

Days out of role due to common physical and mental conditions: results from the Northern Ireland study of health and stress

Quantifying the societal impacts of physical and mental disorders on functioning in order to influence social policy decisions about investing in healthcare is an important component of research into the societal burden of these conditions (ACOEM Guidance Statement, 2009; Davis et al., 2005; Suhrcke et al., 2008; Loeppke et al., 2009). Data from the World Mental Health Surveys show that “common health conditions, including mental disorders, make up a large proportion of the number of days out of role across a wide range of countries and should be addressed to substantially increase overall productivity” (Alonso et al., 2011). Estimates suggest 3.6 billion annual health-related days out of role in the US (Merikangas et al., 2007). Another report estimated that the annual human capital costs of health-related days out of role in Europe exceed 136 billion Euros (Andlin-Sobocki et al., 2005).

Whilst this study gives an overall global evaluation of the situation, more recently there has been an increasing emphasis on considering different countries individually, given their unique social, economic and political situations. For example, Brazil and South Africa have been studied separately given that they represent low/middle income countries (Andrade et al., 2013, Mall et al., 2015). Similarly, given the position as a culture with vast experience of violence and economic strain over the past 30 years, but currently in the process of reconstruction, Al_Hamzawi et al. (2014) studied days out of role separately within the Iraq population.

Northern Ireland also represents a unique situation, particularly with regard to mental health. Despite the formal end to conflict in Northern Ireland in 1999, a substantial proportion of the population continues to suffer the adverse mental health effects of chronic trauma exposure (Ferry et al., 2014). Previous papers based on the Northern Ireland Study of Health and Stress (NISHS) reveal that mental health disorders pose a substantial burden among the Northern Ireland

1 population, with rates of mood, anxiety and substance disorders among the highest across countries
2 that have produced comparable estimates (Bunting et al., 2011; Bunting et al., 2013).
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4 A recent report found that lost output among individuals with mental health disorders
5 accounted for a substantial proportion of the overall economic costs (£789 million in 2002-3), far
6 outweighing the direct costs of care (Northern Ireland Association for Mental Health, 2004).
7 However, importantly given the unique health profile, no studies can be identified in Northern that
8 focus specifically on days out of role. It is also important to quantify the relative importance of
9 specific disorders in accounting for these effects and to evaluate the extent to which expanded
10 outreach and best-practices treatment of the disorders associated with the largest losses reduce these
11 effects. The first step in such a program of research should be to distinguish relative effects of
12 specific disorders.
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26 This requires epidemiological data on a broad range of disorders so as to adjust for the high
27 rates of comorbidity within and between physical and mental disorders (Von Korff, 2009; Stang et
28 al., 2006). The current report presents data of this sort from the World Health Organization (WHO)
29 World Mental Health (WMH) Surveys (www.hcp.med.harvard.edu/WMH) Northern Ireland Study
30 of Health and Stress (NISHS). The WMH Initiative was launched by the WHO to carry out general
31 population surveys in countries throughout the world to assess the prevalence and correlates of
32 mental disorders. WMH data from the NISHS are used in this report to examine these relative
33 effects on days out of role in the month before interview. The novel methods employed by the
34 World Mental Health studies are also employed here as estimation of effects, whilst adjusting for
35 comorbidity.
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50 **Methods**

51 *Sample*

52 The NISHS was based on a probability sample of the adult household population (those aged 18
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1 probability sample of household residents. The NISHS is a representative survey of English
2 speaking household residents aged 18 years and older in NI (Ferry et al., 2014). The NISHS is the
3 first epidemiological survey of mental health to produce unbiased estimates of a range of mental
4 health and behavioural disorders according to validated international diagnostic criteria, namely
5 DSM-IV and ICD 10 (Ferry et al., 2014). The overall sample includes 4340 adults, representing a
6 response rate of 68.4%. More details about sampling are provided elsewhere (Heeringa et al., 2008).
7 All NISHS interviews were administered face-to-face by trained lay interviewers using training, and
8 field quality control procedures described elsewhere (Kessler & Üstün, 2008; Pennell et al., 2008;
9 Harkness et al., 2008).

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22 Ethical approval was granted by the host institution, whose principles are compliant with the
23 Helsinki Declaration on ethical principles for medical research involving human subjects. Informed
24 consent was obtained before beginning interviews using procedures approved by the ethics
25 committee of the hosting institution. Each interview had two parts. Part I, which was administered
26 to all respondents (N=4340), contained assessments of core mental disorders. All Part I respondents
27 who met criteria for any core mental disorder plus a probability sub-sample of other Part I
28 respondents were administered Part II, which assessed correlates and disorders of secondary interest
29 to the study. The assessment of physical disorders was included in Part II. Part II is consequently
30 the focus of the current report and is based on analysis of 1708 NISHS respondents. The Part II data
31 were weighted to adjust for the under-sampling of Part II non-cases and to adjust for residual
32 discrepancies between sample and population distributions on a range of socio-demographic and
33 geographic variables.

34 ***Measurement***

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66 ***Mental disorders:*** Mental disorders were assessed with Version 3.0 of the WHO Composite
International Diagnostic Interview (CIDI), a fully structured lay-administered interview designed to
generate research diagnoses of common mental disorders according to the definitions and criteria of

1 both the DSM-IV and ICD-10 diagnostic systems (Kessler & Ustun, 2004). The mental disorders
2 considered here include any mood disorder (major depressive disorder, bipolar I-II disorder), any
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4 anxiety disorders (panic disorder and/or agoraphobia, specific phobia, social phobia, generalized
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6 anxiety disorder, post-traumatic stress disorder) and any substance disorders (alcohol abuse with
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8 and without dependence, drug abuse with and without dependence).
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11 ***Chronic physical disorders:***
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14 Physical disorders were assessed with a standard chronic disorders checklist. Checklists of this sort
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16 have been shown to yield more complete and accurate reports of disorder prevalence than estimates
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18 derived from responses to open-ended question (Center for Disease Control and Prevention. Health,
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20 United States, 2004; Schoenborn et al., 2000). Reports based on such checklists have been shown in
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22 previous studies to have moderate to good concordance with medical records (Knight et al., 2001;
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24 Baker et al., 2001). The conditions considered here are: arthritis, cardiovascular disorders (heart
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26 attack, heart disease, hypertension, stroke), chronic pain conditions (chronic back or neck pain,
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28 other chronic pain), diabetes, migraines or other frequent or severe headaches, insomnia, digestive
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30 disorders (stomach or intestinal ulcers, irritable bowel disorder), and respiratory disorders (seasonal
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32 allergies, asthma, COPD, emphysema). The symptom-based disorders in this set (arthritis, pain
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34 disorders, heart attack, stroke) were assessed with respondents reports as to whether or not they ever
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36 experienced the disorder, while the remaining conditions were assessed with respondent reports of
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38 whether or not a doctor or other health professional ever told them they had the disorder. Questions
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40 about persistence were also asked about lifetime disorders that can remit. The focus in this report is
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42 on disorders present in the 12 months before interview.
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51 ***Days out of role:***
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54 A modified version (Von Korff et al., 2008) of the WHO Disability Assessment Schedule (WHO-
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56 DAS) (WHO, 2010; Kessler et al., 2003)) was used to ask respondents the number of days in the 30
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58 days before interview (i.e., *beginning yesterday and going back 30 days*) they were totally unable to
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work or carry out your normal activities because of problems with either your physical health, your mental health, or your use of alcohol or drugs. Good concordance of these reports have been documented both with payroll records of employed people (Kessler et al., 2003; Revicki et al., 1994) and with prospective daily diary reports (Kessler et al., 2004) .

Statistical analysis

Multiple regression analysis was used to examine the associations of the physical and mental disorders assessed in the survey. Days out of role are reported in the past 30 days controlling for age, gender, employment status, and education. As substantial comorbidity was found among the disorders (Gureje, 2009), we included terms to capture the effects of comorbidity in the regression models. Given that the number of possible combinations of comorbid disorders in the data ($2^{11} - 20 = 2028$) exceeds the number of respondents, it was necessary to impose some structure on the terms used to capture the effects of comorbidity. This was done by including a term equal to the sum of regression coefficients for each disorder respondents had, as well as an interaction of this term with each disorder. This term called a ‘score’ is only positive for respondents with at least two comorbid disorders. Nonlinear regression methods requiring iterative estimation procedure (Seber & Wild, 1989) were used for this purpose. This is needed to identify this model because each score is constructed from coefficients estimated at the previous iteration of the model. This approach is continued until the scores converge.

As the outcome variable (a 0-30 measure of number of days out of role) was highly skewed, we investigated a number of different model specifications that included an ordinary least squares regression model and six generalized linear models (GLM) that considered the conjunction of two link functions (logarithmic or square root) and three error structures (constant, error variance proportional to the mean and error variance proportional to the mean squared). Standard diagnostic procedures to compare model fit (Buntin & Zaslavsky, 2004), showed that GLM with a log link

1 function and constant variance was the best-fitting model. (Detailed results of model comparison
2 are available under request).
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4 As the prediction equation includes interaction terms, the predictive effect of each disorder
5 is distributed across a number of different coefficients. Simulation was used to produce a single
6 term to summarize all these components' effects. This was done by estimating the predicted value
7 of the outcome for each respondent from the coefficients in the final model (the *base* estimate) and
8 then repeating this exercise in modified form 11 different times, each time assuming that one of the
9 11 disorders no longer existed. The difference between the predicted mean of the outcome
10 generated by the simulated estimate and the base estimate was divided by the number of
11 respondents with the disorder in question to obtain the estimated individual-level effect of the
12 disorder on the outcomes. The estimated societal-level effect of the disorder was then obtained by
13 multiplying the individual-level estimate by the prevalence of the disorder. The same procedure was
14 used to calculate total effects of any physical disorder, any mental disorder, and any disorder.
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31 The fact that the Northern Ireland survey data are geographically clustered and weighted
32 means that design-based methods were needed to obtain accurate estimates of standard errors and
33 statistical significance. The Taylor series linearization method (Wolter, 1985), implemented in SAS
34 (SAS, 2002-2003), was used to do this for the basic model. The more computationally intensive
35 method of Jackknife Repeated Replications (Kriegsman et al., 1996) implemented in a SAS macro
36 that we wrote for this purpose was used to obtain standard errors of the simulated estimates of
37 individual-level and societal-level disorder effects. Significance tests were consistently evaluated
38 using .05-level, two-sided design-based tests.
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51 **Results**

52 *The distribution of days out of role*

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1 Among the overall NISHS sample 16.8% of respondents reported any days out of role (Table 1).

2 Those with high levels of days out of role (21-30 days) accounted for 34.4% of this figure. The
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4 mean number of health-related days out of role in the previous month was 2.3 in the sample.
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7 **(Table 1 about here)**
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9 ***Disorder prevalence estimates***
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11 Almost two thirds (60.6%) of respondents in the NISHS reported one or more of the
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13 physical/mental disorders considered. The proportion that reported at least one physical disorder
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15 (54.4%) is considerably higher than the proportion that reported any mental disorder (19.1%).
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18 Chronic pain disorders (arthritis and pain) are among the two most commonly reported disorders in
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20 Northern Ireland (18.3 and 18.6% respectively), while cardiovascular disorders and respiratory
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22 disorders are also prevalent (18.3% and 17.1% respectively). Any anxiety disorder is the most
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24 commonly reported mental disorder (12.2%) followed by depression or bipolar (9.1%).
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29 **(Table 2 about here)**
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31 Respondents who reported any disorder had an average of 2.3 disorders. Comorbidity was
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33 the norm, with 58.0% of the respondents with a disorder reporting at least two. Odds-ratios (ORs)
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35 between pairs of disorders are largely positive (80% of all the $11 \times 10 / 2 = 55$ odds-ratios between
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37 pairs of disorders) and statistically significant (60.0%). The ORs are higher (median and inter-
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39 quartile range [IQR]) among pairs of physical (2.3, 1.4-4.0) and mental (3.5, 3.0- 8.9) disorders than
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41 between physical-mental pairs (1.7, 0.8-30).
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45 Mean days out of role per year vary by substantially by condition (Table 2). Individuals with
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47 any anxiety disorder had the highest mean numbers of days out of role (86.5), followed by pain
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49 (77.1). Individuals with any mental health disorder had a higher average number of annual days out
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51 of (63.3) compared to those with any physical health condition (41.5).
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54 Table 3 shows the additional days totally out of role in a year among respondents with a
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56 disorder (individual-level effect) adjusted for age, gender, marital status and employment, as well as
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1 the number and type of comorbid disorders. In Northern Ireland, any anxiety disorder (32.3
2 additional days), arthritis (26.1 additional days), and pain (22.0 additional days) were the most
3 disabling conditions. Also in table 3, the population attributable risk proportion (PARP) of days
4 totally out of role for each condition is presented. Arthritis contributed the highest proportion
5 (23.5%), followed by any anxiety disorder (20.9%), and pain (18.7%).
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11 **(Table 3 about here)**
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13 **Discussion**

14 In this study any anxiety disorder, pain and digestive disorder were associated with the highest
15 proportion of days out of role, followed closely by insomnia and headache or migraine. Global
16 results show that anxiety disorders are among the top six disorders with the highest mean days out
17 of role (Alonso et al., 2011). However, pain disorders were not in this top six (Alonso et al., 2011).
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26 These results show that mental disorders (as a category) are among the most strongly
27 associated with productivity loss. Individuals with any mental health disorder had a higher average
28 number of annual days out of (63.3) compared to those with any physical health condition (41.5).
29 This finding is broadly consistent with previous studies (Polder & Achterberg, 2004). This trend has
30 been documented within Brazil (Andrade et al., 2013) and on a global basis, although to a lesser
31 magnitude (31.3 days versus 24.5 days) (Alonso et al., 2011).
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41 Nevertheless, comorbidity is a common issue for mental disorders, and the failure to adjust
42 adequately for comorbidity, could have accounted for these findings. In the current analyses and
43 other similar research, the rank order of disorders in terms of their relative impact on days out of
44 role changes adjustments for comorbidity are considered. Our results show that the 11 health
45 conditions account for 93% of the days out of role in the general population of Northern Ireland.
46 Physical conditions accounted for 66.8% and mental disorders, 18.1% of the total days lost. Pain
47 conditions are disabling and highly prevalent, and were by far, one of the most important
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1 contributors to days out of role in the NI population. In addition, anxiety disorders and arthritis
2 were major contributors to population-level days out of role.
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4 Anxiety disorders (e.g. PTSD or panic disorder) were also among the most important
5 predictors of days out of role globally (Alonso et al., 2011). Both studies also documented pain
6 disorders among the conditions associated with days out of role, but not arthritis (Andrade et al.,
7 2013, Alonso et al., 2011). Depression and anxiety tend to be co-morbid disorders (Kessler, Chiu,
8 Demler & Walters, 2005) and both are associated with pain and arthritis (Gureje et al., 2008, He et
9 al., 2007), which also tend to be comorbid. Depression may therefore play a key role in the effects
10 of all of these disorders and may underlie the strong effect of chronic pain. Comorbid depressive-
11 anxiety disorder has been more strongly associated with several physical conditions than single
12 mental disorders (Scott et al., 2008). The prominence of pain disorders as a contributor to days out
13 of role has also been found by Andrade et al. (2013) and Alonso et al. (2011), however at a global
14 level, the physical disorders that exerted the most profound effects were headaches/migraine and
15 cardiovascular diseases as opposed to arthritis (Alonso et al., 2011).
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34 Similar to the current Northern Ireland results, within the results from Brazil, anxiety
35 disorders were the mental health disorder that exerted the strongest effects (Andrade et al., 2013).
36 However, at a global level, the mental health disorder that had the largest effect was mood disorders
37 rather than anxiety disorders (Alonso et al., 2011). It must be remembered that despite the formal
38 end to conflict in NI in 1999, a substantial proportion of the adult population continue to suffer the
39 adverse mental health effects of chronic trauma exposure (Ferry et al., 2014). Rates of post-traumatic
40 stress disorder are elevated in relation to other countries (Bunting et al., 2012). Intercountry
41 differences may reflect cultural differences in the reporting of symptoms and responses to questions
42 on the reasons for low productivity. In certain cultures people may be reluctant to take days off
43 work due to mental health symptoms and therefore are more likely to report somatic symptoms and
44 physical health difficulties as being responsible for their days off. Comorbid depressive-anxiety
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1 disorder is more strongly associated with several physical conditions than single mental disorders
2 (Scott et al., 2008). Whilst stigma is prevalent in relation to mental illness, it is particularly
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4 prominent in the experiences of those with comorbid depression and anxiety (Alonso et al., 2008).
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6 Consideration of cross cultural differences in stigma and willingness to report different symptoms
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8 warrants further consideration.
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11 It is also important to note that the conditions found to be associated with days out of role in NI
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13 are also conditions associated with disability. The global burden of disease project and other
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15 epidemiological studies illustrate that disability is an important predictor of the impact of the mental
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17 disorders on functioning (Alonso et al., 2013). In the current study the importance of pain and
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19 arthritis on days out of role may also be due to the levels of disability associated with these
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21 conditions. These conditions should be prioritized to improve the productivity of our society.
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23 Nonetheless, while PARPs indicate the theoretical proportion of outcome events that could be
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25 avoided if the exposure (the disorders in our study) was completely eliminated and are useful for
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27 identifying the burdensome targets for population intervention, it should be borne in mind that
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29 disability days avoided by removing one disorder might limit the opportunity of avoiding the same
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31 days by removing another condition (Steenland & Armstrong, 2006).
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38 A number of limitations must be considered before interpreting our results. First, only a
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40 restricted set of the most common conditions was included in the analysis and some were pooled to
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42 form larger disorder groups. Some burdensome conditions, such as dementia and psychosis, were
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44 not included. While the conditions we did consider are amongst those most commonly reported in
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46 previous population studies (Merikangas et al., 2007), an expansion and disaggregation of these
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48 conditions would be beneficial in future studies. Secondly, diagnoses of chronic physical
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50 conditions were based on self-reports. Prior research has demonstrated reasonable correspondence
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52 between self-reported chronic conditions such as diabetes, heart disease and asthma, and general
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54 practitioner records (Kriegsman et al., 1996).
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Thirdly, we only considered days out of role that the respondents reported they were *totally* unable to do their work or usual activities. It is common that individuals perform their role activities less or worse than expected (i.e., presenteeism) (Sanderson & Andrews, 2006.), therefore information about days out of role underestimates total productivity loss. Finally, to increase validity of self-reporting, we assessed restriction of activities in the 30 days previous to the interview and then projected the numbers in this recall interval to a full year, improving the comparability with published literature (Merikangas et al., 2007). But some mismatch between severity of the disease and its prevalence may exist: for more episodic conditions this recall period might have missed a severe exacerbation present in the previous year but not in the month before the interview. Due to the relative large number of events assessed, we expect this to cancel out with the opposite situation and overall not affect our estimates.

Implications

This study identifies the relative contribution of different common disorders to population loss of productivity. Lowering the impact of common and disabling conditions such as arthritis, pain, migraine, as well as cardiovascular and depression would have major productivity returns. Considering that indirect costs are usually higher than direct medical and social services costs to care for disorders (Sobocki et al., 2005; Rice et al., 1998; Smit et al., 2006), prevention and treatment of these disorders should be cost-effective.

Interactions were found to be sub-additive in the best-fitting model. This supports the highly disabling burden of comorbidity (Turner et al., 2008). However, this has an important implication for the prevention of disability, it means that disability increases at a decreasing rate when comorbid conditions exist. Addressing only one disorder (treatment or prevention) when it coexists with other disorders will render less effective outcomes than addressing all the coexisting conditions (Kessler et al., 2012). Finally, it is important to note that employers have legal responsibility to ensure the health safety and welfare (including the risk of stress related difficulties)

1 of their employees whilst they are at work (Health and Safety Executive, 1999). These findings,
2 other analyses from the NI study of health and stress (McFeeters, Ferry, Murphy, & O'Neill, 2012)
3 and other governmental audits (Northern Ireland Audit Office, 2010) suggest that occupational
4 stress may result in both adverse physical and mental health symptoms and may be an important
5 financial burden. It is therefore recommended that employers give due consideration to minimising
6 occupational stress and the provision of mental health screening and interventions for their
7 employees.
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21 **Conflict of interest;** The authors declare no conflict of interest.
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Table 1. Distribution of days totally out of role.

	%	SE
Any days out of role	16.8	1.2
1 day	8.3	1.7
2 days	12.0	1.9
3-5 days	30.5	4.1
6-10 days	7.7	1.8
11-20 days	7.2	1.6
21-30 days	34.4	4.2

Mean among all respondents	2.3	0.2
Mean among respondents with positive days out of role	13.7	1.1
Median among respondents with positive days out of role	5.0	1.9

Table 2. Prevalence of the disorder and mean number of days totally out of role per year

Disorder	Prevalence (%)	SE %	Mean yearly DOR	SE Mean
Depression or bipolar	9.1	0.9	49.2	7.6
Any anxiety disorder	12.2	1.0	86.5	14.4
Any substance disorder	3.2	0.5	36.0	10.9
Insomnia	9.8	1.0	74.2	10.7
Headache or migraine	9.9	1.0	61.9	13.2
Arthritis	18.3	1.5	54.3	6.4
Pain	18.6	1.4	77.1	12.2
Cardiovascular	18.3	1.3	48.8	9.0
Respiratory	17.1	1.1	36.8	5.5
Diabetes	3.8	0.6	56.2	17.4
Digestive	2.8	0.3	74.9	14.1
Any mental	19.1	1.5	63.3	10.3
Any physical	54.4	1.9	41.5	5.2
Any disorder	60.6	1.8	40.7	4.4
Respondents with positive days out of role	.	.	167.0	12.8
All respondents	.	.	28.0	2.9
Respondents with positive days out of role (median)			60.4	22.6

Table 3. Additional* yearly days totally out of role ('individual effects') and PARPs for each condition considered.

	Additional days		(PARP)	
	Mean	SE	%	SE
All disorders	33.5	6.8	93.0%	21.2%
All mental	18.8	14.4	18.1%	13.2%
All physical	26.8	7.6	66.8%	15.3%
Depression or bipolar	-7.5	14.2	-3.7%	6.4%
Any anxiety disorder	32.3	31.7	20.9%	17.2%
Any substance disorder	-23.3	23.5	-3.3%	3.2%
Insomnia	14.7	15.3	7.6%	8.1%
Headache or migraine	12.4	12.8	5.6%	6.1%
Arthritis	26.1	35.7	23.5%	33.7%
Pain	22.0	32.8	18.7%	24.8%
Cardiovascular	-1.2	22.9	-1.1%	19.4%
Respiratory	0.2	17.2	0.2%	13.3%
Diabetes	13.1	29.0	2.3%	5.4%
Digestive	29.5	20.0	5.1%	4.0%

Abbreviations: PARP, population attributable risk proportion.

Title: Days out of role due to common physical and mental conditions: results from the Northern Ireland study of health and stress.

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Abstract

Purpose: Days out of role due to health problems are a major source of lost human capital.

We examined the relative importance of common physical and mental disorders in accounting for days out of role in Northern Ireland using the Northern Ireland Study of Health and Stress (NISHS) WHO World Mental Health (WMH) Survey. **Methods:** Face-to-face interviews were carried out with 4340 respondents (68.4% response rate). Multiple regression analysis estimated associations of specific chronic physical disorders and mental disorders conditions and comorbidities with days out of role controlling for basic socio-demographics. **Results:** Overall, 16.8% of respondents had at least one day totally out of role in the previous year. The strongest population-level effect was associated with arthritis, which accounted for 23.5% of all days out of role. The strongest individual-level effects (days out of role per year) were associated with any anxiety disorder (32.3) arthritis (26.1) and pain (22.0). The 11 conditions accounted for 93% of all days out of role, as measured by population attributable risk proportions (PARPs). **Conclusions:** Common health conditions, including mental disorders, make up a large proportion of the number of days out of role and should be addressed to substantially increase overall productivity.

Keywords: Mental Disorders; Chronic Disease; Disability; Productivity loss; Prevalence; Burden of Disease