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Prevalence of Anxiety and Depressive Symptoms among Medical Residents in Tunisia: A Cross-Sectional survey

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3 1 **Prevalence of Anxiety and Depressive Symptoms among Medical Residents in**
4 2 **Tunisia: A Cross-Sectional survey**

5
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3 21 **Abstract:**

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5 22 **Objective:** assess the prevalence of anxiety and depressive symptoms in Tunisian residents
6 23 and associated risk factors.

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8 24 **Design:** cross-sectional survey

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10 25 **Setting:** Faculty of Medicine, Tunis

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12 26 **Participants:** all Tunisian residents willing to choose their next 6-month rotation

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14 27 **Intervention:** the items of the Hospital Anxiety and Depression score (HAD) questionnaire
15 28 was employed to capture the prevalence of anxiety and/or depression among residents.
16 29 Statistical relationships between anxiety and depression, and socio-demographic and work-
17 30 related data were explored by Poisson regression.

18
19 31 **Results:** 1,700 out of 2,200 (77%) medical residents (median age:28 years, female: 60.8%)
20 32 answered the questionnaire. The median working hours per week were 60 [IQR: 48;76]; 73%
21 33 ensured a median 6 [IQR: 4;7] night shifts per month; only 8% could benefit from
22 34 compensatory rest. Overall, 74.1% of participating residents had either, definite (43.6%) or
23 35 doubtful (30.5%) anxiety, while 62% had definite (30.5%) or doubtful (31.5%) depression
24 36 symptoms, with 20% having both. Symptoms of anxiety-depression were significantly
25 37 associated with resident's age (OR= 1.014; 95%CI:1.006-1.023, p= 0.001); female gender
26 38 (OR= 1.114;95%CI: 1.083-1.145, p<0.0001); and the heavy burden of work imposed on a
27 39 weekly or monthly basis, as reflected by night shift number per month (OR= 1.048;95%CI,
28 40 1.016-1.082, p= 0.03), worked hours per week (OR= 1.008;95%CI:1.005-1.011, p<0.0001).
29 41 Compared to medical specialties, the generally accepted difficult specialties (surgical or
30 42 medical-surgical) were associated with higher HAD scale (OR= 1.459;95%CI: 1.172-1.816, p=
31 43 0.001).

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35 44 **Conclusion:** Tunisian residents experience a rate of anxiety/depression substantially higher
36 45 than that reported at the international level. This phenomenon is worrying as it usually lasts
37 46 beyond the residency years, and is also a source of an increase in medical errors, work
38 47 dissatisfaction and attrition.

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43 49 **Strengths and limitations of this study:**

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45 50 First study to assess the prevalence of Anxiety/Depression among Tunisian residents

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47 51 Provides insights into associated socio-demographic and work-related variables

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49 52 The large participation rate

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51 53 The HAD questionnaire is in French (but this language is well mastered by Tunisian residents)

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53 54 No information on the rates of mood disorders in the general Tunisian population for
54 55 comparison

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56 56 No assessment of the prevalence of Burnout syndrome

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3 57 The increasing exposure of physicians to stressful situations is a global phenomenon without
4 58 distinction between age, sex, or level of advancement in the profession[1-4]. Only a few
5 59 variables inherent in the personalities, or in work-related strain, are able to modulate the
6 60 expression of this stress by attenuating or exaggerating the generated mood disorders
7 61 (anxiety, depression, burn out), and their impact on the personal and professional life[5 6].
8 62 These disorders may hamper the physician's professional performance by affecting the
9 63 concentration at work, and the quality of provided healthcare services, and provoking
10 64 conflicts with patients or their families, or with colleagues, [7-9]. They are also associated
11 65 with a higher substance use and abuse, divorce, and even more suicidal ideations [9 10] [11].
12 66 Medical residents seem at increased risk of developing mental disorders [7 12-14]. A recent
13 67 systematic review reported a 28.8% pooled prevalence of depression or depressive
14 68 symptoms in medical residents, with a wide variation in the rate (20.9% and 43.2%)
15 69 depending on the instrument used[15]. In countries with socio-economic conditions similar
16 70 to those of Tunisia, the prevalence of depressive symptoms in medical residents
17 71 ranges from 17% in India to 48% in Argentina[16-18]

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30 72 Tunisia is a country that is currently experiencing major socio-economic and political
31 73 mutations as a consequence of the so-called "Jasmine revolution" which was in 2011 the
32 74 spark that ignited the whole region during the "Arabic spring". These mutations have
33 75 particularly altered the relationship between the main body of the society and the medical
34 76 profession, the latter being perceived by a large part of the population as a body of
35 77 privileged, insufficiently empathic, and little concerned by the misfortunes of the population.
36 78 The assaults against doctors, particularly in public hospitals and their emergency services,
37 79 malpractice suits and prosecutions, are now very frequent, and are highly publicized on a
38 80 daily basis on the various media in the country. Moreover, public hospitals experienced just
39 81 after the revolution a sharp deterioration in the resources and staff made available, together
40 82 with an alteration of their governance, which paralleled that of the public health sector. This
41 83 situation has greatly frustrated the population, in particular the citizens who cannot afford
42 84 the private medical sector and its large out-of-pocket costs.

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3 85 Among the medical profession, the young Tunisian residents are considered the pillar of
4 86 these public hospitals. Residents are the only physicians present at the hospital at night, on
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6 87 weekends, and on holidays.
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9 88 Residents come to term of a long, demanding, and selective course of studies. The
10
11 89 typical resident must have passed his baccalaureate among the first ranked ones, be among
12
13 90 the "happy few" who enter the medical school after a draconian selection, and successfully
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15 91 undergo a final residency contest usually after 2 to 3 attempts (Annual pass rate = 25%).
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17 92 Aged at least 26, the resident faces the reality of the public hospital, where he is exposed to
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19 93 stress resulting from non-optimal exercise conditions: the need to meet his professional
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21 94 duties set by his supervisors, and the growing demand of the population.

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23 95 We hypothesized that the combination of all of these unfavorable circumstances for
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25 96 professional fulfillment, should result in a high level of mood disorders in medical residents.
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27 97 We conducted a large cross-sectional survey to address the prevalence in Tunisian residents
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29 98 of anxiety and depressive symptoms and highlight associated risk factors.
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3 **100 Patients-Methods**

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5 **101 Participants** : In Tunisia, specialization in medicine takes place at the end of general medical
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7 102 studies accomplished in one of the 4 faculties of medicine in the country. Doctors who wish
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9 103 to specialize do so following a national contest, bringing together the candidates from the
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11 104 four faculties of medicine. This contest is very selective, and takes place over three days. It
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13 105 consists in more than 300 questions (multiple choice, short answer), covering separately
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15 106 each of the following areas: medical specialties, surgical specialties, and basic sciences.
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17 107 More than 1,500 candidates participate annually, for about 500 elected members, who are
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19 108 ranked consecutively in order of merit. The choice of the specialty is then made according to
20
21 109 the rank of success in the contest, on a number of posts that is equal to the number of
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23 110 candidates, and distributed among all the medical specialties by quotas which are fixed
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25 111 according to the needs of the country in doctors practicing in medical specialties. The
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27 112 internship periods (of 6 months each) and their distribution between specialties, in order to
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29 113 validate a given specialty, are specified in advance by the college of each specialty. Every six
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31 114 months, all trainee residents in the country (more than 2,000) gather over ten days at the
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33 115 Faculty of Medicine of Tunis, the Tunisian capital, to choose the next 6-month rotation.
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35 116 Within the chosen specialty, the candidate chooses according to seniority first, and his
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37 117 classification in the corresponding level afterwards.

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39 118 **Protocol**: The study protocol was approved by the local Institutional Review Board of
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41 119 Fatouma Bourguiba Teaching Hospital, Monastir (reference #2013/108). All the medical
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43 120 residents gathered at the faculty of medicine of Tunis, between December 14 and December
44
45 121 22, 2015 for the choice of the next 6 month-rotation, were invited to answer an anonymous,
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47 122 self-administered questionnaire. The questionnaire covers their civil and marital status, the
48
49 123 specialty chosen, their level of advancement in the specialty (duration 4 years for medical
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51 124 specialties and 5 years for surgical specialties), and items of the Hospital Anxiety and
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53 125 Depression score (HAD) questionnaire. On this specific date, the first level residents were the
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55 126 new candidates of the very recent residency contest and for the record, the 2015 residency
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57 127 contest' results were published on 17th December 2015 just 48 hours before an irreversible
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59 128 choice, which engages for lifetime.

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61 129 Each residency level includes a number of residents between 300 and 600 and the operation
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63 130 of choice begins at 9am and lasts until 5pm.

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3 131 A resident of our unit (MM) waited at the exit of the choice' lecture room to distribute the
4 132 questionnaire to the residents who accepted to participate anonymously after they had just
5
6 133 finished their choice operation.
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9 134 **Measurements :** The questionnaire explored three fields: socio-demographic data, work-
10 135 related characteristics, and HAD score.
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13 136 *Socio-demographic* information concerned the gender, age, marital status, number of
14 137 dependent children if married or divorced.
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17 138 *Work-related characteristics* included specialty, the level achieved so far in the specific
18 139 curriculum of each specialty, the number of shifts per month, working hours per week, and
19 140 the presence or not of compensatory rest. For the statistical analysis purpose, specialties
20 141 were split into four groups according to their degree of difficulty: medical (example
21 142 dermatology, pulmonology, rheumatology, fundamental specialties like histology, physiology
22 143 etc...) ; medical and surgical (example: ophthalmology, gynecology-obstetrics,
23 144 otorhinolaryngology etc...); difficult medical specialties (example: critical care medicine,
24 145 emergency medicine, cardiology), and difficult surgical specialties (neurosurgery,
25 146 cardiovascular surgery etc).
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33 147 *The survey tool* used in our study was Hospital Anxiety and Depression score (HAD) scale that
34 148 was developed by Zigmond & Snaith [19]. It is a brief questionnaire (containing 14 items),
35 149 and was originally designed to detect emotional disturbances in non-psychiatric patients
36 150 treated at hospital clinics. It is a self-report rating scale designed to measure both anxiety
37 151 and depression. It consists of two subscales, each containing seven items on a 4-point Likert
38 152 scale (ranging from 0-3). HAD is scored by summing the ratings for the 14 items to yield a
39 153 total score, and by summing the ratings for the 7 items of each subscale to yield separate
40 154 scores for anxiety and depression. Two cutoff scores are validated for detecting anxiety and
41 155 depression, namely 8 for doubtful cases and 11 for actual cases.
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49 156 The survey was written in French and self-completed by each resident who has agreed to
50 157 participate in the study, the residents having a perfect mastery of French, the language in
51 158 which all medical studies are carried out in Tunisia. The total for depression, anxiety
52 159 subscales the whole HAD scale were calculated by a resident from our unit.
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56 160 **Statistical analysis :**
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3 161 The study design focused on determination of the number of residents who meet the criteria
4 162 for anxiety and depression. Continuous parameters are expressed as medians and inter-
5 163 Quartile Ranges (IQR). The dichotomous variables are expressed as numbers and
6 164 percentages. Adjusted Odds Ratios (ORs) and 95% Confidence Intervals (CIs) for each
7 165 variable were calculated.

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12 166 Prevalence of anxiety and depression were calculated and correlated to socio-demographic
13 167 and work-related characteristics. Chi-square tests were carried out to compare the
14 168 prevalence of anxiety and depression between groups. Multivariable Poisson regression was
15 169 used to assess risk factors associated with anxiety and depression cases.

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20 170 *p*-values less than 0.05 were considered statistically significant. All statistical procedures
21 171 were performed using IBM SPSS Statistics 21.0 software.

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3 **183 Results:**
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6 **184** During the study-period corresponding to December 14th to December 22nd 2015, 1700 out
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8 **185** of 2200 (77%) medical residents willingly answered the proposed questionnaire. They had a
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10 **186** median age of 28 years [IQR: 27; 30] with a predominance of the female gender (60.8%);
11
12 **187** 40% were married, of whom 20% had at least one child (Table I).

13
14 **188** Tunisian Residents from all levels and different specialties answered the survey. Residents
15
16 **189** declared they used to work for a median of 60 hours [IQR : 48 ; 76] per week. 73% (1239)
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18 **190** among them ensured night shifts with a median number of 6 [IQR : 4 ; 7] per month; only 8%
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20 **191** (98) of these could benefit from compensatory rest. (Table I).

21
22 **192** The median HAD score amounted to 19 [IQR: 14 ; 23], split on the anxiety subscale (HAD-A) :
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24 **193** 10 [IQR: 7 ; 12], and the depression subscale (HAD-B): 9 [IQR: 6 ; 11].

25
26 **194** Overall, 742 (43.6%) residents reached the cut-off defining definite anxiety state (ie a score
27
28 **195** ≥ 11), and 519 (30.5%) reached the scale level defining definite depression. Out of these
29
30 **196** residents, 342 (20%) had both anxiety and depression. In the remaining, the prevalence of
31
32 **197** doubtful anxiety score (ie a score ≥ 8) was 30.5%, and that of doubtful depression was 31.5%.

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34 **198** Tables II and III depict the association between demographic and workload characteristics,
35
36 **199** and the occurrence of anxiety or depression, respectively.

37
38 **200** Age, female gender (66.7% Vs. 56.2%, $p < 0.0001$) and marital status (42% Vs. 36.7%, $p =$
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40 **201** 0.027) were significantly associated with definite cases of anxiety (HAD-A ≥ 11) compared to
41
42 **202** negative or doubtful ones (HAD-A < 11). The fifth level of residency course (13.9% vs. 9.7%, p
43
44 **203** = 0.009), and the choice of medical/surgical specialties (15.9% Vs. 10.8%, $p = 0.002$) were
45
46 **204** also significantly associated with anxiety. Medical specialties (45% Vs. 54.2%, $p < 0.0001$)
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48 **205** were on the contrary associated with a lower risk of developing anxiety symptoms (Table II).

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50 **206** For definite depressive cases (HAD-D ≥ 11) compared to negative and doubtful ones (HAD-D
51
52 **207** < 11), age, marital status (45.7% Vs. 36.2%, $p < 0.0001$) were significantly different between
53
54 **208** the two groups. Moreover, difficult surgical specialties (22.9% Vs. 17.5%, $p = 0.011$) were
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56 **209** significantly associated with depressive symptoms in contrast to medical specialties (44.7 Vs.
57
58 **210** 52.6%, $p = 0.003$) which were associated with lower depressive symptoms (Table III).

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60 **211** The number of shifts per month, and working hours per month were associated with both
212 probable anxiety and depressive cases (Table II and III).

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3 213 The Poisson regression analysis disclosed the following variables as associated with HAD
4 214 score: age (OR = 1.014, 95% CI, 1.006-1.023, p = 0.001); female gender (OR = 1.114, 95% CI,
5 215 1.083-1.145, p <0.0001); night shift number per month (OR = 1.048, 95% CI, 1.016-1.082, p =
6 216 0.03), working hours per week (OR = 1.008, 95% CI, 1.005-1.011, p = <0.0001) . Compared
7 217 with medical specialties, medico-surgical ones (OR = 1.459, 95% CI, 1.172-1.816, p = 0.001)
8 218 were independently associated with higher HAD scale (fig 1).
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224 Discussion

225 This large survey encompassing 1700 out of the 2200 Tunisian residents involved in
226 the periodic process of choosing internship positions in their specialties, shows that 74.1% of
227 them fulfilled the criteria of either definite (43.6%) or doubtful (30.5%) anxiety, while 62% of
228 them had either definite (30.5%) or doubtful (31.5%) depression symptoms. In 20% there
229 were both symptoms of anxiety and depression. Symptoms of anxiety-depression were
230 significantly associated with age, female sex, and the heavy burden of work imposed on a
231 weekly or monthly basis as reflected by the weekly working hours, the night-shift number
232 per month, and the choice of a specialty generally accepted as a difficult one (surgical or
233 medical-surgical specialty compared to medical specialty).

234 Of interest, the system of work revealed in this survey is very demanding, since the average
235 working hours per week (60 hours), and the number of night shifts per month (6 on average
236 regardless of the type of specialty) most often without compensatory rest, are extremely
237 high.

238 Although, mood disorders and physician distress such as burnout syndrome, depression, and
239 anxiety are admitted as both, more prevalent among caregivers compared to general
240 population, and a devastating situation in this particular population, information about their
241 prevalence in Tunisia is scarce, both in the general population and in physicians [5 20 21]. In
242 this first survey on the subject in our country, we succeeded to enroll 77% of potentially
243 concerned residents, yielding a picture that could be considered both large and accurate
244 snapshot of the actual situation of a corporate representing the real backbone of the public
245 health system in Tunisia. The use of the French version of the HAD questionnaire should not
246 be considered as a potential bias, as medical studies are conducted in French which is
247 perfectly mastered by all Tunisian residents.

248 Benchmarking the rates of moods disorders observed in young physicians with those
249 prevailing in the general Tunisian population is not easy since we are unaware of studies
250 assessing anxiety and depression rates among general Tunisian population, but international
251 studies stressed the fact that residents usually have higher rates of depression than the
252 general population [15 22]. Estimates of the prevalence of depression or depressive
253 symptoms among resident physicians vary from 3% to 60%, whereas a recent meta-analysis
254 yielded an overall pooled prevalence of depression or depressive symptoms of 28.8%

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3 255 rendering the definite or doubtful diagnosis rate of depression observed in our study very
4 256 high in comparison to the median rate at the international level[15].
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7 257 Resident physicians share the same known causes of depression than the general
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9 258 population: physical health, lifestyle, marital status, history of previous depression,
10 259 childhood, religiosity etc... They have in addition specific factors pertaining to the work
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12 260 organisation and the development of their career [4]. These risk-factors correspond to the
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14 261 difficulty of their specialty, postgraduate year, stress at work, current rotation difficulty,
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16 262 working hours, shift number etc...[4 15 23]. In our study the Poisson regression model
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18 263 disclosed the following items as statistically associated with the occurrence of anxiety-
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20 264 depression: age, female sex, practice of a specialty generally accepted as a difficult one, and
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22 265 the heavy burden of work imposed on a weekly or monthly basis as reflected by the weekly
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24 266 working hours, and the night-shift number per month. Most of these risk-factors have been
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26 267 reported elsewhere, or are intuitive, but it is their magnitude that makes the originality, and
27
28 268 intrigue in our study

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30 269 The occurrence of depression should be considered as a major event in the young
31
32 270 physician career or even life. It is indeed about a long-lasting phenomenon, as it has been
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34 271 shown that once present, depression as well as burnout is prone to persist throughout the
35
36 272 whole residency duration, or even beyond [24 25]. In a nationwide survey involving 3500
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38 273 Canadian physicians, Sullivan et al reported that 55% found that medicine as a profession
39
40 274 impacted negatively their family and personal life, whereas 65% reported that opportunities
41
42 275 to change career despite dissatisfaction were limited [26]

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44 276 Depression is also a source of decreased concentration at work, an increase in the rate of
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46 277 medical error, work dissatisfaction and conflicts, impaired sleep quality, and a greater
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48 278 propensity to attrition[7 27 28]. Hence, every effort aiming at improving the mental health
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50 279 of young physicians should be encouraged. This begins by acting on the risk factors
51
52 280 associated with anxiety and depression in this specific population.

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54 281 The resident physician should first be aware of the mental problem and seek help. We did
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56 282 not investigate whether the participating residents sought for or actually had psychological
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58 283 counseling, but we strongly believe that most did not. Residents' careers and the pace of
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60 284 work should also be better managed. Some measures could be immediate such as a

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3 285 compensatory rest after the night shifts. Others require the restoration of trust with the
4 286 population, a better governance of the health system, objectives that seem very difficult to
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6 287 achieve in the current political and social climate in the country.
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3 289 **Legend Figure1:** Risk Factors associated with Total HAD Score
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5 290 **Authors' contributions**
6

7 291 Study Concept and design: MM and FA; Data Acquisition: MM; Analysis and interpretation of
8 292 the data: MM, LOB, ZH, IO, FD, FA; All authors read and approved the final manuscript. MM
9 293 and FA had full access to the data and take responsibility for its integrity and the accuracy of
10 294 the analyses.
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14 296 editing of the manuscript
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16
17 297 **Data Sharing statement:** dataset is available by contacting FA at f.abroug@rns.tn
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Table 1 : Demographic and work characteristics of the study population (n=1700) :

Sex ratio (M/F)		667/1033
Age, med [IQR]		28 [27 ; 30]
Marital Status	Single, n(%)	1036 (61)
	Married, n(%)	655 (38.5)
	Divorced, n(%)	9 (0.5)
Number of Children	Zero, n(%)	343 (20.2)
	One, n(%)	235 (13.8)
	More than one, n(%)	86 (5.1)
Residency Level (year)	I, n(%)	320 (18.8)
	II, n(%)	410 (24.1)
	III, n(%)	434 (25.5)
	IV, n(%)	340 (20)
	V, n(%)	196 (11.5)
Specialty*	Medical, n(%)	854 (50.2)
	Medical and Surgical, n(%)	221 (13%)
	Hard Medical, n(%)	299 (17.6)
	Hard Surgical, n(%)	326 (19.2)
Night shifts per month, med [IQR]		6 [4 ; 7]
Working hours per week, med [IQR]		60 [48 ; 76]
Compensatory rest, n (%)		98 (5.7)

**Specialties were split into four categories according to everyday difficulties: medical (example dermatology, pulmonology, rheumatology, fundamental specialties like histology, physiology etc) ; medical and surgical (example: ophthalmology, gynecology-obstetrics, otorhinolaryngology etc); hard medical (example: critical care medicine, emergency medicine, cardiology), and hard surgical specialties (neurosurgery, cardiovascular surgery etc).*

Table II : Demographic and workload characteristics and their association with anxiety :

	No Anxiety	Definite Anxiety	
n (%)	958 (56.4)	742 (43.6)	
Age, med [IQR]	29 [28 ; 30]	29 [28 ; 30]	<u>0.008</u>
Gender			<u><0.0001</u>
Male	420 (43.8)	247 (33.3)	
Female	538 (56.2)	495 (66.7)	
Marital Status			<u>0.027</u>
Single	606 (63.3)	430 (58)	
Married	352 (36.7)	312 (42)	
Level of Residency			<u>0.005</u>
I	188 (19.6)	132 (17.8)	
II	244 (25.5)	166 (22.4)	
III	251 (26.2)	183 (24.7)	
IV	182 (19)	158 (21.3)	
V	93 (9.7)	103 (13.9)	
Specialty			<u>0.018</u>
Medical	519 (54.2)	334 (45)	
Medical and Surgical	103 (10.8)	118 (15.9)	
Hard Surgical	181 (18.9)	145 (19.5)	
Hard Medical	155 (16.2)	145 (19.5)	
Shifts/month, med [IQR]	5 [2;7]	6 [5;8]	<u><0.0001</u>
Working Hours/week, med [IQR]	60 [40;72]	60 [50 ; 80]	<u><0.0001</u>

Table III : Demographic and workload characteristics and association with depression cases

	No depression	Definite depression	
N (%)	1181 (69.5)	519 (30.5)	
Age, med [IQR]	29 [28;30]	29 [28 ; 30]	<0.0001
Gender			0.281
Male	453 (38.4)	214 (41.2)	
Female	728 (61.6)	305 (58.8)	
Marital Status			<0.0001
Single	754 (63.8)	282 (54.3)	
Married	427 (36.2)	237 (45.7)	
Level of Residency			<0.0001
I	263 (22.3)	57 (11)	
II	292 (24.7)	118 (22.7)	
III	294 (24.9)	140 (27)	
IV	218 (18.5)	122 (23.5)	
V	114 (9.7)	82 (15.8)	
Specialty			0.962
Medical	621 (52.6)	232 (44.7)	
Medical and Surgical	156 (13.2)	65 (12.5)	
Hard Surgical	207 (17.5)	119 (22.9)	
Hard Medical	197 (16.7)	103 (19.8)	
Shifts/month, med [IQR]	5 [3;7]	6 [4 ; 8]	<0.0001
Working Hours/week, med [IQR]	60 [42;72]	64 [51 ; 80]	<0.0001

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For peer review only

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

	Item No	Recommendation	
Title and abstract	1	(a) Indicate the study's design with a commonly used term in the title or the abstract	X
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	X
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	P3
Objectives	3	State specific objectives, including any prespecified hypotheses	P4
Methods			
Study design	4	Present key elements of study design early in the paper	P5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	P5
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants	P5
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	P5
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	P6
Bias	9	Describe any efforts to address potential sources of bias	P5
Study size	10	Explain how the study size was arrived at	P5
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	P7
		(b) Describe any methods used to examine subgroups and interactions	NA
		(c) Explain how missing data were addressed	NA
		(d) If applicable, describe analytical methods taking account of sampling strategy	NA
		(e) Describe any sensitivity analyses	P7
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	P8
		(b) Give reasons for non-participation at each stage	P8
		(c) Consider use of a flow diagram	NA
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	Table I
		(b) Indicate number of participants with missing data for each variable of interest	NA
Outcome data	15*	Report numbers of outcome events or summary measures	P8
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	P8

		(b) Report category boundaries when continuous variables were categorized	P8
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	NA
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	P8
Discussion			
Key results	18	Summarise key results with reference to study objectives	P10
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	P10
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	P10-11
Generalisability	21	Discuss the generalisability (external validity) of the study results	P11
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	P1

*Give information separately for exposed and unexposed groups.

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

Prevalence of Anxiety and Depressive Symptoms among Medical Residents in Tunisia: A Cross-Sectional survey

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3 **1 Prevalence of Anxiety and Depressive Symptoms among Medical Residents in**
4 **2 Tunisia: A Cross-Sectional survey**

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7 3 Mehdi Marzouk¹ (MD), Lamia Ouanes-Besbes¹ (MD), Islem Ouanes¹ (MD), Zeineb
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17
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3 21 **Abstract:**

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5 22 **Objective:** assess the prevalence of anxiety and depressive symptoms, and associated risk
6 23 factors in Tunisian residents.

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8 24 **Design:** cross-sectional survey

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10 25 **Setting:** Faculty of Medicine, Tunis

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12 26 **Participants:** all Tunisian residents brought together to choose their next 6-month rotation

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14 27 **Intervention:** the items of the Hospital Anxiety and Depression score (HAD) questionnaire
15 28 was employed to capture the prevalence of anxiety and/or depression among residents.
16 29 Statistical relationships between anxiety and depression, and socio-demographic and work-
17 30 related data were explored by Poisson regression.

18
19 31 **Results:** 1,700 out of 2,200 (77%) medical residents (mean age: 28.5±2 years, female: 60.8%)
20 32 answered the questionnaire. The mean working hours per week were 62±21 hours; 73%
21 33 ensured a mean of 5.4±3 night shifts per month; only 8% of them could benefit from a day of
22 34 safety rest. Overall, 74.1% of participating residents had either, definite (43.6%) or doubtful
23 35 (30.5%) anxiety, while 62% had definite (30.5%) or doubtful (31.5%) depression symptoms,
24 36 with 20% having both. Symptoms of anxiety-depression were significantly associated with
25 37 resident's age (OR= 1.014; 95%CI:1.006-1.023, p= 0.001); female gender (OR= 1.114;95%CI:
26 38 1.083-1.145, p<0.0001); and the heavy burden of work imposed on a weekly or monthly
27 39 basis, as reflected by night shift number per month (OR= 1.048;95%CI, 1.016-1.082, p= 0.03),
28 40 worked hours per week (OR= 1.008;95%CI:1.005-1.011, p<0.0001). Compared to medical
29 41 specialties, the generally accepted difficult specialties (surgical or medical-surgical) were
30 42 associated with higher HAD scale (OR= 1.459;95%CI: 1.172-1.816, p= 0.001).

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33 43 **Conclusion:** Tunisian residents experience a rate of anxiety/depression substantially higher
34 44 than that reported at the international level. This phenomenon is worrying as it has been
35 45 associated with an increase in medical errors, work dissatisfaction and attrition. Means of
36 46 improving the well-being of Tunisian residents are explored, emphasizing those requiring
37 47 immediate implementation.

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43 49 **Strengths and limitations of this study:**

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45 50 First study to assess the prevalence of Anxiety/Depression among Tunisian residents

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47 51 The large participation rate

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49 52 The HAD questionnaire is in French (but this language is well mastered by Tunisian residents)

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51 53 No information on the rates of mood disorders in the general Tunisian population for
52 54 comparison

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54 55 No assessment of the prevalence of Burnout syndrome

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3 56 Physicians are increasingly exposed to stressful situations regardless of age, gender, or
4 57 seniority in the profession¹⁻⁴. Only a few variables inherent in the personalities, or in work-
5 58 related strain, are able to modulate the expression of this stress by attenuating or
6 59 exaggerating the generated mood disorders (anxiety, depression, burn out), and their impact
7 60 on the personal and professional life^{5 6}. These disorders may hamper the physician's
8 61 professional performance by affecting the concentration at work, and the quality of
9 62 provided healthcare services, and provoking conflicts with patients or their families, or with
10 63 colleagues,⁷⁻⁹. They are also associated with a higher substance use and abuse, divorce, and
11 64 even more suicidal ideations^{9 10 11}. Medical residents seem at increased risk of developing
12 65 mental disorders^{7 12-14}. A recent systematic review reported a 28.8% pooled prevalence of
13 66 depression or depressive symptoms in medical residents with a wide variation in this rate,
14 67 depending on the instrument used¹⁵. In countries with socio-economic conditions similar to
15 68 those of Tunisia, the prevalence of depressive symptoms in medical residents ranges from
16 69 17% in India to 48% in Argentina¹⁶⁻¹⁸

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28 70 Tunisia is a country that is currently experiencing major socio-economic and political
29 71 changes as a consequence of "Arab spring". Arab spring was a series of anti-government
30 72 protests, or armed rebellions ignited in Tunisia by the so-called "Jasmine revolution" which
31 73 spread across North African countries and in the Middle East. It is seen as the translation of
32 74 peoples' aspirations to democracy, and to replace dictators in place. According to the United
33 75 nations Development Program (UNDP), the average annual Human Development Index (HDI)
34 76 has fallen in Tunisia from 0.88% during the decade before the advent of the Arab spring to
35 77 0.25% during the 5 years that followed leading to a sustained erosion of the middle class, an
36 78 increase in poverty, and a decrease in overall wealth¹⁹. The Tunisian downturn has
37 79 particularly altered the relationship between the main body of the society and the medical
38 80 profession, the latter being perceived by a large part of the population as a body of
39 81 privileged, insufficiently empathic, and little concerned by the misfortunes of the population.
40 82 The assaults against doctors, particularly in public hospitals and their emergency services,
41 83 malpractice suits and prosecutions, are now very frequent, and are highly publicized on a
42 84 daily basis on the various media in the country. Moreover, public hospitals experienced just
43 85 after the revolution a sharp deterioration in the resources and staff made available, together
44 86 with an alteration of their governance, which paralleled that of the public health sector²⁰.

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3 87 This situation has greatly frustrated the population, in particular the citizens who cannot
4 88 afford the private medical sector and its large out-of-pocket costs²¹.

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7 89 Among the medical profession, the young Tunisian residents are considered the pillar of
8
9 90 these public hospitals. Residents are the only physicians present at the hospital at night, on
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11 91 weekends, and on holidays.

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13 92 Residents come to term of a long, demanding, and selective course of studies. The typical
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15 93 resident must have passed his baccalaureate among the first ranked ones, be among the
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17 94 "happy few" who enter the medical school after a tight selection. Indeed, admission to one
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19 95 of the four Faculties of Medicine is reserved to top-ranked graduates both in the
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21 96 baccalaureate and in a specific ranking taking into account the grades of key scientific
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23 97 disciplines. Overall, only 3 to 5% of bachelors are accepted annually to pursue medical
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25 98 studies. After 7 years of medical studies, graduates wishing to specialize, have to successfully
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27 99 undergo a final residency contest usually after 2 to 3 attempts (Annual pass rate = 25%).
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29 100 Aged at least 26, the resident faces the reality of the public hospital, where he is exposed to
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31 101 stress resulting from non-optimal working conditions: the need to meet his professional
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33 102 duties set by his supervisors, and the growing demand of the population.

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35 103 We hypothesized that the combination of all of these unfavorable circumstances for
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37 104 professional fulfillment, should result in a high level of mood disorders in medical residents.
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39 105 We conducted a large cross-sectional survey to address the prevalence in Tunisian residents
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41 106 of anxiety and depressive symptoms and highlight associated risk factors.

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3 108 **Patients-Methods**

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5 109 **Participants** : In Tunisia, specialization in medicine takes place at the end of general medical
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7 110 studies accomplished in one of the four faculties of medicine in the country. Doctors who
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9 111 wish to specialize do so following a national contest, bringing together the candidates from
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11 112 the four faculties of medicine. This contest is very selective, and takes place over three days.
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13 113 It consists in more than 300 questions (multiple choice, short answer), covering separately
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15 114 each of the following areas: medical specialties, surgical specialties, and basic sciences.
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17 115 More than 1,500 candidates participate annually, for about 500 elected members, who are
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19 116 ranked consecutively in order of merit. The choice of the specialty is then made according to
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21 117 the rank of success in the contest, on a number of posts that is equal to the number of
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23 118 candidates, and distributed among all the medical specialties by quotas which are fixed
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25 119 according to the needs of the country in doctors practicing in medical specialties. The
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27 120 internship periods (of 6 months each) and their distribution between specialties, in order to
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29 121 validate a given specialty, are specified in advance by the college of each specialty. Every six
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31 122 months, all trainee residents in the country (more than 2,000) gather over ten days at the
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33 123 Faculty of Medicine of Tunis, the Tunisian capital, to choose the next 6-month rotation.
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35 124 Within the chosen specialty, the candidate chooses according to seniority first, and his
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37 125 classification in the corresponding level afterwards.

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39 126 **Protocol**: The study protocol was approved by the local Institutional Review Board of
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41 127 Fatouma Bourguiba Teaching Hospital, Monastir (reference #2013/108). All the medical
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43 128 residents gathered at the faculty of medicine of Tunis, between December 14 and December
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45 129 22, 2015 for the choice of the next 6 month-rotation, were invited to answer an anonymous,
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47 130 self-administered questionnaire. The questionnaire covers their civil and marital status, the
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49 131 specialty chosen, their level of advancement in the specialty (duration 4 years for medical
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51 132 specialties and 5 years for surgical specialties), and items of the Hospital Anxiety and
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53 133 Depression score (HAD) questionnaire²².

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55 134 Each residency level includes 300-600 young physicians whose order of passage depends on
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57 135 their ranking. Participants answered the questionnaire immediately after having made their
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59 136 choice.

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3 137 **Measurements :** The questionnaire explored three fields: socio-demographic data, work-
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5 138 related characteristics, and HAD score.

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7 139 *Socio-demographic* information concerned the gender, age, marital status, number of
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9 140 dependent children if married or divorced.

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11 141 *Work-related characteristics* included specialty, the level achieved so far in the specific
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13 142 curriculum of each specialty, the number of shifts per month, whether the shift is followed
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15 143 by a day of safety rest, and total working hours per week. For the statistical analysis purpose,
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17 144 specialties were split into four groups according to the associated workload: medical
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19 145 (example dermatology, pulmonology, rheumatology, psychiatry, fundamental specialties
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21 146 such as histology, physiology etc...); medical and surgical (example: ophthalmology,
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23 147 gynecology-obstetrics, otorhinolaryngology etc...); medical specialties with high workload
24
25 148 (example: critical care medicine, emergency medicine, cardiology), and surgical specialties
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27 149 with high workload (neurosurgery, cardiovascular surgery etc).

28
29 150 *The survey tool* used in our study was Hospital Anxiety and Depression score (HAD) scale that
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31 151 was developed by Zigmond & Snaith²². It is a brief questionnaire (containing 14 items), and
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33 152 was originally designed to detect emotional disturbances in non-psychiatric patients treated
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35 153 at hospital clinics. It is a self-report rating scale designed to measure both anxiety and
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37 154 depression. It consists of two subscales, each containing seven items on a 4-point Likert scale
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39 155 (ranging from 0-3). Participants were told that the questions asked relate to their psychic
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41 156 state during the last two weeks. HAD is scored by summing the ratings for the 14 items to
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43 157 yield a total score, and by summing the ratings for the 7 items of each subscale to yield
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45 158 separate scores for anxiety and depression. Two cutoff scores are validated for detecting
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47 159 anxiety and depression, namely 11 for participants who screen positive for
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49 160 anxiety/depression and 8 for probable anxiety/depression.

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51 161 The survey was written in French and self-completed by each resident who has agreed to
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53 162 participate in the study. The language of the survey is not actually a barrier to the residents'
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55 163 completion of the survey, because that is the language of all medical studies in the country.
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57 164 The total for depression, anxiety subscales the whole HAD scale were calculated by a
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59 165 resident from our unit.

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166 **Statistical analysis :**

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3 167 The study design focused on determination of the number of residents who meet the criteria
4 168 for anxiety and depression. Continuous variables are expressed either as means \pm Standard
5 169 Deviations or medians and inter-Quartile Ranges (IQR), according to normal or skewed data
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8 170 distribution. The dichotomous variables are expressed as numbers and percentages.
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10 171 Adjusted Odds Ratios (ORs) and 95% Confidence Intervals (CIs) for each variable were
11 172 calculated.

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14 173 Prevalence of anxiety and depression were calculated and correlated to socio-demographic
15 174 and work-related characteristics. Chi-square tests were carried out to compare the
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17 175 prevalence of anxiety and depression between groups. Multivariable Poisson regression was
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19 176 used to assess risk factors associated with anxiety and depression cases.

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21 177 Statistical significance was denoted by *p*-values less than 0.05. All statistical procedures
22 178 were performed using IBM SPSS Statistics 21.0 software.

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26 179 **Participants and Public involvement:** No participants were involved in setting the research
27 180 question or in the design or conduct of the study. No participants were asked to advise on
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29 181 interpretation or writing up of results. There are no plans to disseminate the results of the
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31 182 research individually to study participants.

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3 **190 Results:**
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6 **191** During the study-period corresponding to December 14th to December 22nd 2015, 1700 out
7 **192** of 2200 (77%) medical residents from all levels and different specialties answered the
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9 **193** survey. They had a mean (\pm SD) age of 28.5 \pm 2 years with a predominance of the female
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11 **194** gender (60.8%); 38.5% were married, of whom 19% had at least one child (Table I).

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13 **195** Residents declared they used to work for a mean of 62 \pm 21 hours per week; 73% (1239)
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15 **196** among them ensured night shifts with a mean number of 5.4 \pm 3 per month, of whom only 8%
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17 **197** (98) declared that the shift was systematically followed by a day of safety rest (Table I).

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19 **198** The median HAD score amounted to 19 [IQR: 14 ; 23], split on the anxiety subscale (HAD-A) :
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21 **199** 10 [IQR: 7 ; 12], and the depression subscale (HAD-B): 9 [IQR: 6 ; 11].

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23 **200** Overall, 742 (43.6%) residents reached the cut-off defining definite anxiety state (ie a score
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25 **201** \geq 11), and 519 (30.5%) reached the scale level defining definite depression. Out of these
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27 **202** residents, 342 (20%) had both anxiety and depression. In the remaining, the prevalence of
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29 **203** doubtful anxiety score (ie a score \geq 8) was 30.5%, and that of doubtful depression was 31.5%.
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31 **204** Tables II and III depict the association between demographic and workload characteristics,
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33 **205** and the occurrence of anxiety or depression, respectively.

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35 **206** Univariate analysis disclosed age, female gender (66.7% Vs. 56.2%, $p < 0.0001$) and marital
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37 **207** status (42% Vs. 36.7%, $p = 0.027$) as significantly associated with definite cases of anxiety
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39 **208** (HAD-A \geq 11) compared to negative or doubtful ones (HAD-A $<$ 11). The fifth level of
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41 **209** residency course (13.9% vs. 9.7%, $p = 0.009$), and the choice of medical/surgical specialties
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43 **210** (15.9% Vs. 10.8%, $p = 0.018$) were also significantly associated with anxiety. Medical
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45 **211** specialties (45% Vs. 54.2%, $p < 0.0001$) were on the contrary associated with a lower risk of
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47 **212** developing anxiety symptoms (Table II).

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49 **213** For definite depressive cases (HAD-D \geq 11) compared to negative and doubtful ones (HAD-D
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51 **214** $<$ 11), age, marital status (45.7% Vs. 36.2%, $p < 0.0001$) were significantly different between
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53 **215** the two groups. Moreover, surgical specialties associated with high-workload (22.9% Vs.
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55 **216** 17.5%, $p = 0.011$) were significantly associated with depressive symptoms in contrast to
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57 **217** medical specialties (44.7 Vs. 52.6%, $p = 0.003$) which were associated with lower depressive
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59 **218** symptoms (Table III).

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219 The number of shifts per month, and working hours per month were associated with both
220 anxiety and depressive cases (Table II and III).

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3 221 The Poisson regression analysis disclosed the following variables as associated with HAD
4 222 score: age (OR = 1.014, 95% CI, 1.006-1.023, p = 0.001); female gender (OR = 1.114, 95% CI,
5 223 1.083-1.145, p <0.0001); night shift number per month (OR = 1.048, 95% CI, 1.016-1.082, p =
6 224 0.03), working hours per week (OR = 1.008, 95% CI, 1.005-1.011, p = <0.0001) . Compared
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9 225 with medical specialties, medico-surgical ones were independently associated with higher
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11 226 HAD scale (OR = 1.459, 95% CI, 1.172-1.816, p = 0.001; fig 1).

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232 Discussion

233 This large survey encompassing 1700 out of the 2200 Tunisian residents brought
234 together for the periodic process of choosing internship positions in their specialties, shows
235 that 43.6% of them had definite criteria of anxiety, and 30.5% had depression. The diagnosis
236 of anxiety or depression was doubtful in an additional 30% each. Symptoms of anxiety-
237 depression were significantly associated with age, female sex, and the heavy burden of work
238 imposed on a weekly or monthly basis as reflected by the high number of weekly working
239 hours, the night-shift number per month, and the choice of a specialty generally accepted as
240 a difficult one (surgical or medical-surgical specialty compared to medical specialty).

241 Of interest, this survey unveils a very demanding health system imposed to Tunisian
242 residents as reflected by the average working hours per week (60 hours), and the number of
243 night shifts per month (6 on average regardless of the type of specialty), most often without
244 a day of safety rest.

245 Although, mood disorders and physician distress (such as burnout and depression) are more
246 prevalent among medical professionals compared to general population, information is
247 lacking about their prevalence in Tunisia^{5 23 24}. This first survey on the subject in our country,
248 enrolled 77% of potentially concerned residents, yielding a snapshot on the burden incurred
249 by residents from all specialties in their everyday practice. The use of the French version of
250 the HAD questionnaire should not be considered as a barrier to the residents' completion of
251 the survey, because that is the language of all medical studies in the country.

252 International studies stressed the fact that residents usually have higher rates of
253 depression than the general population^{15 25}. Estimates of the prevalence of depression or
254 depressive symptoms among resident physicians vary from 3% to 60% with a median of
255 28.8% according to a recent meta-analysis of 54 studies, a proportion that is lower than that
256 recorded in our study whether we only consider the rate of definite depression, or when we
257 add the additional cases qualifying for doubtful depression¹⁵. Of interest, this meta-analysis
258 emphasized the difference in the methodological approach to address this issue (cross
259 sectional vs longitudinal studies), and the great variability in the instruments used (no less
260 than 13 different instruments used in the 54 studies)¹⁵. A prospective cohort study
261 conducted in Switzerland and using the HAD inventory used in our study disclosed a
262 prevalence of 30% anxiety symptoms in the second year residents, and 20% in the fourth

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3 263 and sixth year residents; depression symptoms were present in 15% and 10%, respectively²⁶.
4 264 However, benchmarking with countries with socio-economic similarities could be more
5 265 insightful. In a study including 118 residents from the American University of Beirut, 22%
6 266 qualified for moderate to major depressive symptoms while only 8% had anxiety²⁷.
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8 267 Moreover, in a cross sectional study conducted among residents of various specialties in
9 268 Saudi Arabia, the prevalence of moderate to severe depressive symptoms was around 20%
10 269 ¹⁷.

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15 270 Resident physicians share the same known causes of depression than the general
16 271 population: physical health, lifestyle, marital status, history of previous depression,
17 272 childhood, religiosity etc... They have in addition specific factors according to the way the
18 273 work is done, its everyday planning, and the constraints inherent to their career
19 274 development ⁴. These risk-factors correspond to the difficulty of their specialty,
20 275 postgraduate year, stress at work, current rotation difficulty, working hours, shift number
21 276 etc...^{4 15 28}. In our study the Poisson regression model disclosed the following items as
22 277 statistically associated with the occurrence of anxiety-depression: age, female sex, practice
23 278 of a specialty generally accepted as very demanding and difficult, and the heavy burden of
24 279 work imposed on a weekly or monthly basis as reflected by the weekly working hours, and
25 280 the night-shift number per month. Most of these risk-factors have been reported elsewhere,
26 281 or are intuitive, but it is their magnitude that makes this study important.

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37 282 The occurrence of depression should be considered as a major event in the young
38 283 physician career or even life. It has been shown that once present, depression as well as
39 284 burnout may persist throughout the whole residency duration, or even beyond ^{29 30}. In a
40 285 nationwide survey involving 3500 Canadian physicians, Sullivan et al reported that 55%
41 286 found that medicine as a profession impacted negatively on their family and personal life,
42 287 whereas 65% reported that opportunities to change career despite dissatisfaction were
43 288 limited ³¹. Depression is also a source of decreased concentration at work, an increase in the
44 289 rate of medical error, work dissatisfaction and conflicts, impaired sleep quality, and a greater
45 290 propensity to attrition, and even suicide ideation ^{7 32 33}.

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52 291 Considering the high prevalence of anxiety and depression among Tunisian medical
53 292 residents, every effort aiming at improving the mental health of young physicians should be
54 293 encouraged. Any strategy should target both the personal level to amend the identified and

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3 294 potentially actionable risk-factors, and include more measures targeting the general
4 295 organization of residents' work modalities, and their relationship with the hierarchy and
5 296 administration.

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8 297 The resident physician should first be aware of the mental problem and seek help in
9 298 particular those with previous personal history of depression³⁴. We did not investigate
10 299 whether the participating residents sought for, or actually had psychological counseling, but
11 300 we strongly believe that most did not. More generally, accepted risk factors such as age,
12 301 gender, marital status, stressors outside work, sleep deprivation, or lifestyle, require more
13 302 personal attention⁴. The current study was not designed to allow participants' identification
14 303 so that they could be given individual information and act on it. Future studies targeting
15 304 preferentially residents (or specialties) at high risk of anxiety, depression, or burnout, should
16 305 consider such feedback for more specific training programs.

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24 306 Residency program factors and the pace of work should also be better managed. While
25 307 these details were totally non-existent in Tunisia, this has been recently defined through the
26 308 promulgation on March 9, 2018 of the bylaw regarding the status of Tunisian interns and
27 309 residents³⁵. This promulgation, which has been obtained following long negotiations, and a
28 310 strike that lasted more than 6 weeks, defines for the first time the role and duty of residents.
29 311 The maximum number of weekly working hours and that of shift frequency have been
30 312 clearly defined and have been reduced to a maximum of 40 hours and two per week,
31 313 respectively. A day of safety rest following every shift has been rendered mandatory.
32 314 Although still debated, the issue of work-hour restriction could be effective in reducing high
33 315 emotional exhaustion despite the fact that it carries the risk of alteration in the quality of
34 316 care and education³⁶.

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318 **Table I : Demographic and work characteristics of the study population (n=1700) :**

Sex ratio (M/F)		667/1033
Age, med [IQR]		28 [27 ; 30]
Marital Status	Single, n(%)	1036 (61)
	Married, n(%)	655 (38.5)
	Divorced, n(%)	9 (0.5)
Number of Children	Zero, n(%)	343 (20.2)
	One, n(%)	235 (13.8)
	More than one, n(%)	86 (5.1)
Residency Level (year)	I, n(%)	320 (18.8)
	II, n(%)	410 (24.1)
	III, n(%)	434 (25.5)
	IV, n(%)	340 (20)
	V, n(%)	196 (11.5)
Specialty*	Medical, n(%)	854 (50.2)
	Medical and Surgical, n(%)	221 (13%)
	High-workload Medical specialties, n(%)	299 (17.6)
	High-workload Surgical specialties, n(%)	326 (19.2)
Working hours per week, med [IQR]		60 [48 ; 76]
Night shifts per month, med [IQR]		6 [4 ; 7]
Recovery day following night shift, n (%)		98 (8)

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320 **Specialties were split into four categories according to everyday difficulties: medical*
 321 *(example dermatology, pulmonology, rheumatology, neurology, psychiatry, fundamental specialties*
 322 *like histology, physiology etc) ; medical and surgical (example: ophthalmology, gynecology-obstetrics,*
 323 *otorhinolaryngology etc); high-workload medical (example: critical care medicine, anesthesiology,*
 324 *emergency medicine, cardiology), and high-workload surgical specialties (surgery, pediatric surgery,*
 325 *orthopedics, neurosurgery, urology, cardiovascular surgery etc).*

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327 **Table II** : Demographic and workload characteristics and their association with anxiety :

	No Anxiety	Definite Anxiety	<i>p</i>
<i>n</i> (%)	958 (56.4)	742 (43.6)	
Age, mean±SD	28.5±1.9	28.7±2	0.008
Gender			0.0001
Male	420 (43.8)	247 (33.3)	
Female	538 (56.2)	495 (66.7)	
Marital Status			0.027
Single	606 (63.3)	430 (58)	
Married	352 (36.7)	312 (42)	
Level of Residency			0.005
I	188 (19.6)	132 (17.8)	
II	244 (25.5)	166 (22.4)	
III	251 (26.2)	183 (24.7)	
IV	182 (19)	158 (21.3)	
V	93 (9.7)	103 (13.9)	
Specialty			0.018
Medical	519 (54.2)	334 (45)	
Medical and Surgical	103 (10.8)	118 (15.9)	
High-workload Surgical specialties	181 (18.9)	145 (19.5)	
High-workload Medical specialties	155 (16.2)	145 (19.5)	
Shifts/month, mean±SD	4.9±3	6±2.9	0.0001
Working Hours/week, mean±SD	58.8±20	66.4±20	0.0001

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330 **Table III** : Demographic and workload characteristics and association with depression cases

	No depression	Definite depression	<i>p</i>
N (%)	1181 (69.5)	519 (30.5)	
Age, mean±SD	28.3±1.8]	29±2	0.007
Gender			0.11
Male	453 (38.4)	214 (41.2)	
Female	728 (61.6)	305 (58.8)	
Marital Status			0.0001
Single	754 (63.8)	282 (54.3)	
Married	427 (36.2)	237 (45.7)	
Level of Residency			0.0001
I	263 (22.3)	57 (11)	
II	292 (24.7)	118 (22.7)	
III	294 (24.9)	140 (27)	
IV	218 (18.5)	122 (23.5)	
V	114 (9.7)	82 (15.8)	
Specialty			0.006
Medical	621 (52.6)	232 (44.7)	
Medical and Surgical	156 (13.2)	65 (12.5)	
High-workload Surgical specialties	207 (17.5)	119 (22.9)	
High-workload Medical specialties	197 (16.7)	103 (19.8)	
Shifts/month, mean±SD]	5±3	6±2.9	0.0001
Working Hours/week, med [IQR]	60±20	66±20	0.0001

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5 334 **Legend Figure1:** Risk Factors associated with Total HAD Score
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7 335 **Authors' contributions**
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9 336 Study Concept and design: MM and FA; Data Acquisition: MM; Analysis and interpretation of
10 337 the data: MM, LOB, ZH, IO, FD, FA; All authors read and approved the final manuscript. MM
11 338 and FA had full access to the data and take responsibility for its integrity and the accuracy of
12 339 the analyses.
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16 341 for the Language editing of the manuscript
17
18

19 342 **Data Sharing statement:** dataset is available by contacting FA at f.abroug@rns.tn
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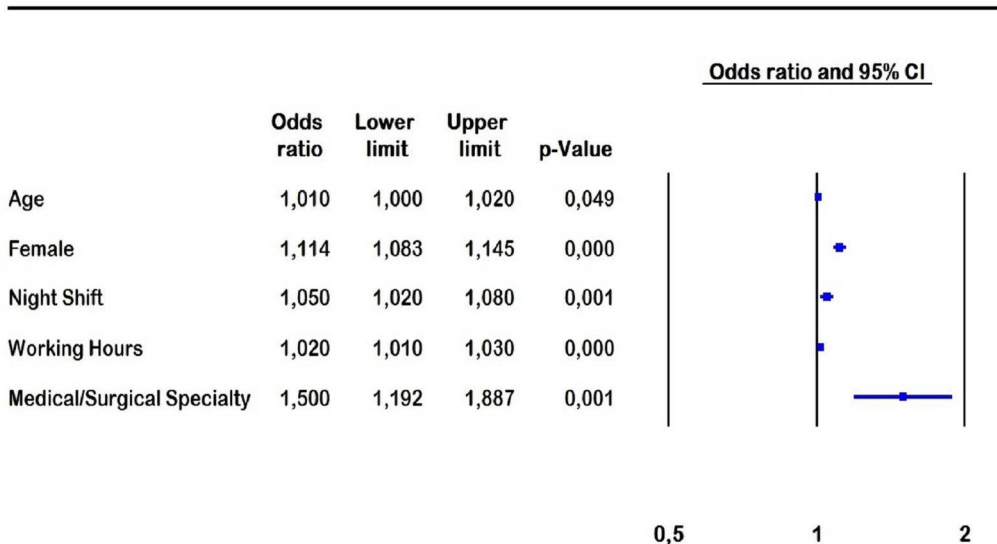
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Risk factors for Anxiety/depression

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Review only

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

	Item No	Recommendation	
Title and abstract	1	(a) Indicate the study's design with a commonly used term in the title or the abstract	X
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	X
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	P2
Objectives	3	State specific objectives, including any prespecified hypotheses	P2
Methods			
Study design	4	Present key elements of study design early in the paper	P5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	P5
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants	P5
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	P6
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	P6
Bias	9	Describe any efforts to address potential sources of bias	P6
Study size	10	Explain how the study size was arrived at	P7
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	P7
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	P7
		(b) Describe any methods used to examine subgroups and interactions	NA
		(c) Explain how missing data were addressed	P7
		(d) If applicable, describe analytical methods taking account of sampling strategy	NA
		(e) Describe any sensitivity analyses	P7
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	P8
		(b) Give reasons for non-participation at each stage	P8
		(c) Consider use of a flow diagram	NA
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	Table I
		(b) Indicate number of participants with missing data for each variable of interest	NA
Outcome data	15*	Report numbers of outcome events or summary measures	P8
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	P8

		(b) Report category boundaries when continuous variables were categorized	P8
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	NA
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	P9
Discussion			
Key results	18	Summarise key results with reference to study objectives	P10
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	P10
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	P10-11
Generalisability	21	Discuss the generalisability (external validity) of the study results	P11
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	P1

*Give information separately for exposed and unexposed groups.

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

Prevalence of Anxiety and Depressive Symptoms among Medical Residents in Tunisia: A Cross-Sectional survey

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3 **1 Prevalence of Anxiety and Depressive Symptoms among Medical Residents in**
4 **2 Tunisia: A Cross-Sectional survey**
5

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22
23

24 12

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3 21 **Abstract:**

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5 22 **Objective:** assess the prevalence of anxiety and depressive symptoms, and associated risk
6 23 factors in Tunisian medical residents.

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8 24 **Design:** cross-sectional survey

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10 25 **Setting:** Faculty of Medicine, Tunis

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12 26 **Participants:** all Tunisian medical residents brought together between December 14 and 22,
13 27 2015, to choose their next 6-month rotation

14
15 28 **Intervention:** the items of the Hospital Anxiety and Depression score (HAD) questionnaire
16 29 was employed to capture the prevalence of anxiety and/or depression among residents.
17 30 Statistical relationships between anxiety and depression (HAD score), and socio-
18 31 demographic and work-related data were explored by Poisson regression.

19
20 32 **Results:** 1,700 out of 2,200 (77%) medical residents (mean age: 28.5±2 years, female: 60.8%)
21 33 answered the questionnaire. The mean working hours per week were 62±21 hours; 73%
22 34 ensured a mean of 5.4±3 night shifts per month; only 8% of them could benefit from a day of
23 35 safety rest. Overall, 74.1% of participating residents had either, definite (43.6%) or probable
24 36 (30.5%) anxiety, while 62% had definite (30.5%) or probable (31.5%) depression symptoms,
25 37 with 20% having both definite anxiety and definite depression. Total HAD score was
26 38 significantly associated with resident's age (OR=1.014; 95%CI:1.006-1.023, p=0.001); female
27 39 gender (OR=1.114;95%CI: 1.083-1.145, p<0.0001); and the heavy burden of work imposed
28 40 on a weekly or monthly basis, as reflected by night shift number per month
29 41 (OR=1.048;95%CI, 1.016-1.082, p=0.03), worked hours per week (OR=1.008;95%CI:1.005-
30 42 1.011, p<0.0001). Compared to medical specialties, the generally accepted difficult
31 43 specialties (surgical or medical-surgical) were associated with a higher HAD score
32 44 (OR=1.459;95%CI: 1.172-1.816, p=0.001).

33
34 45 **Conclusion:** Tunisian residents experience a rate of anxiety/depression substantially higher
35 46 than that reported at the international level. This phenomenon is worrying as it has been
36 47 associated with an increase in medical errors, work dissatisfaction and attrition. Means of
37 48 improving the well-being of Tunisian medical residents are explored, emphasizing those
38 49 requiring immediate implementation.

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45 51 **Strengths and limitations of this study:**

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47 52 First study to assess the prevalence of Anxiety/Depression among Tunisian residents

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49 53 The large participation rate

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51 54 The HAD questionnaire is in French (but this language is well mastered by Tunisian residents)

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53 55 No information on the rates of mood disorders in the general Tunisian population for
54 56 comparison

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56 57 No assessment of the prevalence of Burnout syndrome

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3 58 Physicians are increasingly exposed to stressful situations regardless of age, gender,
4 59 or seniority in the profession¹⁻⁴. Only a few variables inherent in the personalities, or in
5 60 work-related strain, are able to modulate the expression of this stress by attenuating or
6 61 exaggerating the generated mood disorders (anxiety, depression, burnout), and their impact
7 62 on the personal and professional life^{5 6}. Medical residents seem at increased risk of
8 63 developing mental disorders⁷⁻¹⁰. These disorders may hamper the physician's professional
9 64 performance by affecting their concentration at work, and the quality of provided healthcare
10 65 services, and provoking conflicts with patients or their families, or with colleagues,^{9 11 12}.
11 66 These mental health issues are also associated with a higher substance use and abuse,
12 67 divorce, and even more suicidal ideations^{12 13 14}. A recent systematic review reported a
13 68 28.8% pooled prevalence of depression or depressive symptoms in medical residents with a
14 69 wide variation in this rate, depending on the instrument used¹⁵. In countries with socio-
15 70 economic conditions similar to those of Tunisia, the prevalence of depressive symptoms in
16 71 medical residents ranges from 17% in India to 48% in Argentina¹⁶⁻¹⁸

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28 72 Tunisia is a country that is currently experiencing major socio-economic and political
29 73 changes as a consequence of "Arab spring". Arab spring was a series of anti-government
30 74 protests, or armed rebellions ignited in Tunisia by the so-called "Jasmine revolution" which
31 75 spread across North African countries and in the Middle East. It is seen as the translation of
32 76 peoples' aspirations to democracy, and to replace dictators in place. According to the United
33 77 nations Development Program (UNDP), the average annual Human Development Index (HDI)
34 78 has fallen in Tunisia from 0.88%, during the decade before the advent of the Arab spring, to
35 79 0.25% during the 5 years that followed. This led to a sustained erosion of the middle class,
36 80 an increase in poverty, and a decrease in overall wealth¹⁹. The Tunisian downturn has
37 81 particularly altered the relationship between the main body of the society and the medical
38 82 profession, the latter being perceived by a large part of the population as a body of
39 83 privileged, insufficiently empathic, with little concern for the misfortunes of the population.
40 84 Assaults against doctors, particularly in public hospitals and their emergency services,
41 85 malpractice suits and prosecutions, are now very frequent, and are highly publicized on a
42 86 daily basis by the various media in the country. Just after the revolution, public hospitals
43 87 experienced a sharp deterioration in the resources and staff made available, together with
44 88 an alteration in their governance²⁰. This situation has greatly frustrated the population, in

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3 89 particular the citizens who cannot afford the private medical sector and its large out-of-
4 90 pocket costs²¹.

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7 91 Residents come to term of a long, demanding, and selective course of studies. The typical
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9 92 resident must have passed his baccalaureate among the first ranked ones, be among the
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11 93 "happy few" (3-5% top-ranked graduates) who enter to one of the four Tunisian medical
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13 94 schools. After 7 years of medical studies, graduates wishing to specialize, have to
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15 95 successfully undergo a final residency contest. Success usually takes 2 to 3 attempts (annual
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17 96 pass rate = 25%). Aged at least 26, the medical resident faces the reality of the public
18
19 97 hospital where residents are the only physicians present in the hospital at night, on
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21 98 weekends, and on holidays. They are also exposed to stress resulting from non-optimal
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23 99 working conditions: the need to meet professional duties set by supervisors, and the
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25 100 growing demand of the population.

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27 101 We hypothesized that the combination of all of these unfavorable circumstances for
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29 102 professional fulfillment, should result in a high level of mood disorders in medical residents.
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31 103 We conducted a large cross-sectional survey to address the prevalence of anxiety and
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33 104 depressive symptoms and associated risk factors in Tunisian medical residents.

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3 106 **Patients-Methods**

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5 107 **Participants** : In Tunisia, specialization in medicine takes place at the end of general medical
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7 108 studies. Doctors who wish to specialize do so following a national contest, bringing together
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9 109 the candidates from the four faculties of medicine. This contest is very selective, and takes
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11 110 place over three days. It consists of more than 300 questions (multiple choice, short answer),
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13 111 covering separately each of the following areas: medical specialties, surgical specialties, and
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15 112 basic sciences.

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17 113 More than 1,500 candidates participate annually, for about 500 elected members, who are
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19 114 ranked consecutively in order of merit. The choice of the specialty is then made according to
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21 115 the rank of success in the contest, on a number of places that is equal to the number of
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23 116 candidates. Distribution on all the medical specialties is done by quotas which are set
24
25 117 according to the needs of the country in doctors practicing in medical specialties. The
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27 118 internship periods (of 6 months each) and their distribution between specialties, in order to
28
29 119 validate a given specialty, are specified in advance by the college of each specialty. Every six
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31 120 months, all trainee residents in the country (more than 2,000) gather over ten days at the
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33 121 Faculty of Medicine of Tunis, the Tunisian capital, to choose the next 6-month rotation.
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35 122 Within the chosen specialty, the candidate chooses according to seniority first (300-600 in
36
37 123 each residency level), and then classification in the corresponding level afterwards.

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39 124 **Protocol**: The study protocol was approved by the local Institutional Review Board of
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41 125 Fatouma Bourguiba Teaching Hospital, Monastir (reference #2013/108). All the medical
42
43 126 residents gathered at the faculty of medicine of Tunis, between December 14 and December
44
45 127 22, 2015 for the choice of the next 6 month-rotation, and were invited to answer an
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47 128 anonymous, self-administered questionnaire, immediately after having made their choice.
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49 129 The questionnaire covers their civil and marital status, the specialty chosen, their level of
50
51 130 advancement in the specialty (duration 4 years for medical specialties and 5 years for
52
53 131 surgical specialties), and items of the Hospital Anxiety and Depression score (HAD)
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55 132 questionnaire²².

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57 133 **Measurements** : The questionnaire explored three fields: socio-demographic data, work-
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59 134 related characteristics, and HAD score.
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3 135 *Socio-demographic* information concerned the gender, age, marital status, number of
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5 136 dependent children if married or divorced.

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7 137 *Work-related characteristics* included specialty, the level achieved so far in the specific
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9 138 curriculum of each specialty, the number of shifts per month, whether the shift was followed
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11 139 by a day of safety rest, and total working hours per week. For the statistical analysis purpose,
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13 140 specialties were split into four groups according to the associated workload: medical
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15 141 (example dermatology, pulmonology, rheumatology, psychiatry, fundamental specialties
16
17 142 such as histology, physiology etc...); medical and surgical (example: ophthalmology,
18
19 143 gynecology-obstetrics, otorhinolaryngology etc...); medical specialties with high workload
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21 144 (example: critical care medicine, emergency medicine, cardiology), and surgical specialties
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23 145 with high workload (neurosurgery, cardiovascular surgery etc).

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25 146 *The survey tool* used in our study was Hospital Anxiety and Depression score (HAD) scale that
26
27 147 was developed by Zigmond & Snaith²². It is a brief questionnaire (containing 14 items), and
28
29 148 was originally designed to detect emotional disturbances in non-psychiatric patients treated
30
31 149 at hospital clinics. It is a self-report rating scale designed to measure both anxiety and
32
33 150 depression. It consists of two subscales, each containing seven items on a 4-point Likert scale
34
35 151 (ranging from 0-3). Participants were told that the questions asked related to their mental
36
37 152 state during the last two weeks. HAD is scored by summing the ratings for the 14 items to
38
39 153 yield a total score, and by summing the ratings for the 7 items of each subscale to yield
40
41 154 separate scores for anxiety and depression. Two cutoff scores are validated for detecting
42
43 155 anxiety and depression, namely 11 for participants who screen positive for
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45 156 anxiety/depression and 8 for probable anxiety/depression.

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47 157 The survey was written in French and self-completed by each resident who has agreed to
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49 158 participate in the study. The language of the survey is not actually a barrier to the residents'
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51 159 completion of the survey, because that is the language of all medical studies in the country.
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53 160 The total for depression, anxiety subscales the whole HAD scale were calculated by a
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55 161 resident from our unit.

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59 163 **Statistical analysis :**

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61 164 The study design focused on determination of the number of residents who met the criteria
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63 165 for anxiety and depression. Continuous variables were expressed either as means \pm Standard

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3 166 Deviations or medians and inter-Quartile Ranges (IQR), according to normal or skewed data
4 167 distribution. The dichotomous variables were expressed as numbers and percentages.
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6 168 Adjusted Odds Ratios (ORs) and 95% Confidence Intervals (CIs) for each variable were
7
8 169 calculated.

9
10 170 Prevalence of anxiety and depression were calculated and correlated to socio-demographic
11 171 and work-related characteristics. Chi-square tests were carried out to compare the
12 172 prevalence of anxiety and depression between groups. We used multivariable Poisson
13 173 regression to identify explanatory variables with a statistically significant effect on the total HAD
14 174 score.

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17 175 Statistical significance was denoted by *p*-values less than 0.05. All statistical procedures
18 176 were performed using IBM SPSS Statistics 21.0 software.

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21 177 **Participants and Public involvement:** No participants were involved in setting the research
22 178 question or in the design or conduct of the study. No participants were asked to advise on
23 179 interpretation or writing up of results. There are no plans to disseminate the results of the
24 180 research individually to study participants.

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3 **188 Results:**
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6 **189** During the study-period corresponding to December 14th to December 22nd 2015, 1700 out
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8 **190** of 2200 (77%) medical residents from all levels and different specialties answered the
9
10 **191** survey. They had a mean (\pm SD) age of 28.5 \pm 2 years with a predominance of the female
11
12 **192** gender (60.8%); 38.5% were married, of whom 19% had at least one child (Table I).

13
14 **193** Residents declared they worked for a mean of 62 \pm 21 hours per week; 73% (1239) among
15
16 **194** them worked night shifts with a mean number of 5.4 \pm 3 per month, of whom only 8% (98)
17
18 **195** declared that the shift was systematically followed by a day of safety rest (Table I).

19
20 **196** The median HAD score amounted to 19 [IQR: 14 ; 23], split on the anxiety subscale (HAD-A) :
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22 **197** 10 [IQR: 7 ; 12], and the depression subscale (HAD-B): 9 [IQR: 6 ; 11].

23
24 **198** Overall, 742 (43.6%) residents reached the cut-off defining definite anxiety state (ie a score
25
26 **199** \geq 11), and 519 (30.5%) reached the scale level defining definite depression. Out of these
27
28 **200** residents, 342 (20%) had both anxiety and depression. In the remaining, the prevalence of
29
30 **201** probable anxiety score (ie a score \geq 8) was 30.5%, and that of probable depression was
31
32 **202** 31.5%. Tables II and III depict the association between demographic and workload
33
34 **203** characteristics, and the occurrence of anxiety or depression, respectively.

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36 **204** In univariate analysis, comparison of the group of residents with definite anxiety (HAD-A \geq
37
38 **205** 11) to those without definite anxiety (HAD-A < 11), disclosed the following variables as
39
40 **206** significantly associated with the prevalence of anxiety: higher age, married status (42% vs.
41
42 **207** 36.7%, $p=0.027$), and female gender (66.7% vs. 56.2%, $p<0.0001$) The fifth level of residency
43
44 **208** course (13.9% vs. 9.7%, $p=0.009$), and the choice of medical/surgical specialties (15.9% vs.
45
46 **209** 10.8%, $p=0.018$) were also significantly associated with anxiety. Medical specialties (45% vs.
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48 **210** 54.2%, $p < 0.0001$) were on the contrary associated with a lower risk of developing anxiety
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50 **211** symptoms (Table II).

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52 **212** In comparison to residents without definite depression (HAD-D < 11), the group of residents
53
54 **213** with definite depression (HAD-D \geq 11) were older, and more often married (45.7% vs. 36.2%,
55
56 **214** $p<0.0001$). Moreover, surgical specialties associated with high-workload (22.9% vs. 17.5%,
57
58 **215** $p=0.011$) were significantly associated with depressive symptoms in contrast to medical
59
60 **216** specialties (44.7 vs. 52.6%, $p=0.003$) which were associated with lower depressive symptoms
217 (Table III). The number of shifts per month, and working hours per month were associated
218 with both anxiety and depressive cases (Table II and III).

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3 219 The Poisson regression analysis disclosed the following variables as associated with total
4 220 HAD score: age (OR = 1.014, 95% CI, 1.006-1.023, p = 0.001); female gender (OR = 1.114,
5 221 95% CI, 1.083-1.145, p <0.0001); night shift number per month (OR = 1.048, 95% CI, 1.016-
6 222 1.082, p = 0.03), working hours per week (OR = 1.008, 95% CI, 1.005-1.011, p = <0.0001) .
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9 223 Compared with medical specialties, medico-surgical ones were independently associated
10 224 with a higher HAD score (OR = 1.459, 95% CI, 1.172-1.816, p = 0.001; fig 1).

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For peer review only

230 Discussion

231 This large survey encompassing 1700 out of the 2200 Tunisian medical residents
232 brought together for the periodic process of choosing internship positions in their
233 specialties, shows that 43.6% of them had definite criteria of anxiety, and 30.5% had
234 depression. The diagnosis of anxiety or depression was probable in an additional 30% each.
235 Higher scores of anxiety-depression were significantly associated with older age, female sex,
236 and the heavy burden of work imposed on a weekly or monthly basis as reflected by the high
237 number of weekly working hours, the number of night shifts per month, and the choice of a
238 specialty with higher workload (surgical or medical-surgical specialty compared to medical
239 specialty). Of interest, this survey unveils a very demanding health system imposed on
240 Tunisian medical residents as reflected by the average working hours per week (60 hours),
241 and the number of night shifts per month (6 on average regardless of the type of specialty),
242 most often without a day of safety rest.

243 Although, mood disorders and physician distress are more prevalent among medical
244 professionals compared to the general population, information is lacking about their
245 prevalence in Tunisia^{5 23 24}. This first survey on the subject in our country, enrolled 77% of
246 potentially concerned medical residents, yielding a snapshot of the burden incurred by
247 residents from all specialties in their everyday practice. The use of the French version of the
248 HAD questionnaire should not be considered as a barrier to the residents' completion of the
249 survey, because that is the language of all medical studies in the country.

250 International studies stressed the fact that medical residents usually have higher
251 rates of depression than the general population^{15 25}. Estimates of the prevalence of
252 depression or depressive symptoms among resident physicians vary from 3% to 60% with a
253 median of 28.8% according to a recent meta-analysis of 54 studies¹⁵. This proportion is lower
254 than that recorded in our study whether we consider the rate of definite or probable
255 depression (62%), or even when we only consider the cases qualifying for definite
256 depression (30.5%). Of interest, this meta-analysis emphasized the difference in the
257 methodological approach to address the issue of depression in medical residents (cross
258 sectional studies to assess the prevalence vs longitudinal studies which inform on the
259 incidence)¹⁵. The meta-analysis highlighted also the great variability in the instruments used
260 (no less than 13 different instruments were used in the 54 studies)¹⁵. A prospective cohort

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3 261 study conducted in Switzerland and using the HAD inventory used in our study disclosed a
4 262 prevalence of anxiety in 30% of the second year residents, and 20% of the fourth and sixth
5 263 year residents; depressive symptoms were present in 15% and 10%, respectively²⁶. However,
6 264 benchmarking with countries with socio-economic similarities could be more insightful. In a
7 265 study including 118 residents from the American University of Beirut, 22% qualified for
8 266 moderate to major depressive symptoms while only 8% had anxiety²⁷. Moreover, in a cross
9 267 sectional study conducted among residents of various specialties in Saudi Arabia, the
10 268 prevalence of moderate to severe depressive symptoms was around 20%¹⁷.

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17 269 Resident physicians share the same known causes of depression than the general
18 270 population: physical health, lifestyle, marital status, history of previous depression,
19 271 childhood issues, religiosity etc¹⁴. They have in addition specific factors according to the way
20 272 the work is done, its everyday planning, and the constraints inherent to their career
21 273 development⁴. These risk-factors correspond to the difficulty of their specialty,
22 274 postgraduate year, stress at work, current rotation difficulty, working hours, shift number
23 275 etc...^{4 15 28}. In our study the Poisson regression model disclosed the following items as
24 276 statistically associated with the occurrence of anxiety-depression: age, female sex, practice
25 277 of a specialty generally accepted as very demanding and difficult, and the heavy burden of
26 278 work imposed on a weekly or monthly basis as reflected by the weekly working hours, and
27 279 the night-shift number per month. Most of these risk-factors have been reported elsewhere,
28 280 or are intuitive, but it is their magnitude that makes this study important.

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39 281 The occurrence of depression should be considered as a major event in the young
40 282 physician's career or even life. It has been shown that once present, depression as well as
41 283 burnout (another consequence of work-related chronic stress) may persist throughout the
42 284 whole residency duration, or even beyond^{29 30}. In a nationwide survey involving 3500
43 285 Canadian physicians, Sullivan et al reported that 55% found that medicine as a profession
44 286 impacted negatively on their family and personal life, while 65% reported that opportunities
45 287 to change career despite dissatisfaction were limited³¹. Depression is also a source of
46 288 decreased concentration at work, an increase in the rate of medical errors, work
47 289 dissatisfaction and conflicts, impaired sleep quality, and a greater propensity to attrition,
48 290 and even suicide ideation^{9 32 33}.

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3 291 Considering the high prevalence of anxiety and depression among Tunisian medical
4 292 residents, every effort aiming at improving the mental health of young physicians should be
5 293 encouraged. Any strategy should target both the individual level to amend the identified and
6 294 potentially actionable risk-factors, and include more measures targeting the general
7 295 organization of residents' work modalities, and their relationship with the hierarchy and
8 296 administration.

9 297 The resident physician should first become aware of the mental health issue and seek help in
10 298 particular those with a previous personal history of depression³⁴. We did not investigate
11 299 whether the participating residents sought for, or actually had psychological counseling, but
12 300 we strongly believe that most did not. Structures able to provide aid to health professionals
13 301 exposed to, and suffering from stress, anxiety, depression, are anyway non-existent in
14 302 Tunisian hospitals. Our study suggests that such structures can no longer be considered an
15 303 option, but the Ministry of Health should provide support at institutional level. At individual
16 304 level, more generally accepted risk factors such as older age, gender, marital status,
17 305 stressors outside of work, sleep deprivation, or lifestyle, require more personal attention
18 306 and lifestyle education⁴. The current study was not designed to allow participants'
19 307 identification so that they could be given individual information and act on it. Future studies
20 308 targeting preferentially residents (or specialties) at high risk of anxiety, depression, or
21 309 burnout, should consider such feedback for more specific training programs.

22 310 Residency program factors and the pace of work should also be better managed. While
23 311 these details were totally non-existent in Tunisia, this has been recently fixed through a law
24 312 issued on March 9, 2018 whose purpose is the definition of the status of Tunisian interns
25 313 and residents³⁵. This law, which has been torn out following long negotiations, and a strike
26 314 that lasted more than 6 weeks, defines for the first time the role and duty of residents. The
27 315 maximum number of weekly working hours and that of night shift frequency have been
28 316 clearly defined and have been reduced to a maximum of 40 hours and two night shifts per
29 317 week, respectively. A day of safety rest following every night shift has been rendered
30 318 mandatory. Although still debated, the issue of work-hour restriction could be effective in
31 319 reducing high emotional exhaustion, despite the fact that it carries the risk of alteration in
32 320 the quality of care and education by reducing the number, and actual presence of medical
33 321 residents³⁶.

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3 322 **Legend Figure1:** Risk Factors associated with Total HAD Score
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5 323 **Authors' contributions**
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7 324 Study Concept and design: MM and FA; Data Acquisition: MM; Analysis and interpretation of
8 325 the data: MM, LOB, ZH, IO, FD, FA; All authors read and approved the final manuscript. MM
9 326 and FA had full access to the data and take responsibility for its integrity and the accuracy of
10 327 the analyses.
11

12
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15

16
17 330 **Data Sharing statement:** dataset is available by contacting FA at f.abroug@rns.tn
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333 **Table I : Demographic and work characteristics of the study population (n=1700) :**

Sex ratio (M/F)		667/1033
Age, med [IQR]		28 [27 ; 30]
Marital Status	Single, n(%)	1036 (61)
	Married, n(%)	655 (38.5)
	Divorced, n(%)	9 (0.5)
Number of Children	Zero, n(%)	343 (20.2)
	One, n(%)	235 (13.8)
	More than one, n(%)	86 (5.1)
Residency Level (year)	I, n(%)	320 (18.8)
	II, n(%)	410 (24.1)
	III, n(%)	434 (25.5)
	IV, n(%)	340 (20)
	V, n(%)	196 (11.5)
Specialty*	Medical, n(%)	854 (50.2)
	Medical and Surgical, n(%)	221 (13%)
	High-workload Medical specialties, n(%)	299 (17.6)
	High-workload Surgical specialties, n(%)	326 (19.2)
Working hours per week, med [IQR]		60 [48 ; 76]
Night shifts per month, med [IQR]		6 [4 ; 7]
Recovery day following night shift, n (%)		98 (8)

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335 **Specialties were split into four categories according to everyday difficulties: medical*
 336 *(example dermatology, pulmonology, rheumatology, neurology, psychiatry, fundamental specialties*
 337 *like histology, physiology etc) ; medical and surgical (example: ophthalmology, gynecology-obstetrics,*
 338 *otorhinolaryngology etc); high-workload medical (example: critical care medicine, anesthesiology,*
 339 *emergency medicine, cardiology), and high-workload surgical specialties (surgery, pediatric surgery,*
 340 *orthopedics, neurosurgery, urology, cardiovascular surgery etc).*

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342 **Table II : Demographic and workload characteristics and their association with anxiety :**

	No Anxiety	Definite Anxiety	<i>p</i>
<i>n</i> (%)	958 (56.4)	742 (43.6)	
Age, mean±SD	28.5±1.9	28.7±2	0.008
Gender			0.0001
Male	420 (43.8)	247 (33.3)	
Female	538 (56.2)	495 (66.7)	
Marital Status			0.027
Single	606 (63.3)	430 (58)	
Married	352 (36.7)	312 (42)	
Level of Residency			0.005
I	188 (19.6)	132 (17.8)	
II	244 (25.5)	166 (22.4)	
III	251 (26.2)	183 (24.7)	
IV	182 (19)	158 (21.3)	
V	93 (9.7)	103 (13.9)	
Specialty			0.018
Medical	519 (54.2)	334 (45)	
Medical and Surgical	103 (10.8)	118 (15.9)	
High-workload Surgical specialties	181 (18.9)	145 (19.5)	
High-workload Medical specialties	155 (16.2)	145 (19.5)	
Shifts/month, mean±SD	4.9±3	6±2.9	0.0001
Working Hours/week, mean±SD	58.8±20	66.4±20	0.0001

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345 **Table III** : Demographic and workload characteristics and association with depression cases

	No depression	Definite depression	<i>p</i>
N (%)	1181 (69.5)	519 (30.5)	
Age, mean±SD	28.3±1.8]	29±2	0.007
Gender			0.11
Male	453 (38.4)	214 (41.2)	
Female	728 (61.6)	305 (58.8)	
Marital Status			0.0001
Single	754 (63.8)	282 (54.3)	
Married	427 (36.2)	237 (45.7)	
Level of Residency			0.0001
I	263 (22.3)	57 (11)	
II	292 (24.7)	118 (22.7)	
III	294 (24.9)	140 (27)	
IV	218 (18.5)	122 (23.5)	
V	114 (9.7)	82 (15.8)	
Specialty			0.006
Medical	621 (52.6)	232 (44.7)	
Medical and Surgical	156 (13.2)	65 (12.5)	
High-workload Surgical specialties	207 (17.5)	119 (22.9)	
High-workload Medical specialties	197 (16.7)	103 (19.8)	
Shifts/month, mean±SD]	5±3	6±2.9	0.0001
Working Hours/week, med [IQR]	60±20	66±20	0.0001

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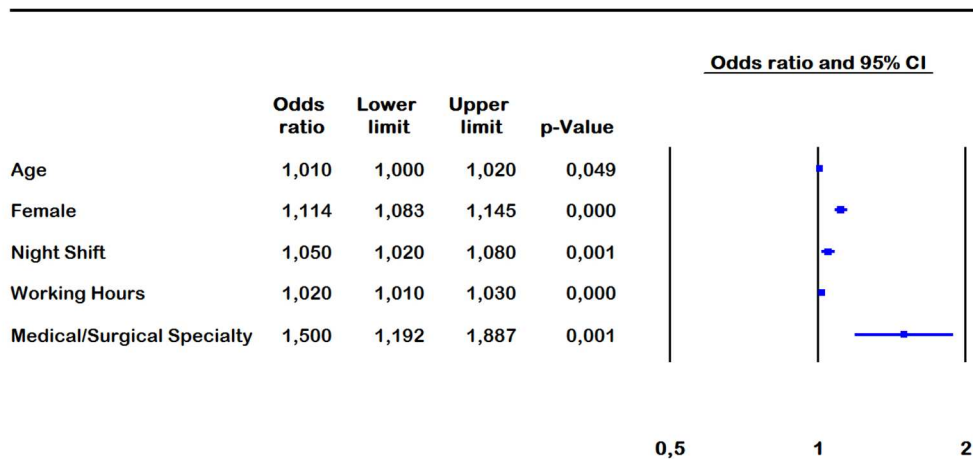


Figure1: Risk factors

114x52mm (300 x 300 DPI)

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

	Item No	Recommendation	
Title and abstract	1	(a) Indicate the study's design with a commonly used term in the title or the abstract	X
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	X
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	P2
Objectives	3	State specific objectives, including any prespecified hypotheses	P2
Methods			
Study design	4	Present key elements of study design early in the paper	P5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	P5
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants	P5
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	P6
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	P6
Bias	9	Describe any efforts to address potential sources of bias	P6
Study size	10	Explain how the study size was arrived at	P7
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	P7
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	P7
		(b) Describe any methods used to examine subgroups and interactions	NA
		(c) Explain how missing data were addressed	P7
		(d) If applicable, describe analytical methods taking account of sampling strategy	NA
		(e) Describe any sensitivity analyses	P7
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	P8
		(b) Give reasons for non-participation at each stage	P8
		(c) Consider use of a flow diagram	NA
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	Table I
		(b) Indicate number of participants with missing data for each variable of interest	NA
Outcome data	15*	Report numbers of outcome events or summary measures	P8
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	P8

		(b) Report category boundaries when continuous variables were categorized	P8
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	NA
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	P9
Discussion			
Key results	18	Summarise key results with reference to study objectives	P10
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	P10
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	P10-11
Generalisability	21	Discuss the generalisability (external validity) of the study results	P11
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	P1

*Give information separately for exposed and unexposed groups.

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.