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What's up doc? A national cross- sectional study of wellbeing of hospital doctors in Ireland

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What's up doc? A national cross-sectional study of wellbeing of hospital doctors in Ireland

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Keywords: wellbeing, doctor, depression, anxiety, psychological distress, self-stigma.

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Abstract

Objectives: To measure levels of psychological distress, psychological wellbeing and self-stigma in hospital doctors in Ireland.

Design: National cross-sectional study of randomised population of hospital doctors. Participants provided sociodemographic data (age, sex, marital status), work grade (consultant, higher/ basic specialist trainee), specialty, work hours and completed wellbeing questionnaires (the Depression Anxiety Stress Scale, World Health Organisation Wellbeing index, General Health Questionnaire) and single item scales on self-rated health and self-stigma.

Setting: Irish publicly funded hospitals and residential institutions.

Participants: 1749 doctors (response rate of 55%). All hospital specialties were represented except radiology.

Results: Half of participants were male (50.5%). Mean hours worked per week were 57 hours. Over half (52% (95% CI [49.7-54.4]) rated their health as very good/ excellent while 50.5% (95% CI [48.2 -52.9] reported positive subjective wellbeing. Over a third (35%, 95% CI [33.5-37]) experienced psychological distress. Severe/ extremely severe symptoms of depression, anxiety and stress were evident in 7.2% (95% CI [6.0 -8.4]), 6.1% (95% CI [5.0-7.2]) and 9.5% (95% CI [8.2 – 10.9]) of participants. Symptoms of distress, depression, anxiety and stress were significantly higher and levels of wellbeing were significantly lower in trainees compared to consultants and this was not accounted for by differences in sociodemographic variables. Self-stigma was present in 68.4% (95% CI [66.2 -70.5]).

Conclusions: The work hours of doctors working in Irish hospitals were in excess of European Working Time Directive's requirements. Just over half of hospital doctors in Ireland had positive wellbeing. Compared to international evidence, they had higher levels of psychological distress, but slightly lower symptoms of depression and anxiety. Two thirds of respondents reported self-stigma which is likely to be a barrier to accessing care. These findings have implications for the design of support services for doctors, for discussions on quality of patient care and for future research.

Strengths and limitations of this study

- This study provides new information on levels of wellbeing in a national cohort of hospital doctors in Ireland in the aftermath of the country's economic crises which resulted in substantial cut backs in health expenditure and workforce depletion
- The utilisation of widely used standard instruments allows for comparison with previous studies of the profession and the national population
- The good response rate and the range of specialties represented validates the results as being representative
- The population surveyed did not include doctors who may well be experiencing even greater distress including the most junior grade (interns) and those occupying service posts who are not registered with a post-graduate training body
- The study is limited by the fact that it is cross-sectional in design and one cannot determine whether the associations observed are causally related nor the potential direction of any effects

Introduction

The healthcare landscape is changing rapidly and so too is the practice of medicine.(1) Traditional ways of working are being challenged and new models of care are being introduced.(2) Technological and pharmacological developments contribute to ever spiralling costs which governments seek to control whilst striving to improve the quality of patient care. Indeed, the utilisation of huge resources does not always translate into the delivery of high quality care.(3) which is a growing challenge for doctors to provide in an environment where one's autonomy is eroded by cost containment and increasing targets.(4) While many of these changes are global phenomena, the situation in Ireland has been compounded by recent drastic cuts in expenditure resulting in reduced staffing levels while patient numbers and demands increase.(5) These workplace changes set the scene for a challenging psychosocial environment at work and the risk of impaired wellbeing and psychological distress.

There is a growing recognition that the issue of doctors' health (in particular mental health) requires attention.(6-9) Poor health including poor mental health can impair performance and reduce the quality of patient care.(10) Patient safety has become a major focus in healthcare necessitating consideration of the potential interplay between safe practice and clinician wellbeing.(11) Thus, the topic of stress and mental health of doctors is of interest both for itself and because of its link with the health of others.

A number of UK studies exploring psychological distress in hospital doctors, using varying methodologies, suggest a prevalence of high distress with estimates between 22-32%.(12-17) The term refers to an emotional condition felt in response to having to cope with situations that are unsettling, frustrating or perceived as harmful or threatening, and is often used interchangeably with terms such as emotional distress or distress. It is not exactly the opposite end of the continuum to psychological wellbeing though it may be possible to measure just one and make inferences on the other.(18)

Comparison of studies assessing the prevalence of depression and anxiety is also fraught with difficulty not least because of the range of measuring tools, methodologies and response rates (Table 1). The only systematic review to date on depression and anxiety in doctors and medical students generally suggests a prevalence of depression ranging from 14 - 60% and of anxiety from 18-55%, with the conclusion that depression and anxiety are common in doctors at all stages of training but no more so than in other professions.(9) Bringing the focus to hospital doctors, the reported point prevalence of depressive symptoms ranges from 5-29% in Europe(15, 16, 19-23), 23% in Canada(24) and 21-43% in North America(25). Anxiety is less commonly studied but elevated symptoms have been reported as being present in 23%-25% of hospital doctors.(21,23)

There is a culture within the profession that doctors must be healthy and strong or that if they become ill, they must keep on working.(26) This reflects both the commitment to work, reluctance to let people down and the stigma of mental illness within the profession, the latter contributing to the barriers encountered by sick doctors as they struggle to cope.(27, 28) Self-stigma in relation to mental health affects 49% of the general Irish population.(29) Such attitudes, if replicated in doctors, would likely contribute to the challenges they face

in deciding whether they need help and how they access treatment. Patterns of poor self-care and stoicism are already evident in medical school, followed by further deterioration of health-related behaviour patterns after graduation with potential impact on the promotion of positive behaviours to patients.(30, 31) There is also emerging evidence linking doctor's personal and professional wellbeing with quality of patient care and patient health outcomes.(11, 32)

Table 1: Prevalence of depression and anxiety in doctors

1 st Author	Study population and location	Measuring tool	Response rate	Prevalence of depression %	Prevalence of anxiety %
Firth-Cozens ²⁰ (1987)	170 UK junior house officers (Sheffield)	Symptom Checklist-Depression (SCL-D-90)	72%	28	Not measured
Caplan ²¹ (1994)	81 UK hospital consultants	HADS	80%	5	23
Vaglum ²² (1999)	National sample including hospital doctors (NMA members) ^a	GHQ-28	73%	11	Not measured
Coomber ¹⁶ (2002)	National sample (UK intensivists)	SCL-D 90	80%	12 (95% CI 9.9-15.0)	Not measured
Burbeck ¹⁷ (2002)	National sample (UK Accident & Emergency)	SCL-D 90	78%	18	Not measured
Compton ²⁴ (2011)	National sample including hospital doctors (CMA ^b nearly half were primary care physicians).	2 questions measuring anhedonia and depressed mood	41%	23	Not measured
Ruitenburg ²³ (2012)	Academic centre in The Netherlands	Brief Symptom Inventory (BSI)	51%	29	25

^a NMA = Norwegian Medical Association

^b CMA = Canadian Medical Association

Though a number of international studies have been published on the mental health of doctors, the possibility for comparisons and generalisation to the Irish setting is limited due to their heterogeneity both in terms of instruments used, diagnostic cut-offs and sampling. This study set out to measure the self-rated health, subjective wellbeing, level of psychological distress, symptoms of depression, anxiety and stress, along with and self-stigma in a population of hospital doctors, both consultant and trainee, working within a single healthcare system, to explore differences between grades and to compare findings with international evidence.

Methods

Design

The study was a national cross-sectional survey of hospital doctors working in Ireland.

Sample

A stratified random sample of 3164 doctors as determined by the Raosoft sample size calculator(33) was invited to participate in the study. The participants were registered by one of nine national postgraduate medical training bodies in Ireland and included both consultants and trainee doctors in either Basic Specialist Training (BST – equivalent to residency in North America) or Higher Specialist Training (HST– equivalent to fellowship in North America). The sample size was calculated for a 95% confidence interval, an acceptable margin of error of +/- 5% and an expected prevalence of 20%. This number was then doubled to allow for an estimated response rate of 50% rather than 100%.

In order to be invited to participate in this study, the participants had to work almost exclusively in hospitals, public clinics or residential institutions (e.g. psychiatry). Additionally, they had to be fully registered and actively working as either consultants or trainees in a formal training programme in anaesthetics, medicine (including emergency medicine), obstetrics / gynaecology, ophthalmology, paediatrics, pathology, psychiatry and surgery. The Faculty of Radiology opted out of the study.

Data collection

A postal and electronic questionnaire were distributed in April 2014. Two reminders were sent over the subsequent two months, the first electronically, the second and final by post and email.

Participants provided data on demographics (age, sex, nationality, employment stage/ grade), specialty and workload as measured by weekly mean hours at work over a two-week period. To assess the prevalence of psychological distress, depressive and anxiety symptoms, stress and wellbeing, a number of validated, widely used instruments was selected. Internal consistency was satisfactory on all scales (Cronbach α =0.80-0.93). Two single question items on self-rated health and self-stigma were included.

Self-rated health

An item widely used in population studies which gives a sense of subjective wellbeing is the single item general self-rated health question '*in general would you say your health is*' with 5 response options from excellent to poor.(34, 35)

Subjective wellbeing

The World Health Organisation's Wellbeing index (WHO-5) was chosen to measure subjective wellbeing because it is short, simple and widely used. Five positively worded questions are rated by the respondent from 0 to 5, with higher scores indicating greater wellbeing.(36)

Psychological distress

The General Health Questionnaire (GHQ 12) measures psychological distress and has been widely used in studies of doctors. It is a 12-item tool with dichotomous scoring method (0-0-1-1) which determines the point prevalence of psychological distress or 'caseness' with the most widely used threshold being ≥ 4 .(37) The scores, relating to symptoms over the previous 'few weeks', range from 0 to 12, with 0 indicating no evidence

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3 of probable mental ill health, 1-3 indicating less than optimal mental health and 4 or more indicating probable
4 mental ill health. The GHQ-12 can also be analysed as a continuous variable and has good psychometric
5 properties.(37-39)
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8 **Mental health (depression, anxiety and stress)**

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10 The 21-item Depression Anxiety Stress Scale (DASS-21) was chosen because it measures three negative
11 emotional states concomitantly, whilst allowing discrimination between the constructs. The DASS-21 is a self-
12 reporting scale using a 4-point severity / frequency range to rate symptoms of depression, anxiety and stress
13 over the previous week.(40) Each scale has 7 items, with response options ranging from 0 to 4. Higher scores
14 indicate higher levels of symptoms. Although not intended for use as a diagnostic tool, cut-offs for
15 conventional severity labels (normal, mild, moderate, severe, extremely severe) are given in the DASS
16 manual.(40)
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21 **Self-stigma**

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23 A single question, used previously in population surveys,(41) *'if I was experiencing mental health problems I*
24 *wouldn't want people to know'* offers the respondent 5 options from strongly agree to strongly disagree, with
25 lower scores indicating greater levels of self-stigma.
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28 **Statistical analyses**

29 All analysis was performed using statistical software (SPSS version: IBM SPSS for Windows, version 21.0).
30 Descriptive analyses were performed initially and categorical group differences between consultant, higher
31 specialist trainee (HST) and basic specialist trainee (BST) groups were tested using Chi-square. Mean
32 differences for continuous variables were tested using ANOVA, adjusting for age and gender. General linear
33 models (GLM) were used to analyse the differences between employment groups adjusting for demographic
34 and work variables (age, gender and marital status). Internal consistency of scales was assessed using
35 Cronbach's alpha.
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40 **Ethics**

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42 The study protocol was approved by the Royal College of Physicians of Ireland's (RCPI) Research Ethics
43 Committee in December 2013 (RCPI RECSAF 20).
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46 **Results**

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48 1749 doctors participated (response rate = 55%, range 33-63% between specialties). Respondents held
49 predominantly Irish nationality (85%) and though there was no gender preponderance overall, consultants
50 were predominantly male (61%) and trainees predominantly female (Table 2).
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53 *Workload*

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55 The mean hours worked weekly for all doctors were 57.01 (SD = 15.08). Consultants worked an average of
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54.17 (SD = 15.09), HSTs 61.08 (15.47) and BSTs 59.63 (SD = 13.02) hours with significant differences between groups (F = 38.41, p < .001) (Table 3). The differences were significant between consultants and HSTs (p < .001) and between consultants and BSTs (p < .001) but not between HSTs and BSTs (p = .517). The group differences remained significant after adjustment across all demographic variables: age (p < .05), gender (p < .001), marital status (p < .01) and specialty (p < .001), B = -3.06 [SE = 1.55] CI -6.09 to -.02).

Table 2: Sample demographics (age, sex).

	Consultants		Higher Specialist Trainees		Basic Specialist Trainees		Total		χ^2
	N	%	N	%	N	%	N	%	
Total	950	54	424	24	375	22	1749	100	
Age									1700.6***
< 30			82	19.5	267	71.6	349	20.3	
31-40	114	12.1	318	75.4	97	26.0	529	30.8	
41-50	440	46.7	20	4.7	9	2.4	469	27.3	
> 50	389	41.3	2	1.0	-	-	391	22.7	
Sex									86.9***
Male	574	60.5	178	42.1	130	34.8	882	50.5	
Female	375	39.5	245	57.9	244	65.2	864	49.5	
Marital status									303.9***
Co-habiting	805	86.7	274	65.1	144	38.9	1223	71.1	
Single	124	13.3	147	34.9	226	61.1	497	28.9	

***= ≤ .001

Table 3. Mean weekly hours worked and self-stigma (as measured by a single item).

	Consultants		HST		BST		Total		Fp
	n	%	n	%	n	%	n	%	
	mean	(SD)	mean	(SD)	mean	(SD)	mean	(SD)	
Mean weekly hours worked									
	54.2	15.1	61.1	15.5	59.6	13.0	57.0	15.1	38.4***
Self-stigma									
Strongly disagree	20	2.1	11	2.6	10	2.7	41	2.4	
Disagree	134	14.1	51	12.0	43	11.5	228	13.1	
Neutral	166	17.5	61	14.4	56	15.0	283	16.2	
Agree	438	46.3	177	41.7	173	46.4	788	45.2	
Strongly agree	189	19.9	124	29.2	91	24.4	404	23.2	
Mean	2.32	1.01	2.17	1.06	2.22	1.03	2.26	1.03	3.68*

* = p ≤ .05 *** = p ≤ .001 Fp=ANOVA

Self-rated health

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General self-rated health measured on a 5-point Likert scale was reported as very good or excellent by 52% of respondents overall. ANOVA identified significant differences between the groups ($F(2,1739) = 15.47, p < .001$). More consultants reported their general health as very good or excellent (56.9%) compared with their HST (47.6%) and BST (44.6%) colleagues. The difference between consultants and both HSTs and BSTs was significant ($p \leq .001$) but the difference between HSTs and BSTs was not ($p = .361$). As determined by ANOVA the group differences in total scores were maintained after adjustment for age ($p < .05$) but not for gender or marital status ($B = .45 [SE = .11] CI .24 \text{ to } .67$). (Table 4&5)

Subjective wellbeing

The level of subjective wellbeing, as measured by the WHO-5, classified 882 (50.5%) of the doctors as normal, 476 (27.3%) as having low mood and 388 (22.2%) as having likely depression. For consultants, the prevalence of wellbeing, determined as normal was 59.5%, for HST 40.1% and for BSTs 39.7% ($\chi^2 = 66.38, p < .001$). ANOVA confirmed significant differences between the groups ($F(2,1743) = 39.1, p < .001$). When adjustment was made for age, gender, marital status and specialty, the employment group differences were maintained ($B = 8.96 [SE = 2.39] CI 4.27 \text{ to } 13.65$) ($p < .001$). (Table 4&5)

Psychological distress (GHQ-12)

As measured by the GHQ-12, 596 (34.8%) of the doctors were categorised as probable cases of mental ill health, 540 (31.5%) as having less than optimal mental health and 579 (33.8%) as having no evidence of mental ill health (Table 4). Chi square test found significant differences between grades for these categories ($\chi^2 = 47.2, p < .001$) with BSTs having the highest prevalence of probable mental ill health (42.3%) and consultants the lowest (30.2%). One-way ANOVA confirmed significant differences in mean scores between groups ($F(2,1712) = 16.5, p < .001$) with BSTs having the highest psychological distress and consultants having the lowest. Employment group differences were maintained when GLM (general linear modelling) was performed to adjust for age, gender, marital status and specialty ($B = -1.4 [SE = .392] CI -2.17 \text{ to } -.63$) ($p < .001$). (Table 4&5)

Mental health

Depression

As measured by DASS-21, 125 (7.1%) of all respondents were classified as having severe or extremely severe levels of depression, with this figure increasing to 290 (16.6%) when those with moderate depression were included. Severe/ extremely severe levels of depression were evident in 4.5% consultants, 8.7% HSTs and 12.1% BSTs ($\chi^2 = 51.96, p < .001$). As determined by ANOVA the group differences in total scores remained significant after adjusting with GLM for age and gender ($F(2, 1725) = 27.3, p < .001$) though being married or having a partner was protective ($p < .05$). (Table 4&5)

Table 4: Wellbeing scales (GHQ-12¹, DASS-21², WHO-5³, SRH⁴).

	Consultants		HST		BST		Total		χ ²	ANOVA (F)	GLM (B)	
	N	%	N	%	N	%	N	%				
	mean	(SD)	mean	(SD)	Mean	(SD)	mean	(SD)				
Self-rated health (SRH)											.45***	
Poor	3	0.3	9	2.1	13	3.5	25	1.4				
Fair	102	10.8	53	12.5	59	15.8	214	12.2				
Good	302	32	160	37.7	135	36.0	597	34.1				
Very good	352	37.3	140	33.0	118	31.5	610	34.9				
Excellent	185	19.6	62	14.6	49	13.1	296	16.9				
Mean score	3.65	.925	3.46	.959	3.35	1.01	3.54	.960	15.5***			
Subjective wellbeing (WHO-5)											66.38**	8.96***
Likely depression	169	17.8	117	27.6	102	27.2	388	22.2				
Low mood	215	22.7	137	32.3	124	33.1	476	27.3				
Normal	563	59.5	170	40.1	149	39.7	882	50.5				
Mean score	53.4	21.3	44.7	19.8	44.4	20.5	49.3	21.2	39.1***			
Psychological distress (GHQ-12)											47.2***	-1.4***
No evidence of mental ill health	379	40.8	109	26.1	91	24.7	579	33.8				
Less than optimal mental health	269	29	149	35.7	122	33.1	540	31.5				
Probable mental ill health	281	30.2	159	38.1	156	42.3	596	34.8				
Mean score	2.6	3.3	3.4	3.4	3.7	3.6	3.0	3.4	16.5***			
Depression (DASS-21)											51.96***	-2.64**
Normal	761	80.5	288	67.9	254	68.3	1303	74.8				
Mild	74	7.8	39	9.2	35	9.4	148	8.5				
Moderate	67	7.1	60	14.2	38	10.2	165	9.5				
Severe	20	2.1	23	5.4	29	7.8	72	4.1				
Extremely severe	23	2.4	14	3.3	16	4.3	53	3.0				
Mean score	5.2	7.1	7.7	8.0	8.1	8.7	6.4	7.8	27.3***			
Anxiety (DASS-21)											100.41***	-3.31***
Normal	828	89.0	310	74.5	250	67.0	1388	80.7				
Mild	30	3.2	24	5.8	30	8.0	84	4.9				
Moderate	44	4.7	46	11.1	52	13.9	142	8.3				
Severe	11	1.2	17	4.1	14	3.8	42	2.4				
Extremely severe	17	1.8	19	4.6	27	7.2	63	3.7				
Mean score	2.6	4.7	5.0	6.3	6.4	6.9	4.0	5.9	67.2***			
Stress (DASS-21)											37.31***	-1.66NS
Normal	709	75.9	271	65.8	226	60.8	1206	70.2				
Mild	76	8.1	53	12.9	55	14.8	184	10.7				
Moderate	74	7.9	41	10.0	49	13.2	164	9.5				
Severe	55	5.9	31	7.5	31	8.3	117	6.8				
Extremely severe	20	2.1	16	3.9	11	3.0	47	2.7				
Mean score	10.8	8.6	12.8	9.3	13.2	9.2	11.8	8.9	13.6***			
Severe levels in multiple DASS-21 subscales											0.421NS	
At least severe levels of 1 DASS variable	63	6.9	42	10.3	45	12.3	150	8.9				
At least severe levels of 2 DASS variables	22	2.4	15	3.7	20	5.4	57	3.4				
At least severe levels of all DASS variables	11	1.2	16	3.9	13	3.5	40	2.4				

χ² = categorical group differences, F = ANOVA (continuous variables), GLM (B) = employment group differences adjusted for sociodemographic variables

ns = not significant; ** = p ≤ .01; *** = p ≤ .001;

GHQ-12 = General Health Questionnaire (12 item); DASS 21 = Depression Anxiety Stress Scale (21 item); WHO 5 = World Health Organisation wellbeing scale; SRH = Self Rated Health (single item).

Anxiety

Severe or extremely severe levels of anxiety were present in 105 (6.1%), with this figure increasing to 247 (14.4%) when those with moderate anxiety were included. Severe levels of anxiety were evident in 3% consultants, 8.7% of HSTs and 11% of BSTs ($\chi^2 = 100.4$, $p < .001$). As determined by ANOVA the group differences in total scores remained significant after adjusting with GLM for age, gender and marital status ($F(2,1716) = 67.2$, $p < .001$). (Table 4&5)

Table 5: Confidence intervals (95% CI) for prevalence of wellbeing scales and self-stigma in total population.

	Odds Ratio	95% Confidence Intervals
Psychological distress		
Probable mental ill health (GHQ-12)	34.8***	32.5-37.0
Depression (DASS-21)		
Severe/ extremely severe depression	7.18***	6.0 -8.4
Anxiety (DASS-21)		
Severe/ extremely severe anxiety	6.11***	5.0-7.2
Stress (DASS-21)		
Severe/ extremely severe stress	9.55***	8.2 – 10.9
Overall wellbeing (WHO-5)		
Normal	50.5***	48.2 -52.9
Self-rated health (SRH)		
Very good/ excellent	52.0***	49.7-54.4
Self- stigma		
Agree/ strongly agree	68.3***	66.2 -70.5

GHQ-12 = General Health Questionnaire (12 item), DASS 21 = Depression Anxiety Stress Scale (21 item); WHO 5 = World Health Organisation wellbeing scale

*** = $p \leq .001$;

Stress

Severe or extremely severe levels of stress were observed in 164 (9.5%) and including those moderately affected this figure rose to 328 (19%). Severe and extremely severe levels of stress were evident in 8% of consultants, 11.4% HSTs and 11.3% BSTs ($\chi^2 = 37.3$, $p < .001$). ANOVA confirmed significant differences in the mean scores between the groups ($F(2,1715) = 13.6$, $p < .001$). However these were not maintained after adjustment for demographic variables. (Table 4&5)

There was some overlap in the three constructs with further analysis confirming that 14.7% of all respondents had at least severe levels of one variable, (8.9% had one, 3.4% had two and 2.4% had at least severe levels of all three) though there was no significant difference between the employment grades. (Table 4)

Self-stigma

Two thirds of hospital doctors (68%) agreed or strongly agreed that they wouldn't want people to know if they were experiencing mental health problems. Trainees were more likely to respond positively (HSTs: 70.9%, BSTs: 70.8%) than consultants (66%). ANOVA confirmed significant differences between the groups ($F(2, 1741) = 3.68, p = .026$). None of the group differences on this measure persisted after adjustment for age, gender or marital status. (Table 3)

Discussion

This national survey of hospital doctors working within a single healthcare system set out to measure psychological distress, mental ill health, subjective wellbeing, self-rated health and self-stigma. The differences between grades were explored and findings compared to those from other healthcare systems. Hours worked were found to be well in excess of European Working Time Directive (EWTd) requirements.⁽⁴²⁾ The working hours were higher than EWTd limits particularly in trainees. This suggests that simply implementing the EWTd, without consideration of how it is implemented, will be of little benefit to doctors' wellbeing.⁽⁴³⁾ As a group, doctors are conscientious and expect hard work and long hours.⁽⁴⁴⁾ Reducing hours in a manner that compromises continuity and quality of care is a significant stressor for hospital trainees in Ireland.⁽⁴³⁾

Overall, self-rated health was very good or excellent in just over half of respondents while 50.5% rated their personal wellbeing as normal. Both self-rated health and subjective wellbeing demonstrated the improving level of health with seniority of grade.

Psychological distress was evident in over a third of respondents and severe levels of depression, anxiety and stress occurred in 7.1%, 6.1% and 9.5% respectively. When those affected to a moderate degree were included, the levels of depression, anxiety and stress affected 16.6%, 14.4% and 19% of respondents. Self-stigma was expressed by 68%. The response rate of 55% implies that the study's findings may be considered representative and are a particular cause for concern in a population which is reluctant to disclose and to access care.

The GHQ-12 allows for comparison of the findings of this study with the published literature since it has been widely used on different populations of doctors, notwithstanding the fact that concerns have been raised about its potential to yield an inflated prevalence of distress.⁽⁴⁵⁾ Using the higher scoring threshold (≥ 4 cut-off) the point prevalence for psychological distress amounting to probable psychiatric 'caseness' in the respondents in this study was 34.8%. This figure exceeds the prevalence figures in all other studies of hospital doctors which used the GHQ 12 in the same manner (postal survey) including those from the United Kingdom's National Health Service where the prevalence of distress ranged from 22-32%.⁽¹³⁻¹⁹⁾ We observed significant differences between grades with levels of psychological distress in trainees significantly higher than in consultants (Table 4). While our finding of 30% prevalence in consultants falls just short of the 32% prevalence

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3 in UK consultants in 2005,(18) the point prevalence of 38% in HSTs and 42% in BSTs greatly exceeds the levels
4 reported elsewhere. Furthermore, the incremental reduction in distress from the most junior trainee to the
5 most senior doctor as measured by GHQ-12 is unlikely to be spurious as it is replicated across all of the
6 wellbeing variables. It is noteworthy that the prevalence of psychological distress in these hospital doctors is
7 2.5 times higher than measured in a survey of the general population undertaken in 2007 where 12% of
8 respondents were currently experiencing psychological distress.(46) This survey used the same instrument,
9 albeit that it was undertaken at a time prior to the country's economic collapse in 2008.

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14 The prevalence of severe depression in the total sample was in the lower range of what has been reported in
15 other studies of hospital doctors albeit that inclusion of those with moderate depression would put this in the
16 median range (Table 1). The prevalence was inversely related to seniority, a pattern echoing that already
17 described with psychological distress. While one in fourteen respondents was experiencing severe or
18 extremely severe depression, it is not appropriate to compare this with other studies cited as they covered
19 different subsets of doctors and used different instruments and cut-off points.(16,17,20-24)

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24 Anxiety is less commonly reported upon in studies of doctors. The prevalence of severe anxiety amongst the
25 respondents overall was much lower than that observed in the limited number of studies summarised in Table
26 1, even if those with moderate anxiety are included. The inverse relationship with seniority is again evident,
27 with anxiety in higher in BSTs. This may reflect the highly challenging and relatively unsupported role of the
28 BSTs in an environment where work demand exceeds the ability to cope in the context of drastic health
29 budgetary cuts and low numbers of doctors.(43, 47) It may also be that these differences reflect well
30 documented changes observed in generation Y who are thought to be less resilient than their antecedents(48).
31 The caveats outlined in the previous paragraph in relation to comparison of prevalence with that found in
32 other studies also apply in relation to anxiety.

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38 General stress, is not comparable to any other studies in healthcare but severe levels were reported in 9.3% of
39 respondents (19% when moderate stress is included) and again, this was most evident in junior trainees. As
40 with depression and anxiety, the inverse relationship with seniority is noted.

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43 The observed employment grade differential has been observed previously(49). It may reflect the highly
44 challenging and relatively unsupported role of the trainees in an environment where work demand exceeds
45 the ability to cope in the context of drastic health budgetary cuts and low numbers of doctors.(43, 50) It may
46 also reflect the attrition of doctors in difficulty who fail or choose not to progress to senior grades, resulting in
47 a cohort of consultants representing the 'survival of the fittest' in a challenging work environment.
48 Alternatively, it may reflect the aforementioned generational difference between the 'baby boomers'
49 occupying consultant posts and 'generation y' and 'millennials' who largely occupy the training grades. Indeed,
50 the observed grade differential is further exemplified in a recent paper where the prevalence of psychological
51 distress in interns (the most junior grade of doctor working in the Irish hospital system) at 48.5% was even
52 higher than in this cohort of BSTs.(51)
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3 Doctors are reluctant to disclose when they have mental health problems and this is particularly so in younger
4 doctors, which may be explained by their perceived vulnerability in terms of career progression.(52) Doctors'
5 prediction of how they might behave in relation to disclosure is influenced by whether or not they have
6 experienced mental ill health, with those who have not being more likely to predict they would disclose.(52)
7 Considerably more doctors in this study than population controls perceived stigma in relation to mental health
8 and this likely contributes in no small way to reluctance to disclose.(53) In an occupation where mental ill
9 health, substance misuse and suicide risk are high, addressing this attitude at an early stage of training may
10 provide a mechanism for helping to reduce barriers to care at a later stage.

15 **Strengths and limitations**

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17 This Irish study is the first national survey conducted on a cohort of hospital doctors working within the same
18 health system. The results can be taken as representative as all but one hospital specialty (radiology) are
19 included. The 55% response rate would be considered high in this population where response rates tend to be
20 low and are declining.(54) Moreover, response rates tend to be lower when questionnaires are long and deal
21 with sensitive topics.(55) The use of GHQ-12 allows for comparison with previous studies of the profession. The
22 use of instruments for measuring self-rated health and self-stigmatisation allow for comparison with previous
23 national surveys of the general population.

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25 The study is limited by the fact that it is cross-sectional in design and one cannot determine whether the
26 associations observed are causally related nor the potential direction of any effects. Another limitation is that
27 the DASS-21 measures emotional states rather than diagnostic categories.

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29 The study did not include certain doctors working within the hospital system who may be at greatest risk of
30 stress and work related ill health. This includes three key groups:

- 31 **a)** Interns occupy a transitional role for a period of 1 year, having emerged from either undergraduate
32 or postgraduate medical school, as pre-registration doctors.
- 33 **b)** Non-consultant hospital doctors (NCHDs) who occupy service roles but are not allied to any
34 undergraduate training body and whose numbers have increased substantially over the past 5
35 years.(56)
- 36 **c)** Locum doctors, particularly at consultant level, whose position is insecure and in some cases
37 protracted.

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39 Arguably, were these groups to be included, the prevalence of all negative measures might well be higher, as
40 they deal with the same demands as their colleagues but with even less support.

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42 Finally, the study did not attempt to take any measure of external personal stressors, personality or the
43 availability of close personal support, any of which may have had an effect on measures of distress.

Implications

This study paves the way for further work to be done in Ireland at the level of both inquiry and intervention. While some interventions can be based on extrapolation from studies elsewhere, local data is vital in convincing employers and senior managers of the extent of problems locally and allows for measurement after any intervention.

In the first instance, medical schools and post-graduate training bodies will need to ensure that doctors' mental health and wellbeing are firmly embedded in their training curricula. Doctors need to be made aware that they are as vulnerable to common mental disorders as anyone else and that when left untreated, these problems can affect not only their personal wellbeing, but also their work engagement and this has an impact on the care they provide to patients.

Society, policy makers and healthcare employers need to question the apparent inevitability of this phenomenon and to ask how the work environment can be improved so that the contribution of doctors (and other clinicians) is more valued, so that those who experience distress and ill health may be supported to continue in or return to the workforce. Indeed, calls for an expansion of the Triple Aim to the Quadruple Aim have been made for both primary and hospital workplaces whereby care of the provider is added to the laudable goals of improving population health, patient experience and reducing cost.(57,58) In an era of doctor shortages, this is particularly imperative. Moreover, not only do doctors who have experienced mental ill health bring great compassion and empathy to their role but also, those with mental health and substance use problems tend to respond very well to treatment.(59-61)

The self-stigmatising attitudes to mental health problems evident at all grades need to be challenged particularly since treatment of these disorders is highly effective.(60) This must begin in medical school and continue throughout post-graduate training.

The employer needs to prioritise the welfare of its medical staff, beginning with a commitment to make posts more attractive to young doctors so that recruitment gaps can be eliminated. It is easier to put in place support services such as counselling and Employee Assistance Programmes and to encourage healthy lifestyles for staff than to 'fix' the deep rooted systemic problems which exist within the healthcare work environment.(43) While these approaches can be very effective for individuals, including doctors, they do not address the underlying problems of low staff numbers, work organisation and poor people management. Indeed, a recent report calls for research to identify strategies to improve physician wellness and emphasises *inter alia* the responsibility of the organisation in creating an environment and culture conducive to health, efficiency and meaning in work.(62)

Conclusion

Hospital doctors in Ireland have higher levels of psychological distress than their international peers and the general population. While levels of depression and anxiety fall within previously reported ranges, levels of psychological distress, depression and anxiety are particularly high in junior trainees. These findings suggest

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3 that much needs to be done to improve both working conditions for young doctors and their awareness of
4 mental health issues. Senior doctors also need to be trained in how to recognise signs of distress in their
5 colleagues and in how they can support them. The findings highlight the need for policy makers, employers
6 and training bodies to focus their attention on this vulnerable cohort, upon whom we will rely to lead the
7 future provision of hospital care. Moreover, they are likely to be applicable to doctors and health professionals
8 working elsewhere as the tension between high demand and depleted resources is an international
9 phenomenon.
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13 14 15 16 17 **Acknowledgements**

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23
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25 research, education and communications departments of the Royal College of Physicians of Ireland for their
26 expertise and support.
27
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29 30 31 **Data sharing statement**

32 As per Strobe guidelines, flow diagram may be provided as supplementary information. Plans for
33 dissemination have been outlined in the research ethics proposal document
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37 38 **Contributors**

39 All authors met at least one of the criteria recommended by the ICMJE and have agreed on the final version of
40 the manuscript. BH and GW were involved in conceiving and designing the original protocol. BH wrote the first
41 draft of the manuscript. LP, SD, GW and FD contributed to subsequent drafts and FD provided statistical
42 advice.
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47 48 **Ethics approval**

49 Research Ethics Committee Royal College of Physicians of Ireland December 2013 (RCPI RECSAF 20).
50

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Reliability checking of data

All data returned, whether by post or Survey Monkey, were entered into the database by a single individual. A quality reliability check was carried out systematically on 10% of the raw dataset by the lead researcher and the Research Department Manager. This involved cross-checking the SPSS entry with the original data on the returned questionnaire. Errors were noted in less than 1% of entries and appropriate corrections were made. All the analyses were performed using commercially available statistical software (SPSS version: IBM SPSS for Windows, version 21.0). A preliminary missing data analysis was then performed. Demographic analysis identified that some doctors working exclusively in the private sector had responded and been entered into the database erroneously. These were removed.

STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of cross-sectional studies

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(a) Indicate the study’s design with a commonly used term in the title or the abstract	1
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	1
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	3
Objectives	3	State specific objectives, including any prespecified hypotheses	4
Methods			
Study design	4	Present key elements of study design early in the paper	4
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants	5
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	5,6
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	5,6
Bias	9	Describe any efforts to address potential sources of bias	5
Study size	10	Explain how the study size was arrived at	5
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	6
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	6
		(b) Describe any methods used to examine subgroups and interactions	6-11
		(c) Explain how missing data were addressed	Supp file 2
		(d) If applicable, describe analytical methods taking account of sampling strategy	-
		(e) Describe any sensitivity analyses	-
Results			

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	5
		(b) Give reasons for non-participation at each stage	N/A
		(c) Consider use of a flow diagram	-
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	6,7
		(b) Indicate number of participants with missing data for each variable of interest	-
Outcome data	15*	Report numbers of outcome events or summary measures	6-11
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	6-11
		(b) Report category boundaries when continuous variables were categorized	6-11
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	-
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	-
Discussion			
Key results	18	Summarise key results with reference to study objectives	15-16
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	14
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	11-13
Generalisability	21	Discuss the generalisability (external validity) of the study results	15
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	10

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at www.strobe-statement.org.

BMJ Open

What's up doc? A national cross-sectional study of psychological wellbeing of hospital doctors in Ireland

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Keywords:	wellbeing, doctor, depression, anxiety, psychological distress, self-stigma

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3 **What's up doc? A national cross-sectional study of psychological wellbeing of hospital doctors in Ireland**
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Abstract

Objectives: To measure levels of psychological distress, psychological wellbeing and self-stigma in hospital doctors in Ireland.

Design: National cross-sectional study of randomised sample of hospital doctors. Participants provided sociodemographic data (age, sex, marital status), work grade (consultant, higher/ basic specialist trainee), specialty, work hours and completed wellbeing questionnaires (the Depression Anxiety Stress Scale, World Health Organisation Wellbeing index, General Health Questionnaire) and single item scales on self-rated health and self-stigma.

Setting: Irish publicly funded hospitals and residential institutions.

Participants: 1749 doctors (response rate of 55%). All hospital specialties were represented except radiology.

Results: Half of participants were male (50.5%). Mean hours worked per week were 57 hours. Over half (52%) rated their health as very good/ excellent while 50.5% reported positive subjective wellbeing (World Health Organisation 5). Over a third (35%) experienced psychological distress (General Health Questionnaire 12). Severe/ extremely severe symptoms of depression, anxiety and stress were evident in 7.2%, 6.1% and 9.5% of participants (Depression, Anxiety, Stress Scale 21). Symptoms of distress, depression, anxiety and stress were significantly higher and levels of wellbeing were significantly lower in trainees compared to consultants and this was not accounted for by differences in sociodemographic variables. Self-stigma was present in 68.4%.

Conclusions: The work hours of doctors working in Irish hospitals were in excess of European Working Time Directive's requirements. Just over half of hospital doctors in Ireland had positive wellbeing. Compared to international evidence, they had higher levels of psychological distress, but slightly lower symptoms of depression and anxiety. Two thirds of respondents reported self-stigma which is likely to be a barrier to accessing care. These findings have implications for the design of support services for doctors, for discussions on quality of patient care and for future research.

Words = 288

Strengths and limitations of this study

- This study provides new information on levels of wellbeing in a national cohort of hospital doctors in Ireland in the aftermath of the country's economic crises which resulted in substantial cut backs in health expenditure and workforce depletion
- The utilisation of widely used standard instruments allows for comparison with previous studies of the profession and the national population
- The good response rate and the range of specialties represented validates the results as being representative
- The population surveyed did not include doctors who may well be experiencing even greater distress including the most junior grade (interns) and those occupying service posts who are not registered with a post-graduate training body
- The study is limited by the fact that it is cross-sectional in design and one cannot determine whether the associations observed are causally related nor the potential direction of any effects

Introduction

The healthcare landscape is changing rapidly and so too is the practice of medicine.(1) Traditional ways of working are being challenged and new models of care are being introduced.(2) Technological and pharmacological developments contribute to ever spiralling costs which governments seek to control whilst striving to improve the quality of patient care. Indeed, the utilisation of huge resources does not always translate into the delivery of high quality care.(3) which is a growing challenge for doctors to provide in an environment where one's autonomy is eroded by cost containment and increasing targets.(4) While many of these changes are global phenomena, the situation in Ireland has been compounded by recent drastic cuts in expenditure resulting in reduced staffing levels while patient numbers and demands increase.(5) These workplace changes set the scene for a challenging psychosocial environment at work and the risk of impaired wellbeing and psychological distress.

There is a growing recognition that the issue of doctors' health (in particular mental health) requires attention.(6-9) Poor health including poor mental health can impair performance and reduce the quality of patient care.(10) Patient safety has become a major focus in healthcare necessitating consideration of the potential interplay between safe practice and clinician wellbeing.(11) Thus, the topic of stress and mental health of doctors is of interest both for itself and because of its link with the health of others.

A number of UK studies exploring psychological distress in hospital doctors, using varying methodologies, suggest a prevalence of high distress with estimates between 22-32%.(12-17) The term refers to an emotional condition felt in response to having to cope with situations that are unsettling, frustrating or perceived as harmful or threatening, and is often used interchangeably with terms such as emotional distress or distress. It is not exactly the opposite end of the continuum to psychological wellbeing though it may be possible to measure just one and make inferences on the other.(18)

Comparison of studies assessing the prevalence of depression and anxiety is also fraught with difficulty not least because of the range of measuring tools, methodologies and response rates (Table 1). The only systematic review to date on depression and anxiety in doctors and medical students generally suggests a prevalence of depression ranging from 14 - 60% and of anxiety from 18-55%, with the conclusion that depression and anxiety are common in doctors at all stages of training but no more so than in other professions.(9) Bringing the focus to hospital doctors, the reported point prevalence of depressive symptoms ranges from 5-29% in Europe(15, 16, 19-23), 23% in Canada(24) and 21-43% in North America(25). Anxiety is less commonly studied but elevated symptoms have been reported as being present in 23%-25% of hospital doctors.(21, 23)

There is a culture within the profession that doctors must be healthy and strong or that if they become ill, they must keep on working.(26) This reflects both the commitment to work, reluctance to let people down and the stigma of mental illness within the profession, the latter contributing to the barriers encountered by sick doctors as they struggle to cope.(27, 28) Self-stigma in relation to mental health affects 49% of the general Irish population.(29) Such attitudes, if replicated in doctors, would likely contribute to the challenges they face in deciding whether they need help and how they access treatment. Patterns of poor self-care and stoicism are already evident in medical school, followed by further deterioration of health-related behaviour patterns after graduation with potential impact on the promotion of positive behaviours to patients.(30, 31) There is also emerging evidence linking doctor's personal and professional wellbeing with quality of patient care and patient health outcomes.(11, 32)

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Though a number of international studies have been published on the mental health of doctors, the possibility for comparisons and generalisation to the Irish setting is limited due to their heterogeneity both in terms of instruments used, diagnostic cut-offs and sampling. This study set out to measure the self-rated health, subjective wellbeing, level of psychological distress, symptoms of depression, anxiety and stress, along with self-stigma in a population of hospital doctors, both consultant and trainee, working within a single healthcare system, to explore differences between grades and to compare findings with international evidence.

Methods

Design

The study was a national cross-sectional survey of hospital doctors working in the Republic of Ireland.

Sample

A stratified random sample of 3164 doctors as determined by the Raosoft sample size calculator(33) was invited to participate in the study. The participants were registered with one of nine national postgraduate medical training bodies in Ireland and included both consultants and trainee doctors in either Basic Specialist Training (BST – equivalent to residency in North America) or Higher Specialist Training (HST– equivalent to fellowship in North America). The sample size was calculated for a 95% confidence interval, an acceptable margin of error of +/- 5% and an expected prevalence of psychological distress of 20%. This number was then doubled to allow for an estimated response rate of 50% rather than 100%.

In order to be invited to participate in this study, the participants had to work mainly in hospitals, public clinics or residential institutions (e.g. psychiatry). Additionally, they had to be fully registered and actively working as either consultants or trainees in a formal training programme in anaesthetics, medicine (including emergency medicine), obstetrics / gynaecology, ophthalmology, paediatrics, pathology, psychiatry and surgery. The Faculty of Radiology opted out of the study. Thus, those working exclusively in private practice and those who were retired or on sick leave / maternity leave at the time of the survey were excluded. The denominator was adjusted accordingly (see supplementary files 1 & 2).

Data collection

A postal and electronic questionnaire were distributed in April 2014. Two reminders were sent over the subsequent two months, the first electronically, the second and final by post and email.

Participants provided data on demographics (age, sex, nationality, employment stage/ grade), and workload as measured by the question 'how many hours per week did you work over 2 consecutive working weeks in the past month'). To assess the prevalence of psychological distress, depressive and anxiety symptoms, stress and wellbeing, a number of validated, widely used instruments was selected. The General Health Questionnaire (GHQ 12) was included in order to allow for comparison with internationally reported rates of psychological distress. The 21 item Depression, Anxiety, Stress Scale (DASS 21), though not previously used in doctors, was attractive to us because of its facility to measure 3 separate states i.e. core symptoms of depression, anxiety and tension (stress). The WHO-5 likewise is little used in doctors but we chose it because of its brevity and in order to ensure that we were not exclusively focused on negative states. Internal consistency was satisfactory on all scales (Cronbach's $\alpha=0.80-0.93$). Two single question items on self-rated health and self-stigma were included and both have previously been used in surveys of population health.

Self-rated health

An item widely used in population studies which gives a sense of subjective wellbeing is the single item general self-rated health question 'in general would you say your health is' with 5 response options from excellent to poor.(34, 35)

Subjective wellbeing

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3 The World Health Organisation's Wellbeing index (WHO-5) was chosen to measure subjective wellbeing
4 because it is short, simple and widely used. Five positively worded questions are rated by the respondent from
5 0 to 5, with higher scores indicating greater wellbeing.(36)
6

7 **Psychological distress**

8 The GHQ 12 measures psychological distress and has been widely used in studies of doctors. It is a 12-item tool
9 with dichotomous scoring method (0-0-1-1) which determines the point prevalence of psychological distress or
10 'caseness' with the most widely used threshold being ≥ 4 .(37) The scores, relating to symptoms over the
11 previous 'few weeks', range from 0 to 12, with 0 indicating no evidence of probable mental ill health, 1-3
12 indicating less than optimal mental health and 4 or more indicating probable mental ill health. The GHQ-12 can
13 also be analysed as a continuous variable and has good psychometric properties.(37-39)
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15 **Mental health (depression, anxiety and stress)**

16
17 The DASS-21 was chosen because it measures three negative emotional states concomitantly, whilst allowing
18 discrimination between the constructs. It is a self-reporting scale using a 4-point severity / frequency range to
19 rate symptoms of depression, anxiety and stress over the previous week.(40) Each scale has 7 items, with
20 response options ranging from 0 to 4. Higher scores indicate higher levels of symptoms. Although not
21 intended for use as a diagnostic tool, cut-offs for conventional severity labels (normal, mild, moderate, severe,
22 extremely severe) are given in the DASS manual.(40)
23

24 **Self-stigma**

25
26 A single question, used previously in population surveys,(41) *'if I was experiencing mental health problems I*
27 *wouldn't want people to know'* offers the respondent 5 options from strongly agree to strongly disagree, with
28 lower scores indicating greater levels of self-stigma.
29

30 **Statistical analyses**

31 All analysis was performed using statistical software (SPSS version: IBM SPSS for Windows, version 21.0).
32 Descriptive analyses were performed initially and categorical group differences between consultant, higher
33 specialist trainee (HST) and basic specialist trainee (BST) groups were tested using Chi-square. Mean
34 unadjusted differences for continuous variables were tested using ANOVA. General linear models (GLM) were
35 used to analyse the differences between employment groups adjusting for demographic and work variables
36 (age, sex, marital status and mean hours worked (MHW)). Internal consistency of scales was assessed using
37 Cronbach's alpha.
38

39 **Ethics**

40 The study protocol was approved by the Royal College of Physicians of Ireland's (RCPI) Research Ethics
41 Committee in December 2013 (RCPI RECSAF 20).
42

43 **Results**

44
45 1749 doctors participated (response rate = 55%, range 33-63% between specialties). Respondents held
46 predominantly Irish nationality (85%) and though there was no sex preponderance overall, consultants were
47 predominantly male (61%) and trainees predominantly female (Table 2). According to a workforce intelligence
48 report on the healthcare workforce in 2014 (42), 69% of trainee and consultant doctors were Irish graduates.
49 While nationality is not synonymous with country of graduation, this suggests that respondents were more
50 likely to be Irish.
51

52 *Workload*

53
54 The mean hours worked weekly for all doctors were 57.01 (SD = 15.08). Consultants worked an average of
55 54.17 (SD = 15.09), HSTs 61.08 (15.47) and BSTs 59.63 (SD = 13.02) hours with significant differences between
56 groups (F = 38.41, $p < .001$) (Table 3). The differences were significant between consultants and HSTs ($p < .001$)
57 and between consultants and BSTs ($p < .001$) but not between HSTs and BSTs ($p = .517$). The group differences
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remained significant after adjustment across all demographic variables: age ($p < .05$), sex ($p < .001$) and marital status ($p < .01$) (Table 3)

Insert Table2 about here

Self-rated health

General self-rated health was reported as very good or excellent by 52% of respondents overall. One-way ANOVA identified significant differences between the groups ($F(2,1739) = 15.47, p < .001$), with consultants reporting significantly higher SRH than both HSTs and BSTs. The difference between consultants and both HSTs and BSTs was significant ($p \leq .001$) but the difference between HSTs and BSTs was not ($p = .361$). As determined by GLM (general linear modelling), the group differences in total scores were maintained after adjustment for age, sex, marital status and MHW. (Table 4) In addition, lower MHW was significantly associated with higher SRH ($B = -0.01, p \leq .001$).

Insert Table3 about here

Subjective wellbeing

The level of subjective wellbeing, as measured by the WHO-5, classified 882 (50.5%) of the doctors as normal, 476 (27.3%) as having low mood and 388 (22.2%) as having likely depression. For consultants, the prevalence of wellbeing, determined as normal was 59.5%, for HST 40.1% and for BSTs 39.7% ($\chi^2 = 66.4, p < .001$). ANOVA confirmed significant differences between the groups ($F(2,1743) = 39.1, p < .001$) with consultants reporting significantly higher subjective wellbeing than both HSTs and BSTs. As determined by GLM, the employment group differences were maintained after adjustment for age, sex, marital status, and MHW for BSTs but not for HSTs. (Table 4) In addition, lower MHW were significantly associated with higher subjective wellbeing ($B = -.23, p \leq .001$).

Psychological distress (GHQ-12)

As measured by the GHQ-12, 596 (34.8%) of the doctors were categorised as probable cases of mental ill health, 540 (31.5%) as having less than optimal mental health and 579 (33.8%) as having no evidence of mental ill health (Table 4). Chi square test found significant differences between grades for these categories ($\chi^2 = 47.2, p < .001$) with BSTs having the highest prevalence of probable mental ill health (42.3%) and consultants the lowest (30.2%). ANOVA confirmed significant differences in mean scores between groups ($F(2,1712) = 16.5, p < .001$) with BSTs having the highest psychological distress and consultants having the lowest. As determined by GLM, the employment group differences were maintained when adjustment was made for age, sex, marital status and MHW. (Table 4) In addition, higher MHW were significantly associated with higher psychological distress ($B = .07, p \leq .001$).

Mental health

Depression

As measured by DASS-21, 125 (7.1%) of all respondents were classified as having severe or extremely severe levels of depression, with this figure increasing to 290 (16.6%) when those with moderate depression were included. Severe/ extremely severe levels of depression were evident in 4.5% consultants, 8.7% HSTs and 12.1% BSTs ($\chi^2 = 52, p < .001$). The group differences in total scores determined by ANOVA remained significant after adjusting with GLM for age, sex, marital status and MHW for BSTs but not for HSTs. (Table 4) In addition, higher MHW were significantly associated with higher levels of depression ($B = .07, p \leq .001$).

Anxiety

Severe or extremely severe levels of anxiety were present in 105 (6.1%), with this figure increasing to 247 (14.4%) when those with moderate anxiety were included. Severe levels of anxiety were evident in 3%

consultants, 8.7% of HSTs and 11% of BSTs ($\chi^2 = 100.4$, $p < .001$). The group differences in total scores determined by ANOVA remained significant after adjusting with GLM for age, sex, marital status and MHW. (Table 4) In addition, higher MHW were significantly associated with higher levels of anxiety ($B = .05$, $p \leq .001$).

Stress

Severe or extremely severe levels of stress were observed in 164 (9.5%) and including those moderately affected this figure rose to 328 (19%). Severe and extremely severe levels of stress were evident in 8% of consultants, 11.4% HSTs and 11.3% BSTs ($\chi^2 = 37.3$, $p < .001$). These group differences confirmed by ANOVA were not significant after adjusting with GLM for age or marital status (Table 4) though males were less likely to have high scores for stress than females ($B = -1.07$, $p \leq .05$) and higher MHW were significantly associated with higher stress scores ($B = 1.0$, $p \leq .001$).

Insert Table 4 about here

There was some overlap in the three constructs with further analysis confirming that 14.7% of all respondents had at least severe levels of one variable, (8.9% had one, 3.4% had two and 2.4% had at least severe levels of all three) though there was no significant difference between the employment grades. (Table 4)

Self-stigma

Two thirds of hospital doctors (68%) agreed or strongly agreed that they wouldn't want people to know if they were experiencing mental health problems. Trainees were more likely to respond positively (HSTs: 70.9%, BSTs: 70.8%) than consultants (66%). ANOVA confirmed significant differences between the groups ($F(2, 1741) = 3.7$, $p = .026$). None of the group differences on this measure persisted after adjustment for age, sex or marital status. (Table 3)

Discussion

This national survey of hospital doctors working within a single healthcare system set out to measure psychological distress, mental ill health, subjective wellbeing, self-rated health and self-stigma. The differences between grades were explored and findings compared to those from other healthcare systems. Hours worked were found to be well in excess of European Working Time Directive (EWTD) requirements.(43) The working hours were higher than EWTD limits particularly in trainees. Given that trainees reported working significantly more hours than their consultant colleagues (Table 4), it may be that this helps to explain the higher prevalence of psychological distress in trainees. However, simply implementing the EWTD, without consideration of how it is implemented, may not be of great benefit to doctors' wellbeing as we know that reducing hours in a manner that compromises continuity and quality of care is a significant stressor for hospital trainees in Ireland.(44) Furthermore, as a group, doctors tend to be conscientious and expect hard work and long hours.(45)

Overall, self-rated health was very good or excellent in just over half of respondents while 50.5% rated their personal wellbeing as normal. Both self-rated health and subjective wellbeing demonstrated the improving level of health with seniority of grade and with less hours worked.

Psychological distress was evident in over a third of respondents and severe levels of depression, anxiety and stress occurred in 7.1%, 6.1% and 9.5% respectively. When those affected to a moderate degree were included, the levels of depression, anxiety and stress affected 16.6%, 14.4% and 19% of respondents. Self-stigma was expressed by 68%. The response rate of 55% implies that the study's findings may be considered largely representative and are a particular cause for concern in a population which is reluctant to disclose and to access care.

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3 The GHQ-12 allows for comparison of the findings of this study with the published literature since it has been
4 widely used on different populations of doctors, notwithstanding the fact that concerns have been raised
5 about its potential to yield an inflated prevalence of distress.(46) Using the higher scoring threshold (≥ 4 cut-
6 off) the point prevalence for psychological distress amounting to probable psychiatric 'caseness' in the
7 respondents in this study was 34.8%. This figure exceeds the prevalence figures in all other studies of hospital
8 doctors which used the GHQ 12 in the same manner (postal survey) including those from the United Kingdom's
9 National Health Service where the prevalence of distress ranged from 22-32%.(13-19) We observed significant
10 differences between grades with levels of psychological distress in trainees significantly higher than in
11 consultants (Table 4). While our finding of 30% prevalence in consultants falls just short of the 32% prevalence
12 in UK consultants in 2005,(18) the point prevalence of 38% in HSTs and 42% in BSTs greatly exceeds the levels
13 reported elsewhere. Furthermore, the incremental reduction in distress from the most junior trainee to the
14 most senior doctor as measured by GHQ-12 is unlikely to be spurious as it is replicated across all of the
15 wellbeing variables as is the link with hours worked. It is noteworthy that the prevalence of psychological
16 distress in these hospital doctors is 2.5 times higher than measured in a survey of the general population
17 undertaken in 2007 where 12% of respondents were currently experiencing psychological distress.(47) This
18 survey used the same instrument, albeit that it was undertaken at a time prior to the country's economic
19 collapse in 2008. Subsequent national surveys have elected to use alternative measures which are not directly
20 comparable.
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23 The prevalence of severe depression in the total sample was in the lower range of what has been reported in
24 other studies of hospital doctors albeit that inclusion of those with moderate depression would put this in the
25 median range. (Table 1) The prevalence was inversely related to seniority, a pattern echoing that already
26 described with psychological distress. While one in fourteen respondents was experiencing severe or
27 extremely severe depression, it is not appropriate to compare this with other studies cited as they covered
28 different subsets of doctors and used different instruments and cut-off points.(16,17,20-24)
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30 Anxiety is less commonly reported upon in studies of doctors. The prevalence of severe anxiety amongst the
31 respondents overall was much lower than that observed in the limited number of studies summarised in Table
32 1, even if those with moderate anxiety are included. The inverse relationship with seniority is again evident,
33 with anxiety in higher in BSTs. This may reflect the highly challenging and relatively unsupported role of the
34 BSTs in an environment where work demand exceeds the ability to cope in the context of drastic health
35 budgetary cuts and low numbers of doctors.(44, 48) It may also be that these differences reflect well
36 documented changes observed in generation Y who are thought to be less resilient than their antecedents(49).
37 The caveats outlined in the previous paragraph in relation to comparison of prevalence with that found in
38 other studies also apply in relation to anxiety.
39

40 General stress, is not comparable to any other studies in healthcare but severe levels were reported in 9.3% of
41 respondents (19% when moderate stress is included) and again, this was most evident in junior trainees. As
42 with depression and anxiety, the inverse relationship with seniority is noted.
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44 The observed employment grade differential has been observed previously.(50) It may reflect the highly
45 challenging and relatively unsupported role of the trainees in an environment where work demand exceeds
46 the ability to cope in the context of drastic health budgetary cuts and low numbers of doctors.(44, 51) It may
47 also reflect the attrition of doctors in difficulty who fail or choose not to progress to senior grades, resulting in
48 a cohort of consultants representing the 'survival of the fittest' in a challenging work environment. Indeed, the
49 observed grade differential is further exemplified in a recent paper where the prevalence of psychological
50 distress in interns (the most junior grade of doctor working in the Irish hospital system) at 48.5% was even
51 higher than in this cohort of BSTs.(52)
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53 Sex was not found to be a significant determinant of either distress or poor health except for stress which was
54 more frequently reported upon by females
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56 Doctors are reluctant to disclose when they have mental health problems and this is particularly so in younger
57 doctors, which may be explained by their perceived vulnerability in terms of career progression.(53) Doctors'
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prediction of how they might behave in relation to disclosure is influenced by whether or not they have experienced mental ill health, with those who have not being more likely to predict they would disclose.⁽⁵³⁾ Considerably more doctors in this study in comparison to the general population (29) perceived stigma in relation to mental health and this likely contributes in no small way to reluctance to disclose.⁽⁵⁴⁾ In an occupation where mental ill health, substance misuse and suicide risk are high, addressing this attitude at an early stage of training may provide a mechanism for helping to reduce barriers to care at a later stage.

Strengths and limitations

This Irish study is the first national survey conducted on a cohort of hospital doctors working within the same health system. The results can be taken as largely representative as all but one hospital specialty (radiology) are included. The 55% response rate would be considered high in this population where response rates tend to be low and are declining.⁽⁵⁵⁾ Moreover, response rates tend to be lower when questionnaires are long and deal with sensitive topics.⁽⁵⁶⁾ The use of GHQ-12 allows for comparison with previous studies of the profession. The use of instruments for measuring self-rated health and self-stigmatisation allow for comparison with previous national surveys of the general population.

The study is limited by the fact that it is cross-sectional in design and one cannot determine whether the associations observed are causally related nor the potential direction of any effects. Another limitation is that the percentage of respondents who were Irish nationals was higher than the number of Irish graduates working in hospitals in a contemporaneous report. The fact that the DASS-21 measures emotional states rather than diagnostic categories may also be seen as a limitation.

The study did not include certain doctors working within the hospital system who may be at greatest risk of stress and work related ill health. This includes three key groups:

- a) Interns occupy a transitional role for a period of 1 year, having emerged from either undergraduate or postgraduate medical school, as pre-registration doctors.
- b) Non-consultant hospital doctors (NCHDs) who occupy service roles but are not allied to any undergraduate training body and whose numbers have increased substantially over the past 5 years.⁽⁵⁷⁾
- c) Locum doctors, particularly at consultant level, whose position is insecure and in some cases protracted.

Arguably, were these groups to be included, the prevalence of all negative measures might well be higher, as they deal with the same demands as their colleagues but with even less support.

Finally, the study did not attempt to take any measure of external personal stressors, personality or the availability of close personal support, any of which may have had an effect on measures of distress.

Implications

This study paves the way for further work to be done in Ireland at the level of both inquiry and intervention. In the first instance, medical schools, post-graduate training bodies and senior clinicians need to tackle self-stigmatising attitudes to mental ill health which were evident at all grades in this cohort, by embedding within training and professional development information and tools on how to maintain good mental health and on supports available.

For those in difficulty and those who manage them, there is a need for clear pathways and easy access to appropriate support and confidential care, such as own general practitioner, quality occupational health services and support in returning after illness to one's professional role.

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3 Most importantly, the employer needs to prioritise the welfare of its staff by addressing deep rooted systemic
4 problems contributing to the challenging work environment, such as low staff numbers, long work hours, work
5 organisation and poor people management.(44) As longer working hours were found to contribute to poor
6 personal wellbeing in this study, and were particularly evident in trainees, we encourage employers to
7 continue working towards achieving compliance with EWTD while also monitoring the unintended
8 consequences such as the break-up of teams and poor quality handover with its implications for patient
9 care.(44)
10

11 There is a need for further research to identify strategies to improve physician wellness with particular
12 emphasis on organisational responsibility to create an environment and culture conducive to health, efficiency
13 and meaning in work.(58) An exploration of doctors' own views on pathways to mental health care would help
14 to elucidate what might be favoured by potential users.
15

16 **Conclusion**

17 Hospital doctors in Ireland have higher levels of psychological distress than their international peers and the
18 general population. While levels of depression and anxiety fall within previously reported ranges, levels of
19 psychological distress, depression and anxiety are particularly high in junior trainees. These findings suggest
20 that much needs to be done to improve both working conditions for young doctors and their awareness of
21 mental health issues. Senior doctors also need to be trained in how to recognise signs of distress in their
22 colleagues and in how they can support them. The findings highlight the need for policy makers, employers
23 and training bodies to focus their attention on this vulnerable cohort, upon whom we will rely to lead the
24 future provision of hospital care. Moreover, they are likely to be applicable to doctors and health professionals
25 working elsewhere as the tension between high demand and depleted resources is an international
26 phenomenon.
27
28

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33

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37

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42 consumables, data entry to SPSS and publication.
43
44

45 **Data sharing statement**

46 As per the ethics approval, the data will not be shared outside of the participating research institutions. Any
47 sharing of the data beyond the group will be subject to review by the host institution (Royal College of
48 Physicians of Ireland) and to independent research ethics application. Any queries on how to access the
49 dataset should be directed to research@rcpi.ie.
50
51

52 **Contributors**

53 All authors met at least one of the criteria recommended by the ICMJE and have agreed on the final version of
54 the manuscript. BH and GW were involved in conceiving and designing the original protocol. BH wrote the first
55 draft of the manuscript. LP, SD, GW and FD contributed to subsequent drafts and FD provided statistical
56 advice.
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Competing interests

None

Ethics approval

Research Ethics Committee Royal College of Physicians of Ireland December 2013 (RCPI RECSAF 20).

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Table 1: Prevalence of depression and anxiety in doctors

1 st Author	Study population and location	Measuring tool	Response rate	Prevalence of depression %	Prevalence of anxiety %
Firth-Cozens ²⁰ (1987)	170 UK junior house officers (Sheffield)	Symptom Checklist-Depression (SCL-D-90)	72%	28	Not measured
Caplan ²¹ (1994)	81 UK hospital consultants	HADS	80%	5	23
Vaglum ²² (1999)	National sample including hospital doctors (NMA members) ^a	GHQ-28	73%	11	Not measured
Coomber ¹⁶ (2002)	National sample (UK intensivists)	SCL-D 90	80%	12 (95% CI 9.9-15.0)	Not measured
Burbeck ¹⁷ (2002)	National sample (UK Accident & Emergency)	SCL-D 90	78%	18	Not measured
Compton ²⁴ (2011)	National sample including hospital doctors (CMA ^b nearly half were primary care physicians).	2 questions measuring anhedonia and depressed mood	41%	23	Not measured
Ruitenburg ²³ (2012)	Academic centre in The Netherlands	Brief Symptom Inventory (BSI)	51%	29	25

^a NMA = Norwegian Medical Association^b CMA = Canadian Medical Association

Table 2: Sample demographics and results of χ^2 test comparing grades across demographics.

	Consultants		Higher Specialist Trainees		Basic Specialist Trainees		Total		χ^2
	N	%	N	%	N	%	N	%	
Total	950	54	424	24	375	22	1749	100	
Age									1700.6***
< 30			82	19.5	267	71.6	349	20.3	
31-40	114	12.1	318	75.4	97	26.0	529	30.8	
41-50	440	46.7	20	4.7	9	2.4	469	27.3	
> 50	389	41.3	2	1.0	-	-	391	22.7	
Sex									86.9***
Male	574	60.5	178	42.1	130	34.8	882	50.5	
Female	375	39.5	245	57.9	244	65.2	864	49.5	
Marital status									303.9***
Co-habiting	805	86.7	274	65.1	144	38.9	1223	71.1	
Single	124	13.3	147	34.9	226	61.1	497	28.9	

***p ≤ .001

Table 3. Prevalence and non-adjusted (ANOVA, Chi-Square) and adjusted (GLM) comparisons of mean weekly hours worked and self-stigma by employment grade (as measured by a single item).

	Consultants		HST		BST		Total		ANOVA (F)	GLM (B) – BST ¹	GLM (B) – HST ²
	n	%	n	%	n	%	n	%			
	mean	(SD)	mean	(SD)	mean	(SD)	mean	(SD)			
Mean weekly hours worked											
	54.2	15.1	61.1	15.5	59.6	13.0	57.0	15.1	38.4***		
Self-stigma											
Strongly disagree	20	2.1	11	2.6	10	2.7	41	2.4			
Disagree	134	14.1	51	12.0	43	11.5	228	13.1			
Neutral	166	17.5	61	14.4	56	15.0	283	16.2			
Agree	438	46.3	177	41.7	173	46.4	788	45.2			
Strongly agree	189	19.9	124	29.2	91	24.4	404	23.2			
Mean	2.32	1.01	2.17	1.06	2.22	1.03	2.26	1.03	3.7*	-.09ns	-.04ns

^{ns} = not significant; * = $p \leq .05$; ** = $p \leq .01$; *** = $p \leq .001$;

F_p=ANOVA; ¹GLM (B) = BST adjusted for sociodemographic variables & mean hours worked; ²GLM (B) = HST adjusted for sociodemographic variables & mean hours worked; ¹ & ² – Reference category: Consultant

Table 4: Prevalence and non-adjusted (ANOVA, Chi-Square) and adjusted (GLM) comparisons of wellbeing scales by employment grade (GHQ-12¹, DASS-21², WHO-5³, SRH⁴).

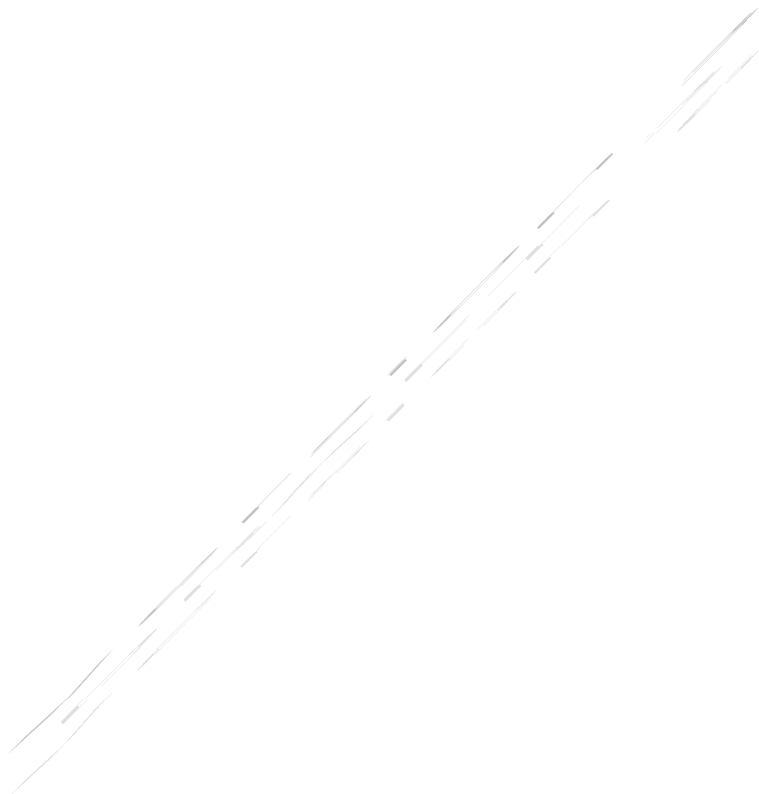
	Consultants		HST		BST		Total		χ^2 ¹	ANOVA (F) ²	GLM (B) – BST ³	GLM (B) – HST ⁴
	N/ mean	%/ SD	N/ mean	%/ SD	N/ mean	%/ SD	N/ mean	%/ SD				
Self-rated health (SRH)												
Poor	3	0.3	9	2.1	13	3.5	25	1.4				
Fair	102	10.8	53	12.5	59	15.8	214	12.2				
Good	302	32	160	37.7	135	36.0	597	34.1				
Very good	352	37.3	140	33.0	118	31.5	610	34.9				
Excellent	185	19.6	62	14.6	49	13.1	296	16.9				
Mean score	3.65	.93	3.46	.96	3.35	1.01	3.54	.96		15.5***	.45***	.25**
Subjective wellbeing (WHO-5)									66.4**			
Likely depression	169	17.8	117	27.6	102	27.2	388	22.2				
Low mood	215	22.7	137	32.3	124	33.1	476	27.3				
Normal	563	59.5	170	40.1	149	39.7	882	50.5				
Mean score	53.4	21.3	44.7	19.8	44.4	20.5	49.3	21.2		39.1***	8.29***	1.92 ^{ns}
Psychological distress (GHQ-12)									47.2***			
No evidence of mental ill health	379	40.8	109	26.1	91	24.7	579	33.8				
Less than optimal mental health	269	29	149	35.7	122	33.1	540	31.5				
Probable mental ill health	281	30.2	159	38.1	156	42.3	596	34.8				
Mean score	2.6	3.3	3.4	3.4	3.7	3.6	3.0	3.4		16.5***	-2.05**	-.96*
Depression (DASS-21)									52***			
Normal	761	80.5	288	67.9	254	68.3	1303	74.8				
Mild	74	7.8	39	9.2	35	9.4	148	8.5				
Moderate	67	7.1	60	14.2	38	10.2	165	9.5				
Severe	20	2.1	23	5.4	29	7.8	72	4.1				
Extremely severe	23	2.4	14	3.3	16	4.3	53	3.0				
Mean score	5.2	7.1	7.7	8.0	8.1	8.7	6.4	7.8		27.3***	-2.5**	-.45 ^{ns}
Anxiety (DASS-21)									100.4***			
Normal	828	89	310	74.5	250	67	1388	80.7				
Mild	30	3.2	24	5.8	30	8.0	84	4.9				
Moderate	44	4.7	46	11.1	52	13.9	142	8.3				
Severe	11	1.2	17	4.1	14	3.8	42	2.4				
Extremely severe	17	1.8	19	4.6	27	7.2	63	3.7				
Mean score	2.6	4.7	5.0	6.3	6.4	6.9	4.0	5.9		67.2***	-3.13***	-1.09*
Stress (DASS-21)									37.3***			
Normal	709	75.9	271	65.8	226	60.8	1206	70.2				
Mild	76	8.1	53	12.9	55	14.8	184	10.7				
Moderate	74	7.9	41	10.0	49	13.2	164	9.5				
Severe	55	5.9	31	7.5	31	8.3	117	6.8				
Extremely severe	20	2.1	16	3.9	11	3.0	47	2.7				
Mean score	10.8	8.6	12.8	9.3	13.2	9.2	11.8	8.9		13.6***	-1.49 ^{ns}	-.41 ^{ns}

¹ χ^2 = categorical group differences; ²F = ANOVA (continuous variables); ³GLM (B) = BST adjusted for sociodemographic variables & mean hours worked; ⁴GLM (B) = HST adjusted for sociodemographic variables & mean hours worked; ³ & ⁴ – Reference category: Consultant

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^{ns} = not significant; * = $p \leq .05$ ** = $p \leq .01$; *** = $p \leq .001$;

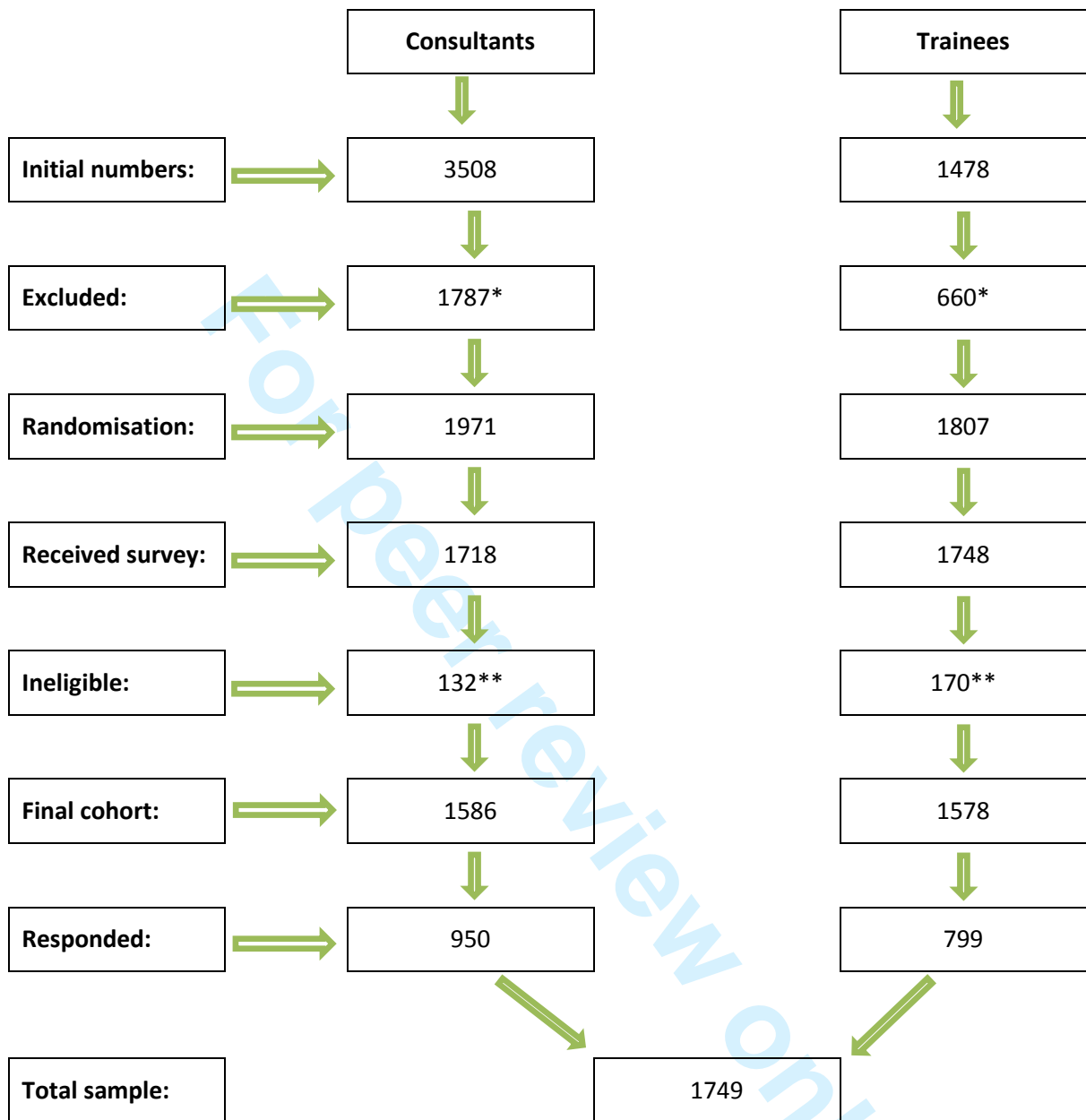
SRH = Self Rated Health (single item); WHO 5 = World Health Organisation Wellbeing scale; GHQ-12 = General Health Questionnaire (12 item); DASS 21 = Depression Anxiety Stress Scale (21 item)



Reliability checking of data

All data returned, whether by post or Survey Monkey, were entered into the database by a single individual. A quality reliability check was carried out systematically on 10% of the raw dataset by the lead researcher and the Research Department Manager. This involved cross-checking the SPSS entry with the original data on the returned questionnaire. Errors were noted in less than 1% of entries and appropriate corrections were made. All the analyses were performed using commercially available statistical software (SPSS version: IBM SPSS for Windows, version 21.0). A preliminary missing data analysis was then performed. Demographic analysis identified that some doctors working exclusively in the private sector had responded and been entered into the database erroneously. These were removed.

Supplementary file 2

**Flow diagram of recruitment to study**

*cases that did not meet the inclusion criteria e.g. retired/private practice only, not on training scheme, on maternity leave or other long term leave due to illness or secondment abroad

** respondents who did not meet inclusion criteria e.g. similar reasons to above

STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(a) Indicate the study's design with a commonly used term in the title or the abstract	1
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	1
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	3
Objectives	3	State specific objectives, including any prespecified hypotheses	4
Methods			
Study design	4	Present key elements of study design early in the paper	4
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants	5
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	5,6
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	5,6
Bias	9	Describe any efforts to address potential sources of bias	5
Study size	10	Explain how the study size was arrived at	5
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	6
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	6
		(b) Describe any methods used to examine subgroups and interactions	6-11
		(c) Explain how missing data were addressed	Supp file 2
		(d) If applicable, describe analytical methods taking account of sampling strategy	-
		(e) Describe any sensitivity analyses	-
Results			

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	5
		(b) Give reasons for non-participation at each stage	N/A
		(c) Consider use of a flow diagram	-
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	6,7
		(b) Indicate number of participants with missing data for each variable of interest	-
Outcome data	15*	Report numbers of outcome events or summary measures	6-11
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	6-11
		(b) Report category boundaries when continuous variables were categorized	6-11
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	-
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	-
Discussion			
Key results	18	Summarise key results with reference to study objectives	15-16
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	14
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	11-13
Generalisability	21	Discuss the generalisability (external validity) of the study results	15
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	10

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at www.strobe-statement.org.