational policies were significantly associated with the prevalence of mental health problems. Especially work-family interface, job demands and job control, the supervisor's leadership style, team decision-making culture, and perception of a career outside academia are linked to mental health problems.

1. Introduction

1.1. Mental health concerns at universities

In recent years, journalists, research policy observers and academics have voiced concerns about the potential impact of research conditions in universities on mental health problems (e.g. The Economist, 2012; Schillebeeckx et al., 2013; Shaw and Ward, 2014; Philips and Heywood-Roos, 2015). These concerns are often related to recent shifts in the organization of academic research, such as increased workloads, intensification and the pace of change (e.g. Petersen et al., 2012; Shen, 2015). For example, across OECD countries, the number of new PhDs (i.e. recipients of doctorate degrees) grew from 158,000 in 2000–247,000 in 2012, a rise of 56% (OECD, 2014). Encouragement by government policy, both at the national and international levels, has led to increased participation rates in the PhD production process (Robotham, 2008). An unfavorable shift in the labor-supply demand balance, a growing popularity of short-term contracts, budget cuts and increased competition for research resources may paint a bleak picture of academic careers for prospective PhD students (e.g. Biron et al., 2008; Petersen et al., 2012; Walsh and Lee, 2015).

Although universities were traditionally regarded as low stress environments, research on occupational stress among academics indicates that it is alarmingly widespread and on the rise (Bozeman and Gaughan, 2011; Reevy and Deason, 2014). Some studies suggest that stress is more prevalent in younger academics (see e.g. Kinman, 2001), a group that typically faces high levels of job insecurity. As a result, the media increasingly reports testimonies of depression and anxiety, burnout and emotional exhaustion. However, the prevalence of mental health problems as shown in official registries remains low. National figures in 2012 for higher education in the UK, for example, show that approximately one in 500 individuals disclosed a mental health problem to their university

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(Shaw, 2015). Reluctance to seek help is often caused by fear of stigma, retaliation or the expected negative impact on one's future career (OECD, 2015).

1.2. Why is the mental health of PhD students important for research policy?

While a genuine concern for individual well-being is probably the most important reason why policymakers should pay attention to mental health problems, we argue that mental health of PhD students should be of concern for three additional main reasons. First, the work of PhD students themselves constitutes a major source of scientific advancement, as a doctoral dissertation requires an original contribution to the scientific knowledge base. Furthermore, the publication of dissertation results is a prerequisite for an academic career (Roach and Sauermann, 2010), making dissertation work a major contributor to academic output (Hagen, 2010; Miller, 2013). Given the compelling evidence for the effects of mental health problems on individuals' research output (Danna and Griffin, 1999), it is to be expected that a sizable cohort of PhD students suffering from mental health problems may affect the overall quality and quantity of individuals' research output.

Second, as most PhD students are part of larger research teams, whose composition determines scientific impact (Lee et al., 2015), PhD students with mental health issues may pose a considerable cost to research institutions and teams. To date, research policy efforts seemed to have focused more on 'hard outcomes' such as publications, impact factors and patents, while ignoring the health effects of 'soft' policy outcomes, such as stress. However, soft outcomes may create serious financial costs for research institutions, and they will impact the functioning of the larger research teams that the individual researchers are part of, thus also determining 'hard' outcomes (see e.g. Goh et al., 2015a,b).

Third, mental health problems of PhD students impact both the supply and entrance to the research industry. Organizational policies that are linked to mental health problems will lead individuals to quit their PhD studies or leave the research industry altogether (Podsakoff et al., 2007). Several studies of PhD students suggest that the dropout numbers range from 30 to 50 percent, depending on the scientific discipline and country (Stubb et al., 2012). Such high turnover will make it difficult for the industry to attract new talent (Lievens and Highhouse, 2003), thus threatening the viability and quality of the academic research industry. Because economic competition between countries is heavily dependent on the nation's scientific advancement and cognitive ability (Rindermann and Thompson, 2011), the prospects of having trained academic researchers not further pursuing a research career because of mental health problems should be a major concern for research policy.

In sum, given the potential importance of mental health problems for research policy, there is an urgent need for systematic empirical data rather than anecdotal information on their prevalence and the organizational policies that are linked to them. Given the current lack of an empirical basis for mental health concerns and solutions, the current study has three aims. First, we aim to inform research policy by assessing mental health prevalence in a large-scale representative sample of PhD students in Flanders, Belgium. Second, to assess the scope of the problem, we compared the mental health of PhD students with that of three other samples, a group of highly educated adults in the general population, a group of highly educated employees and a group of higher education students. Third, with the aim of better understanding how research and organizational policies may relate to mental health, we examined PhD students' perceptions of the academic environment and linked them to mental health problems.

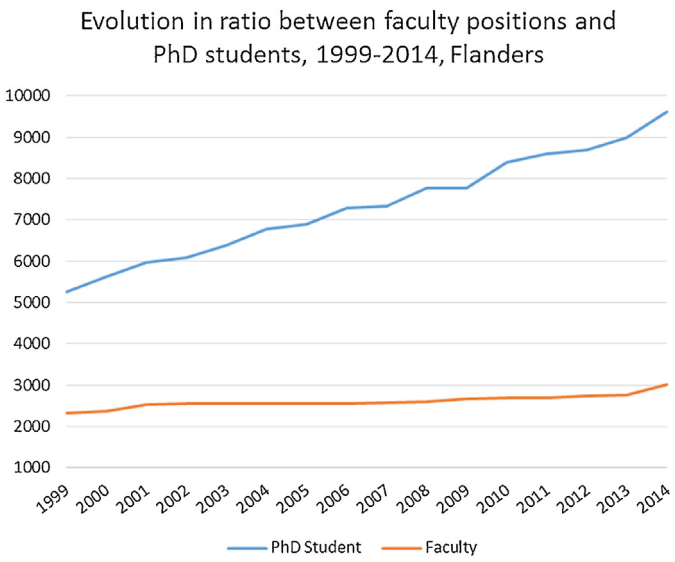

Fig. 1. Evolution in ratio between faculty positions and PhD students, 1999–2014, Flanders (Belgium).
Source: ECOOM (2015).

2. Background and literature review

2.1. PhD students in Flanders, Belgium

Flanders has seen a rise in PhD production that is substantially larger than in other EU countries: in the academic year 2013–2014, a total of 1724 new doctorates were awarded, which is an increase of 71% compared to 2004–2005 (ECOOM, 2015). To depict the overall characteristics of the PhD student experience in Flanders, we compared it to defining characteristics in the U.S. (see Table 1). While there is considerable overlap between the PhD models in the U.S. and Europe, the length of time-to-degree and the intensiveness of coursework seem the most notable differences. This is probably also the key characteristic of the Flemish PhD model that departs most from U.K. and U.S. models: there are only few compulsory classes that PhD students must attend, instead most of the emphasis is placed on doing actual research in close collaboration with their advisor(s).

Note that in Flanders, and in many European countries, a sizeable group of PhD students have a formal employment agreement with a university and have full-time working schedules and a full scholarship, providing them with a financial situation that is better than most of their counterparts on the private job market. Thus, in contrast to U.K. and U.S. systems, PhD students in this setting do not study on a part-time basis, which means they do not have to balance research with paid work in other areas. In the Flemish context, all universities are basically research universities, and most of their funding comes from the Flemish government. Over the past decade, research output has become an increasingly important determinant of the extent of the university's public funding. More specifically, the universities are encouraged (with financial means) to increase the number of PhDs awarded. As shown in Fig. 1, the number of faculty in Flanders has only marginally increased over the past 15 years, leading to an increased ratio of 3.2 PhD students per faculty member in 2014.

2.2. Prior research on mental health in the university sector

A growing line of research has examined mental health problems in academic contexts. Although this undertaking has clearly yielded a range of important insights, we believe it to be currently

Table 1
Context box: Similarities and differences between European and North American (U.S.) PhD programs.

Similarities
- Emphasis on independent, individual research aimed at an original contribution to scientific knowledge
- One or two main faculty advisors, assisted by a guidance committee and ultimately an examination board
- Provision of a structured PhD program with courses on specialist topics and transferrable skills
- Predominance of universities with centralized PhD program policies
- Wide availability of funding opportunities (depending on prior qualifications)
- Universities tend to cooperate with other PhD programs internationally, although internationalization in Europe is more pronounced than in the U.S.

Differences
- Fees. Considerable variation in fees in US higher education institutions, but generally higher than in Europe. In Belgium, the PhD program fee is less than €300 (around 325 USD). A similar fee is charged for the PhD defense.
- Degree. Unlike in the U.S., in most of Europe obtaining a Master's degree is not part of the PhD program, but an entrance requirement. In the U.S., most PhD programs require a Bachelor's degree (4 years of study) or a Master's degree.
- Variation in publication requirement. While publication requirements vary considerably across countries and disciplines, European PhD models may put more emphasis on having published research by the time of dissertation submission.
- Time-to-degree. Although there is significant variation between disciplines, median time-to-degree in the U.S. is 7 years (often due to the mandatory integration of a Master's degree), and, in Europe, 5 years.
- Finance. In the U.S., being accepted into a PhD program is often associated with a scholarship that not only pays the fees but also a stipend. In Belgium, the majority of PhD students has a fixed-term formal employment contract with the university (as research assistant or project researcher) or received a personal PhD scholarship. A small minority of PhD students are employed elsewhere or are unemployed.
- PhD program. In the U.S., more emphasis is put on formalized intensive coursework with PhD students needing to pass qualifying exams before they can proceed. In contrast, European PhD programs may put more emphasis on personal "on-the-job" training by an advisor.

Partly based on Coimbra Group (2016).

limited for drawing strong conclusions about the prevalence and determinants of mental health problems in PhD students, the focal aim of the current study. First, previous studies have been largely restricted to one specific discipline (especially health and social care) (e.g. El-Ghoroury et al., 2012), campus, department or university (see also Gillespie et al., 2001), and are therefore prone to reflecting discipline- or institution-related specificity. Second, the number of published studies focusing on mental health of PhD students is limited (El-Ghoroury et al., 2012), as most studies have focused on the undergraduate level (Peluso et al., 2011). Epidemiological studies provide a plethora of data demonstrating the steadily increasing rates of college students aged between 18 and 24 with diagnosable mental health problems, and there is evidence that students already begin their university careers with mood, anxiety and eating disorders (Blanco et al., 2008). The limited research that is available on graduate students suggests they may be vulnerable to developing depression (Peluso et al., 2011). Other studies, especially European and Australian ones, have tended to utilize samples of university employees in general and mostly reported aggregate findings (Kinman, 2008), making it difficult to draw fine-grained conclusions on the mental health of PhD students as a separate category. As task characteristics and research conditions within the academic population are subject to considerable variation, research focusing on specific features of the organizational environment that predict health outcomes for specific groups within universities is needed (see also Kinman, 2008).

Previous research on mental health in the university sector suggests that, in comparison with other professions and with the general population, levels of self-reported psychological health are generally low (Kinman, 2001). Reported prevalence rates vary considerably, depending on the sample, the specific health problem considered and the measurement instrument being used. Most studies have focused on psychological well-being, psychological distress, or on depression as a specific manifestation of distress. As the issue of mental health is complex and multidimensional, comparison of prevalence rates assessed with different measurement tools should be carried out with caution, as convergent validity between mental health measures is not always high (e.g. Shankman and Klein, 2002).

The most widely used measurement instrument in occupational health research, the General Health Questionnaire (GHQ), enables researchers to tap into both psychological distress and depression (Goldberg, 1972; Goldberg and Williams, 1988). In the university sector, the 12-item version of the GHQ (GHQ-12) has been used both in Australia and the U.K. Both categorical (see Table 2 below) and dimensional (e.g. Boyd et al., 2011) analytical strategies were employed. A categorical strategy assesses whether a mental health problem is present or absent. Such assessment is based on a specific cut-off value, which prescribes the minimum number of symptoms a person has to experience before a mental health problem is considered to be prevalent. In contrast, a dimensional assessment quantifies the extent to which a person has the mental problem. When assessing prevalence rates as in our study, the categorical approach to mental health is most convenient. In Table 2, we present an overview of published prevalence rates in the university sector from 2000 onwards, based on the GHQ-12. As can be seen in the last three columns of Table 2, studies vary in the number of GHQ symptoms required to be present before categorizing a person as psychologically distressed or ill. The GHQ2+ requires that a person experiences at least two GHQ symptoms, the GHQ3+ requires the presence of at least 3 symptoms and the GHQ4+ requires the presence of at least 4 symptoms.

As Table 2 shows, the prevalence of mental health problems as tapped by the GHQ2+, was found to be as high as 43.7% in a study of all staff at the University of Adelaide, Australia (Winefield and Jarret, 2001). GHQ3+ rates were calculated in several studies in the U.K., and range from 24% in men at a British university (Emslie et al., 2002) to 53% in academic and academic-related staff in several UK universities (Kinman, 2001). As for the GHQ4+, results from the U.K. vary from 31.8% in a study of lecturers and senior lecturers (McClenahan et al., 2007) to 41.8% in academic employees (Kinman and Jones, 2008).

2.3. Work organization and mental health problems in universities

While few studies have examined determinants of well-being in PhD students (Stubb et al., 2011), there is a long tradition of research in occupational health showing that work organization and health are highly intertwined. The central idea in occupational health research is that low levels of well-being, or the presence of ill health, is not simply an individual symptom, but results from an

Table 2
Prevalence of GHQ2+, GHQ3+ and GHQ4+ (based on the GHQ-12) in academia samples since 2000[a].

First author, year of publication, title	Population and location	Type of study and sampling strategy	No. of participants[b]	RR	Sample characteristics	GHQ2+	GHQ3+	GHQ4+
Winefield and Jarret (2001) Occupational stress in university staff	All staff from University of Adelaide	Cross-sectional study	2040	57%		43.7%	/	/
Kinman (2001) Pressure points: A review of research on stressors and strains in UK academics (see also Kinman and Jones, 2003; see also Kinman et al., 2006)	Academic and academic-related staff from UK universities	Cross-sectional study. Random sampling	782	37%	66% male 69% between 41–60y	/	53%	/
Emslie et al. (2002) Gender differences in mental health: Evidence from three organisations	White collar workers from a bank, a university and the civil service in the UK (only the data from the British university is presented)	Cross-sectional study	1641	67%	62% male Mean ages: 44y for men, 39y for women	/	Men 24%, women 27%	/
Winefield et al. (2003) Occupational stress in Australian university staff: Results from a national survey	Australian university staff (only the data for the academic staff is presented	Cross-sectional study	3711	25%		/	43%	/
McClenahan et al. (2007) The importance of context specificity in work stress research: A test of the demand-control-support model in academics	UK academics	Cross-sectional and non-random (only lecturers and senior lecturers were included)	166	23% (but not all respondents included in current study)	63% male Mean age 44y	/	/	31.8%
Kinman (2008) Work stressors, health and sense of coherence in UK academic employees	UK academics	Cross-sectional study. Random sample of 1000 UK academic employees working full time	465	47%	59% male Mean age 46y	/	/	43.4%
Kinman and Jones (2008) Effort-reward imbalance and overcommitment: Predicting strain in academic employees in the UK	UK academics	Cross-sectional study. Random sampling	844	22% (but not all respondents included in current study)	59% male 77% aged 40y or more	/	49%	41.8%

[a] Partly based on Goodwin et al. (2013).
[b] No. who completed GHQ (if differently).

imbalance between the individual and his environment, leading to stress (Stubb et al., 2011). For PhD students, the primary context for their roles as students and researchers is the university. The few studies on PhD students suggest that stress may stem from various problems in the PhD process, such as problems concerning one's own learning, different aspects of insecurity (financial insecurity, insecurity concerning unwritten rules), frequent evaluation, competitive atmosphere, supervision, relationships to faculty and peers, workload and work-life interface (Appel and Dahlgren, 2003; Kurtz-Costes et al., 2006; Stubb et al., 2011, 2012). Occupational health research provides an overarching framework by delineating the key determinants in the organizational context that may affect mental health and well-being.

2.3.1. Work context

Work roles and workload demands, job control, support by peers or supervisors, and job insecurity are the most frequently examined characteristics of the work context (e.g. WHO, 2010). Studies almost unanimously report a consistent link between high job demands and emotional exhaustion and depressive feelings (e.g. De Lange et al., 2004). While PhD students clearly have different roles, tasks and responsibilities to fulfill than regular employees do, we believe that there are a series of common psychological characteristics that make it useful to study PhD students' roles through the lens of the organizational context in which they perform their study and research work. For reasons of clarity, we use the commonly accepted terminology in occupational health psychology, with the clear understanding that work-related aspects, such as job demands, refer to the demands experienced by students in their specific study and research roles. Job demands are those physical, social or organizational aspects of the job that require sustained physical or mental effort. Job control on the other hand, refers to control over the work environment, more specifically over the pace of work, the timing of breaks, or the use of skills (Karasek and Theorell, 1990). Most, but not all, occupational health studies find significant emotional costs when job control is low (De Lange et al., 2004; Vanroelen et al., 2009). Existing research on occupational stress in university staff has consistently found work load to be one of the main causes of stress (e.g. Gillespie et al., 2001; Winefield et al., 2003; Kinman, 2001; Kinman et al., 2006; Tytherleigh et al., 2005; Biron et al., 2008; Sun et al., 2011; Mark and Smith, 2012; Boyd et al., 2011).

For PhD students, the balance between demands and control might be different across scientific disciplines as it entails differences in academic practice. Writing a doctoral dissertation in the natural sciences may entail working as part of a large team within a specific well-defined project, and operating with pre-defined, transparent quantitative publication criteria (Larivière, 2012). For PhD students in the humanities and social sciences, establishing one's own research idea (and thus often working in isolation) may constitute more of a challenge in terms of perseverance, given also the lack of consensus over the quality criteria in these fields (Long and Fox, 1995).

Another demand factor is the type of appointment. Depending on the type of appointment, researchers may experience role conflict, for instance, when juggling the demands of their PhD research and teaching obligations. At Flemish universities, there is significant variation in the types of appointment and the resulting demands. The types of appointment or scholarship vary in level of prestige, research autonomy and position security. In research on job stress of university staff, job insecurity has been identified as a major source of occupational stress (e.g. Gillespie et al., 2001; Kinman, 2001; Chandler et al., 2002; Winefield et al., 2003; Tytherleigh et al., 2005; Reevy and Deason, 2014).

Demands and control might also differ along the phase of the PhD process. In Flanders, most PhD students have no prior work experience, implying that the initial PhD phase is associated with taking on new roles, new tasks and responsibilities and entering into new relationships. New work environments might be stressful, and this can trigger, among other things, fear of failure (Ellis et al., 2015). Fear of failure might also be more prevalent at the end of a PhD track, when funding is running out and the submission deadline is rapidly approaching. This stress is often accompanied by the stress associated with making future career decisions.

Occupational health researchers have not only reported extensively on the health effects of job demands and job control, but also on the role of social support (Cox et al., 2000). Social support refers to support received by colleagues, by the supervisor, or both. Low support at work has long been found to affect levels of anxiety, emotional exhaustion, job tension and job satisfaction (e.g. De Lange et al., 2004; Vanroelen et al., 2009). In a Finnish study of 383 PhD students, Stubb et al. (2011) found that 44% reported the academic community as a source of empowerment, enthusiasm and inspiration, while 56% experienced it as a source of burden. Among the burdening factors were lack of meaningfulness, not knowing one's own place, and poor support for learning and doing research. A lack of social support has been identified as a major source of occupational stress in university staff (Gillespie et al., 2001; Biron et al., 2008). In addition, there is a body of research, closely related to social support, that shows significant associations between specific leadership styles, levels of stress and well-being (Kinman, 2001; Gillespie et al., 2001; Winefield et al., 2003; Tytherleigh et al., 2005; Biron et al., 2008). Research on graduate students has also shown that the quality of the advisory relationship is a significant predictor of depressive symptoms (e.g. Peluso et al., 2011).

As prior research has shown that both employment frustration (not finding the work one wants) and reward frustration (e.g. poor promotion prospects) have an impact on self-reported mental health (e.g. Castro et al., 2010), the current study will also examine the career prospects of PhD students. The majority of PhD students in Flanders is at the very beginning of their career. As the supply-side of PhD production steadily increases, and the demand-side of tenure track positions remains largely unaltered (see Fig. 1), more and more students turn to the nonacademic labor market after obtaining their PhD, often regarding this as a second-choice option (Van Damme, 2014).

2.3.2. Organizational context

Contrary to the work context, organizational context has received much less attention in occupational health research, and its effects on workplace health are not always well understood. Organizational context refers to participative management strategies, work-life programs and flexible work arrangements, or elements of high performance/lean production work systems (e.g. teamwork). As organizations have moved toward a greater team orientation over the last two decades, teamwork has become a day-to-day reality for many employees. A similar trend towards large teams has also been observed in research (Lee et al., 2015). A focal variable that has received much attention in research on teams is interpersonal conflict. Several studies have found evidence for the role of task and relational conflict on employee well-being (e.g. Martinez-Corts et al., 2015). Given that the need for teamwork might be higher in the natural sciences than in the humanities or social sciences, we control for disciplines in each analysis (see Section 4).

Another organizational factor presumed to influence health consists of participative management strategies. According to Kinman (2001), the social interaction patterns between university staff have shifted from a culture of collegiality to a bureaucratic culture and a management style in which consultation and participation in decision making are given less importance (see also Biron et al., 2008). Workers' participation in decision making has often been shown

to reduce job-related emotional strain, job dissatisfaction, absenteeism and turnover intentions (e.g. Rhoades and Eisenberger, 2002).

According to the WHO (2010), the interplay between work and home is also a significant potential source of stress impacting mental health, particularly for dual career couples and those experiencing financial difficulties or life crises. Prior research in the university sector has shown that work-life interference is high (e.g. Gmelch et al., 1984; Kinman and Jones, 2003; Fox et al., 2011; Sun et al., 2011), with PhD students and academic employees commonly working evenings and on the weekend (e.g. El-Ghoroury et al., 2012; Kinman, 2001). As in other settings, work-home conflict in the university sector has also shown particularly strong relations with psychological distress (Kinman and Jones, 2003; Kinman et al., 2006). In their cross discipline study in nine US research universities, Fox et al. (2011) show that it is important to consider both the conflict of work with family life and the conflict of family life with work. However, with the exception of Post et al. (2009), few studies among academics have addressed work-family conflict bi-directionally.

3. Data and methodology

3.1. Sample 1: PhD students

We used a sample of PhD students ($N = 3659$), drawn from a cross-sectional survey organized in 2013 addressing the total population of 12191 junior researchers in Flemish universities. For the current study, we included only those junior researchers enrolled in a PhD program. The survey consisted of a web-based questionnaire, administered in English or Dutch depending on the participant's choice. There were 4069 participants (response rate of 33%). Selective non-response analyses showed a slightly higher proportion of females, respondents in the youngest age categories, social scientists and Belgians compared to the total population.

3.2. Sample 2: comparison groups

The mental health data in Sample 1 are compared to mental health data for Flanders, extracted from the National Health Interview Surveys (HIS). These surveys are periodically organized in Belgium by the Scientific Institute of Public Health and follow a similar research design and procedures as for Sample 1. An extensive description of the methods, sampling frame, response rates and respondents is available (HIS, 2013). We used three specific groups from this sample as relevant 'comparison groups': a group of (1) highly educated individuals in the general population ($N = 769$); (2) highly educated employees ($N = 592$); and (3) higher education students ($N = 333$). Higher education refers to educational programs leading to an academic Bachelor, Master or Doctoral degree and to educational programs in higher education outside the university system (3–5 year programs). The first two comparison groups are extracted from the HIS 2013 sample. Due to the small number of higher education students in the HIS 2013, HIS data had to be pooled over the years 2001, 2004, 2008 and 2013 to attain a sizable third comparison group appropriate for statistical comparison. Preliminary analyses showed that pooling of HIS data over years was warranted as year of survey administration had no impact on mental health outcomes.

3.3. Variables

3.3.1. Mental health problems

Mental health problems were measured using the 12-item version of the General Health Questionnaire (GHQ) (Goldberg, 1972; Goldberg and Williams, 1988). The GHQ is a screening instrument to identify psychological distress and potential cases of common psychiatric disorder (especially depression), leaving the task of diagnosing actual disorder to a psychiatric interview (McDowell, 2006). The GHQ is the most frequently used scale worldwide to tap into psychological well-being (e.g. Boyd et al., 2011). The internal consistency of the GHQ-12 was 0.88 in Sample 1 and 0.87 in Sample 2. The 12 GHQ items are presented in Table 3.

GHQ items explore the respondent's experience in recent weeks compared to his or her usual experience. Response categories are item-specific but all responses are given on 4-point Likert-type scales. We adopt the GHQ scoring method, which uses a bimodal 0-0-1-1 scheme (to score subsequent response categories), conceiving the respondent's total number of 1 scores over the 12 items as an indication of the number of symptoms experienced. In order to determine that a person has a mental health problem, (s)he should experience a minimum number of symptoms. The literature reports substantial variation in the minimum number of symptoms to be considered (Goldberg et al., 1997). In the current study we opt for the GHQ2+ (presence of at least 2 symptoms), indicating psychological distress. We also assess the GHQ4+ (presence of at least 4 symptoms), indicating the risk of having or developing a common psychiatric disorder (especially depression) (Goldberg, 1972; Goldberg and Williams, 1988). A worldwide study on mental health by the World Health Organization suggests using the GHQ4+ if the mean GHQ score in the sample is higher than 2.70 (Goldberg et al., 1998). In Sample 1, the mean GHQ score is 2.84. However, for reasons of comparison with other studies on mental health in the

Table 3
Characteristics of PhD students, Flanders 2013 ($N = 3659$): percentage (%), mean (M), standard deviation (SD), minimum-maximum (Min-Max).

	%	M (SD)	Min-Max
Sociodemographics			
Female	52.01		
Age		28.37 (4.67)	22–71
Partner	71.16		
Children	13.48		
Work context			
Job demands		2.12 (0.45)	1–4
Job control		3.01 (0.39)	1–4
Scientific discipline			
Sciences	18.78		
Biomedical sciences	29.80		
Applied sciences	17.18		
Humanities	10.31		
Social sciences	23.92		
Type of appointment			
Assistant lectureship	15.93		
Scholarship	36.03		
Research project	26.31		
No funding by university	10.35		
Other	7.09		
Don't know	4.30		
PhD phase			
Initiating	21.57		
Executing	55.96		
Finishing	22.48		
Leadership style: inspirational		5.14 (1.15)	1–7
Leadership style: autocratic		4.05 (1.10)	1–7
Leadership style: laissez-faire		4.29 (1.25)	1–7
Much interest in an academic career	57.52		
Perception of high chance of an academic career	54.90		
Positive perception of career outside academia		3.43 (0.83)	1–5
Organizational context			
Team conflict		2.12 (0.75)	1–5
Closed team decision making		3.01 (0.93)	1–5
Family-work conflict		2.71 (1.02)	1–5
Work-family conflict		2.02 (0.85)	1–5

university sector (see Table 2), we also include the GHQ3+ (presence of at least 3 symptoms) when calculating prevalence.

Preliminary multigroup confirmatory factor analyses across both samples in our study attested to the stability of the measurement model underlying the GHQ.

3.3.2. Work context

The PhD student's work context was operationalized by job demands and job control, scientific discipline, type of appointment, PhD phase, the supervisor's level of inspirational leadership style, level of autocratic leadership style, and level of laissez-faire leadership style. Three indicators reflecting the PhD student's career perspectives were also included.

Job demands and job control were assessed using the Dutch VBBA-quality of labor questionnaire (Vanroelen et al., 2009). The job demands scale measures psychosocial demands such as work pace and work load (11 items), whereas the job control scale measures aspects of job variation, job autonomy and skill discretion (17 items). All items were measured on 4-point Likert scales. Internal consistency was 0.85 for the job demands scale and 0.88 for the job control scale.

Research discipline was measured by five categories: 1 = sciences; 2 = biomedical sciences; 3 = applied sciences; 4 = humanities; and 5 = social sciences. The type of appointment was assessed by registering the source of research funding. Six categories were distinguished: 1 = assistant lectureship; 2 = research scholarship; 3 = research project; 4 = no funding from the university, only enrollment as a PhD student; 5 = other; and 6 = don't know. Three categories distinguished between PhD phases: 1 = planning; 2 = executing; and 3 = finishing. Inspirational leadership style, autocratic leadership style, and 'laissez-faire' or passive leadership style were measured using 11, 6 and 4 items respectively (de Hoogh et al., 2004). All items were responded to on 7-point Likert scales, with response categories ranging from 'totally disagree' to 'totally agree'. Cronbach's alphas were 0.93, 0.78 and 0.74 for the three leadership styles, respectively.

Three variables measured the PhD student's career perspectives. First, interest in a career in academia was measured with one item, "To what extent are you interested in working at the university in the future?" (1 = not, 2 = a little, and 3 = much). We dichotomized this variable to facilitate interpretation into two categories, namely low interest (0 = not/a little) and high interest (1 = much). The second one-item measure targeted perceived chance of a career in academia, "How big do you perceive your chance of finding a job in academia?" Again, we dichotomized this variable into two categories: low likelihood (0 = (very) small chance/chance is neither small nor big) and high likelihood (1 = (very) big chance). Third, we measured one's perception of a career outside of academia with two 5-point Likert items (ranging from 'totally disagree' to 'totally agree'). Items were "A PhD in my field of study prepares one sufficiently for a career outside academia" and "A PhD in my field of study can represent added value for future employers outside of academia".

3.3.3. Organizational context

Team conflict was assessed using Jehn's (1995) Intragroup Conflict scale. All eight items represent 5-point Likert items on a scale ranging from 1 (none) to 5 (a lot). Cronbach's alpha for this scale was 0.92. Participative management strategy within the team was measured through closedness of decision making in the team with two 5-point Likert items (with response options ranging from 'totally disagree' to 'totally agree'): "only a limited number of people are involved in the decision-making process" and "when decisions are made, everyone's opinion is taken into account". Work-life interface was measured using the two widely adopted scales of family-work conflict (5 items) and work-family conflict (5 items) developed by Netemeyer et al. (1996). All items were rated on 5-point Likert scales ranging from 1 (totally disagree) to 5 (totally agree). Cronbach's alpha was 0.91 for the life-work conflict scale and 0.93 for the work-life conflict scale.

3.3.4. Sociodemographics

Four sociodemographic indicators were included as control variables: gender (0 = male, 1 = female), age (in years), having a partner (0 = no, 1 = yes), and the presence of children in the household (0 = no, 1 = yes).

3.4. Analytical strategy

To assess the differences in mental health problems between PhD students (Sample 1) and the highly educated population members in Flanders (Sample 2), we calculated percentages and risk ratios (RRs) for both samples. The RR is the ratio between the percentage respondents with a mental health problem in Sample 1 and the corresponding percentage in Sample 2. However, following common methodological practices in epidemiology (e.g. McNamee, 2005), an 'adjusted RR' was calculated as well. The adjusted RR statistically corrects for age and gender differences across samples. Technically, the adjusted RR is derived from data from the pooled samples (i.e. sample of PhD students and sample of highly educated general population) using a generalized linear model in STATA (Version 14.0), which includes three covariates, namely a sample indicator (dichotomous variable), age and gender (for technical details see McNamee, 2005).

Associations between mental health problems in PhD students and the independent variables in our two dependency models (Table 4) were estimated using odds ratios (ORs) as produced by the logistic regression procedure in SPSS (Version 22). The OR is a ratio describing (the strength of) the association between the presence or absence of a property (e.g. GHQ2+) and the presence or absence of another property (e.g. job demands). The significance of individual predictors is assessed by means of the Wald test, and their relative importance by relative weights (RWs). The RWs were calculated using procedures described by Tonidandel and LeBreton (2010). For interpretational purposes, percentages corresponding to the RWs were calculated as well. The overall goodness of model fit of both dependency models is quantified using Nagelkerke R^2 (Allison, 1999).

4. Results

As can be seen in Table 3, respondents were on average 28.37 years old, 52.01% was female, 71.16% had a partner, and 13.48% had one or more children.

In Table 4 we assessed the prevalence of mental health problems. Results showed that 51% of PhD students experienced at least two symptoms (GHQ2+), 40% reported at least three symptoms (GHQ3+), while 32% reported at least four symptoms (GHQ4+).

The percentages in columns 2–4 in Table 4 clearly demonstrate that, in terms of mental health problems, PhD students were consistently more affected (as indicated by the higher number of symptoms) than the highly educated general population, highly educated employees and higher education students. The RRs varied from 3.82 (could not face problems) to 1.16 (under constant strain). For psychological distress (GHQ2+), the prevalence was about twice as high in PhD students compared to the highly educated general population (RR = 1.90) and highly educated employees (RR = 2.02). The RRs for risk of a common psychiatric disorder (GHQ4+) was 2.43 and 2.84, respectively. For GHQ3+ we observed RRs of 2.26 and 2.56, respectively. Comparing PhD students with higher education students, we observed that differences in mental health were smaller than for the other comparison groups, but the prevalence

Table 4
Prevalence of common mental health problems in PhD students compared to three comparison groups, Flanders, 2013: %, risk ratio adjusted for age and gender (RR), 95% confidence interval (CI).

	PhD students	Comparison group 1: Highly educated general population			Comparison group 2: Highly educated employees			Comparison group 3: Higher education students		
Source	SJR	HIS			HIS			HIS		
Year of survey	2013	2013			2013			2001, 2004, 2008,2013		
	$N = 3659$	$N = 769$[a]			$N = 592$			$N = 333$[b]		
	%	%	RR	CI	%	RR	CI	%	RR	CI
Felt under constant strain	40.81	27.47	1.38	(1.18–1.62)	26.69	1.43	(1.20–1.70)	30.21	1.16	(0.96–1.42)
Unhappy and depressed	30.30	13.60	2.09	(1.65–2.65)	12.31	2.22	(1.70–2.91)	18.48	1.42	(1.09–1.84)
Lost sleep over worry	28.33	18.13	1.62	(1.32–2.01)	17.16	1.70	(1.35–2.15)	18.13	1.35	(1.03–1.76)
Could not overcome difficulties	26.11	12.00	2.36	(1.82–3.06)	10.57	2.71	(2.01–3.64)	12.69	1.85	(1.35–2.54)
Not enjoying day-to-day activities	25.41	13.07	2.21	(1.74–2.82)	12.31	2.39	(1.82–3.13)	10.88	1.68	(1.19–2.38)
Lost confidence in self	24.35	7.95	3.48	(2.52–4.79)	7.56	3.54	(2.47–5.06)	10.24	2.04	(1.43–2.91)
Not playing a useful role	22.46	9.20	2.33	(1.73–3.15)	8.15	2.54	(1.80–3.59)	10.88	1.78	(1.26–2.53)
Could not concentrate	21.74	10.67	1.94	(1.48–2.54)	9.01	2.14	(1.56–2.92)	10.57	1.53	(1.07–2.20)
Not feeling happy, all things considered	21.15	11.11	2.15	(1.64–2.81)	9.43	2.41	(1.77–3.29)	11.45	1.49	(1.05–2.10)
Felt worthless	16.17	5.30	3.40	(2.29–5.07)	4.30	4.11	(2.57–6.59)	4.22	3.16	(1.82–5.48)
Could not make decisions	14.95	6.00	2.74	(1.87–4.02)	5.03	2.97	(1.91–4.62)	6.04	2.16	(1.35–3.48)
Could not face problems	13.36	4.27	3.69	(2.39–5.68)	3.81	3.82	(2.34–6.24)	4.24	2.42	(1.38–4.25)
GHQ2+	51.11	26.80	1.90	(1.62–2.22)	24.96	2.02	(1.69–2.41)	30.61	1.53	(1.27–1.84)
GHQ3+	39.53	18.40	2.26	(1.85–2.75)	16.12	2.56	(2.03–3.22)	22.21	1.63	(1.29–2.06)
GHQ4+	31.84	14.00	2.43	(1.92–3.08)	11.79	2.84	(2.15–3.74)	14.55	1.85	(1.38–2.49)

[a] Including 14 PhDs.
[b] Including 1 PhD student.

remained higher in PhD students. The RRs were 1.53 for GHQ2+, 1.63 for GHQ3+ and 1.85 for GHQ4+.

Table 5 reports the findings of analyses examining whether characteristics of the work and organizational context of PhD students in Flanders were associated with their mental health, while controlling for sociodemographic characteristics.

The analyses revealed significant relationships with psychological distress (GHQ2+) and with the risk of having or developing a common psychiatric disorder (GHQ4+) in case of high job demands and low job control. For job demands, the model showed an OR of 1.896; this finding indicates that for a one-unit increase in job demands, we expect to see a 90% increase in the odds of experiencing psychological distress. The OR for job control in the same model was 0.784. In the model predicting the odds of having or developing a common psychiatric disorder, the ORs were 1.651 and 0.631, respectively. No differences between scientific disciplines were found. For type of appointment our findings showed that – compared to assistant lecturers – PhD students employed through project funding and those not knowing their funding resources showed significantly more psychological distress (ORs of 1.321 and 1.644, respectively). PhD students receiving project funding and those on a personal scholarship also showed higher risks of having or developing a common psychiatric disorder (ORs of 1.353 and 1.405, respectively). When turning to the PhD phase, we observed that mental health problems were less prevalent in the execution phase as compared to the beginning of the PhD process: the OR was 0.739 for the GHQ2+ and 0.674 for the GHQ4+. The prevalence of mental health problems was not significantly different at the beginning and at the end of the PhD process. Turning to the leadership style of the PhD supervisor, we see evidence for a better mental health in those PhD students who are advised by a professor with an inspirational leadership style (OR is 0.868 for GHQ2+ and 0.908 for GHQ4+). No significant associations were found between an autocratic leadership style and the experience of mental health problems. However, when PhD students were exposed to a laissez-faire leadership style, the risk of experiencing psychological distress significantly increased. For each unit increase on the laissez-faire scale score, the odds of experiencing psychological distress increased by 8%. Finally, we observed that PhD students expressing a high interest in an academic career are in better mental health than those with no or only little interest in remaining in academia. The OR was 0.824 for the GHQ2+ and 0.782 for the GHQ4+. The model showed that even if a PhD student perceived his/her actual chance of an academic career as low, aspiring a career in academia during one's PhD track was associated with a better mental health. The same can be said for a positive career perception for PhDs outside academia. Better mental health was found for those PhD students who thought that a PhD sufficiently prepares them for a career outside academia and consider a PhD in their field as an added value for future employers outside academia: the OR was 0.849 for GHQ2+ and 0.789 for GHQ4+.

Team conflict did not show a significant association with mental health of PhD students. Closedness of decision making within the team showed health damaging associations. The OR of 1.205 means that the odds of having or developing a common psychiatric disorder increases by 20% for each unit increase on the closedness of decision-making scale. Finally, considering the work-family interface, we observed significantly more mental health problems in case of conflicting demands. Both family-work conflict and work-family conflict show higher odds of psychological distress (ORs of 1.206 and 1.521, respectively) and an increased risk of having or developing a common psychiatric disorder (ORs of 1.296 and 1.522, respectively).

The odds of experiencing at least two psychological symptoms were 34% higher for female PhD students than for males (OR = 1.336); the odds of having at least four symptoms was 27% higher (OR = 1.273). Age was not significantly associated with mental health. The OR for having partner was 0.779 for GHQ2+, indicating that having a partner was associated with lower levels of psychological distress. The association with GHQ4+ was in the same direction, but not statistically significant. As for having children in the household, Table 5 shows that there was no association with GHQ2+. However, there was a significant OR of 0.653 for the GHQ4+, indicating that those persons having one or more children in the household showed significantly lower odds of having or developing a common psychiatric disorder.

While several of the predictors listed in Table 5 showed significant associations with GHQ2+ and GHQ4+, a relative weights analysis (% RW) indicated that not all predictors were equally important. Most important was work-family conflict (% RW = 34.1% and 29.8% for GHQ2+ and GHQ4+, respectively), and this was more important than family-work conflict (% RW = 10.2% and 12.2%

Table 5
Predictors of common mental health problems in PhD students, Flanders 2013 ($N = 3659$): odds ratio (OR), 95% confidence intervals (95% CI), level of significance, relative weights (RW – only reported when $p < 0.05$).

	GHQ2+ Psychological distress					GHQ4+ Risk of having or developing a common psychiatric disorder				
	OR	95% CI	Sign	RW	% RW	OR	95% CI	Sign	RW	% RW
Constant	0.089		***	–	–	0.299			–	–
–										
Work context										
Job demands	1.896	(1.495–2.406)	***	0.0353	25.8	1.651	(1.293–2.109)	***	0.0269	19.3
Job control	0.784	(0.627–0.981)	*	0.0079	5.8	0.631	(0.499–0.798)	***	0.0128	9.2
Scientific discipline			n.s.	n.s.	–			n.s.	n.s.	–
Sciences (ref)	–	–	–	–	–	–	–	–	–	–
Biomedical sciences	0.812	(0.638–1.032)	n.s.	n.s.	–	0.784	(0.604–1.018)	n.s.	n.s.	–
Applied sciences	1.104	(0.851–1.433)	n.s.	n.s.	–	1.019	(0.769–1.350)	n.s.	n.s.	–
Humanities	0.994	(0.724–1.364)	n.s.	n.s.	–	0.909	(0.649–1.273)	n.s.	n.s.	–
Social sciences	0.889	(0.700–1.154)	n.s.	n.s.	–	0.871	(0.664–1.143)	n.s.	n.s.	–
Type of appointment			n.s.	n.s.	–			n.s.	n.s.	–
Assistant lectureship (ref)	–	–	–	–	–	–	–	–	–	–
Scholarship	1.256	(0.992–1.591)	n.s.	n.s.	–	1.405	(1.082–1.824)	*	0.0009	0.6
Research project	1.321	(1.032–1.693)	*	0.0010	0.7	1.353	(1.032–1.774)	*	0.0010	0.7
No funding by university	1.133	(0.816–1.572)	n.s.	n.s.	–	1.235	(0.868–1.757)	n.s.	n.s.	–
Other	1.334	(0.929–1.945)	n.s.	n.s.	–	1.264	(0.844–1.893)	n.s.	n.s.	–
Don't know	1.644	(1.064–2.540)	*	0.0007	0.5	1.410	(0.883–2.254)	n.s.	n.s.	–
PhD phase			*	0.0024	1.8			**	0.0037	2.6
Initiating (ref)	–	–	–	–	–	–	–	–	–	–
Executing	0.739	(0.602–0.907)	**	0.0024	1.8	0.674	(0.541–0.840)	***	0.0037	2.6
Finishing	0.805	(0.621–1.043)	n.s.	n.s.	–	0.778	(0.592–1.024)	n.s.	n.s.	–
Leadership style: inspirational	0.868	(0.798–0.943)	***	0.0103	7.5	0.908	(0.833–0.989)	*	0.0081	5.8
Leadership style: autocratic	0.968	(0.896–1.046)	n.s.	n.s.	–	0.929	(0.856–1.009)	n.s.	n.s.	–
Leadership style: laissez–faire	1.084	(1.015–1.158)	*	0.0039	2.9	1.045	(0.974–1.121)	n.s.	n.s.	–
High interest in an academic career	0.824	(0.699–0.972)	*	0.0022	1.6	0.782	(0.656–0.933)	**	0.0030	2.1
Perception of high chance of an academic career	1.064	(0.903–1.254)	n.s.	n.s.	–	1.014	(0.850–1.210)	n.s.	n.s.	–
Positive perception of career outside academia	0.849	(0.765–0.943)	**	0.0067	4.9	0.789	(0.707–0.882)	***	0.0103	7.4
Organizational context										
Team conflict	1.057	(0.936–1.194)	n.s.	n.s.	–	1.050	(0.926–1.190)	n.s.	n.s.	–
Closed team decision making	1.100	(0.995–1.216)	n.s.	n.s.	–	1.205	(1.082–1.342)	**	0.0099	7.1
Family-work conflict	1.206	(1.083–1.344)	***	0.0139	10.2	1.296	(1.162–1.445)	***	0.0171	12.2
Work-family conflict	1.521	(1.363–1.697)	***	0.0467	34.1	1.522	(1.354–1.710)	***	0.0417	29.8
Sociodemographics										
Female	1.336	(1.130–1.579)	***	0.0036	2.6	1.273	(1.063–1.524)	**	0.0023	1.6
Age	0.994	(0.971–1.017)	n.s.	n.s	–	1.001	(0.977–1.026)	n.s.	n.s.	–
Partner	0.779	(0.651–0.932)	**	0.0022	1.6	0.855	(0.706–1.035)	n.s.	n.s.	–
Children	0.824	(0.626–1.084)	n.s.	n.s.	–	0.653	(0.487–0.877)	**	0.0020	1.4

Legend: ref = reference category RW = relative weight n.s. = not significant, * = p < 0.05 ** = p < 0.01 *** = p < 0.001, Model fit GHQ2+: LR = 498.84 df = 27 p < 0.001 Nagelkerke $R^2 = 0.2023$, Model fit GHQ4+: LR = 475.181 df = 27 p < 0.001 Nagelkerke $R^2 = 0.2036$

for GHQ2+ and GHQ4+, respectively). Job demands (% RW = 25.8% and 19.3% for GHQ2+ and GHQ4+, respectively) and, to a lesser extent, job control were also important (% RW = 5.8% and 9.2% for GHQ2+ and GHQ4+, respectively). Inspirational leadership style (% RW = 7.5% and 5.8% for GHQ2+ and GHQ4+, respectively), and closed decision making were moderately important but the latter only for GHQ4+ (% RW = 7.1%). The smaller size of the % RWs (all below 5%) indicate that type of appointment, PhD phase and interest in a future academic career were less important than other features of the work organization incorporated in our models.

Finally, the regression equation relating work context factors to psychological distress showed significant predictive power. The value of the Nagelkerke R2 (pseudo R2) was 0.202 for the GHQ2+ and 0.204 for the GHQ4+, which were reasonable effect sizes for psychological research in the workplace (Bosco et al., 2015; Landry et al., 2006).

5. Discussion and conclusion

5.1. Contributions

Official registration of both staff and student mental health problems (e.g. depression, anxiety, burnout or emotional exhaustion) by universities is relatively low, which seems to be in stark contrast with the picture painted in media reports. From an evidence-based research policy management perspective, systematic empirical data collection on the prevalence of mental health problems and the organizational policies that are linked to them is urgently needed. Our study contributes to this necessity in four ways.

First, we provide empirical estimates for the prevalence of mental health problems in PhD students on the basis of representative data covering all disciplines and all universities in Flanders, Belgium. Previous research on well-being and mental health in academia has usually been restricted to one specific discipline or university.

Second, by adopting the widely used GHQ-12, our study provides an accessible benchmark for future studies on mental health problems in the university sector thereby strengthening the evidence base for accurate research policy management. Our study enables a comparison of the prevalence of mental health problems with many different groups in and outside of the university, whether they are specific occupational groups, groups of students, or the general population.

Third, our study empirically documents the link between organizational factors and the mental health of PhD students. Compared to existing studies on mental health in academia, our study's focus is exclusively on students pursuing a PhD. As task characteristics and working conditions for PhD students might be quite different from other academic groups, fine-grained research identifying the specific organizational factors predicting an individual's mental health is particularly important from a research policy perspective.

Fourth, our study extends previous research on mental health in the sector by considering work-life conflict bi-directionally and by adding data on future career prospects to a series of well-known organizational stressors found in the work environment. Findings have shown that considering the bi-directionality of work-life conflict is informative from a management perspective, as the relative impact of both predictors on mental health is quite different.

5.2. Summary of main findings

Our study shows that 51% of the PhD students in Flanders report at least two symptoms on the GHQ-12 (GHQ2+), 40% report at least three symptoms (GHQ3+), while 32% experience at least four symptoms (GHQ4+). These prevalence rates suggest that a sizeable group of PhD students experience psychological distress or is at risk of having or developing a common psychiatric disorder. Most prevalent are feelings of being under constant strain, unhappiness and depression, sleeping problems due to worries, inability to overcome difficulties and not being able to enjoy day-to-day activities. The prevalence of having or developing a common psychiatric disorder was 2.43 times higher in PhD students compared to the highly educated in the general population. It was 2.84 times higher compared to highly educated employees and 1.85 times higher compared to higher education students.

Multivariate analyses show that work-family conflict is the most important predictor of both psychological distress and a risk of a common psychiatric disorder in PhD students. Another strong predictor is job demands, followed by family-work conflict, job control and inspirational leadership style. A closed decision making culture was found to have a significant impact on risk of psychiatric disorder only.

5.3. Limitations and alternative explanations

Three important limitations are worth mentioning. The first pertains to the interpretation of our study findings. Is working at a university bad for one's mental health? Or, alternatively, are individuals who start on a PhD track more vulnerable to developing mental health problems (self-selection)? Our cross-sectional dataset does not allow us to draw conclusions about causality. A potential alternative interpretation of our findings could, for instance, be that PhD students experiencing mental health problems are more likely to evaluate their environmental conditions negatively. However, the vast number of studies examining causal links between organizational factors and the onset of mental health problems in occupational health research in other settings suggests that the work environment is at least partially responsible for the prevalence of mental health problems observed in the current study.

A second limitation pertains to the generalizability of our findings. Our data consists of PhD students from all scientific disciplines at all universities in Flanders (Belgium). It could be that our findings are idiosyncratic to the Flemish academic landscape. To shed light on the extent of generalizability, we included a context box (see Table 1), which compares characteristics of PhD models in the US and Europe. While some differences may potentially limit generalizability (e.g. intensiveness of coursework), we believe most of the factors in the academic environment should be reasonably comparable from an occupational health perspective. Furthermore, given the international orientation of the academic work environment, with high mobility of researchers across countries, we would expect that research organization factors rapidly spread across the globe, thus making the PhD experience in all probability comparable across countries. Of course, future cross-national research is needed to make stronger claims about generalizability. One noteworthy aspect that should receive attention in future cross-national research is the financial situation of PhD students. Most PhD students in Flanders receive a scholarship or are formally employed by a university. Studies in other countries have shown that financial worries and debts are one of the major stressors experienced by those working towards a PhD (Biron et al., 2008; El-Ghoroury et al., 2012). As financial worries and debts are probably not a crucial issue for PhD students in Flanders, if anything, we would expect that the prevalence of mental health problems is even higher in those countries where PhD candidates have more financial difficulties.

A third limitation pertains to the measurement of mental health. The GHQ4+ is a probabilistic measurement for psychiatric caseness, and advises medical attention to be sought for the reported problems (McDowell, 2006). The diagnosis as to whether an individual actually *has* a clinically significant disorder must be assessed by psychiatric interview. Assessments of mental health problems based on scales such as the GHQ are useful in understanding various sources of distress as well as any predisposing factors. However, the results of such assessments are preferably not used in isolation but rather combined with other information of distress or mental health problems (such as absence due to sickness, poor productivity or increased turnover) (Jackson, 2007).

5.4. Policy implications

Because of the widespread stigma and implicit beliefs, mental ill-health is a key issue for labor market and social policies that has long been neglected (OECD, 2015). In recent years, however, OECD governments have shifted their focus towards mental health, developing specific policies to promote mental health in their citizens (OECD, 2015). We believe the current study should urge research policymakers to make a similar directional shift. The high prevalence of mental health problems in PhD students is critical in terms of individual suffering, organizational and societal costs. In the long run, however, it will also impact on research itself.

What can research policymakers do? First, they should emphasize prevention by raising awareness and by developing mental health competence in recognizing and dealing with problems at the right time. As a second focus, policy research makers may want to screen their own policy rules, especially those underlying research funding and employment conditions. For instance, a gradual increase in governmental research investments in the number of PhD scholarships and financial incentives for universities to increase the number of PhDs could have unforeseen side effects (see Fig. 1). A higher number of PhD students for each advisor could imply that faculty may find it more difficult to invest sufficient time and attention in each PhD student. Our findings suggest that the type of leadership experienced by PhD students, and particularly a lack of inspirational leadership, was associated with a higher risk for mental health problems. In contrast, governmental research

policies that allow advisors to invest in developing an inspirational influence towards their PhD students could buffer against stress (LePine et al., 2016). Similarly, an increase in the number of PhD students versus stability in the number of faculty positions may give graduating PhD students bleak career prospects, in which supply exceeds demand for professionals with a PhD. Our findings indeed show how career prospects (both in and outside academia) were a determinant of mental health problems. Stephan and Levin (2001) have shown that such a situation not only impacts mental health, but weakens the implicit psychological contract between PhD students and the research team in which they are doing their research, thus directly affecting research performance. Although these hypothetical links await further research, they illustrate how policymakers should take into account potential negative effects of macro governmental research policies on individual mental health. A third focus might be on the protection of employees with mental health problems, starting with a more systematic collection and monitoring of mental health data.

Second, what can universities do? By increasing their efforts of systematically mapping and monitoring the stressors and stress outcomes in their organization, they may develop a risk management approach (WHO, 2015) to identify "general" risk factors affecting everyone in the organization or "specific" risk factors affecting only specific categories. Our analyses suggest that universities will benefit in terms of PhD students' mental health when they facilitate management of work-family balance and workload, design open decision-making procedures, and help PhD supervisors to adopt leadership styles that lead to satisfactory and constructive work relations. Our findings also suggest that universities might benefit from offering PhD students clear and full information on job expectations and career prospects, both in and outside academia.

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