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Research paper

Using the simple sample count to estimate the frequency of prescription drug neuroenhancement in a sample of Jordan employees

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ABSTRACT

Background: Epidemiological research indicates that the use of prescription drugs to enhance cognitive functioning is prevalent in Western countries, however, research on this phenomenon in Arab countries is lacking. Our study aimed to investigate the frequency of neuroenhancement (NE) using prescription drugs in a sample of employees in Jordan.

Methods: A sample of 1186 employees (37.11 ± 8.37 years old, 495 female), of whom 723 (35.65 ± 7.53 years old, 396 female) served as teachers, completed a paper–pencil questionnaire. The single sample count technique (SSC) was used in order to secure confidential, self-reporting of prescription drug NE.

Results: The 12-month prevalence of NE, estimated with the SSC was 15.43%. At 26.16%, the prevalence estimate was markedly higher in the subsample of teachers compared to non-teachers, 0.29%. Surprisingly, 336 participants did not use the SSC and directly affirmed or denied prescription drug NE. These direct responses yielded a prevalence of 11.57% for the full sample, 9.73% for the teachers and 15.60% for the non-teachers.

Conclusion: This is the first study of the frequency of NE in an Arab sample. Results indicate that the use of prescription drug NE is not limited to Western countries and that teachers in Jordan might constitute a high-risk population. Further, participants seem to differ in their use of indirect estimation methods for reporting prescription drug NE. For future research, it might be useful to triangulate standard self-reports and indirect estimation methods to assess NE. Possible cultural differences and specific high-risk populations for NE should be investigated further.

Introduction

Nonmedical use of drugs in order to enhance one's cognitive performance has received considerable scientific attention recently (e.g., Dietz, Striegel, et al., 2013; Maher, 2008; Maier, Haug, & Schaub, 2015; Maier & Schaub, 2015; Sattler & Wiegel, 2013; Wolff & Brand, 2013; Wolff, Brand, Baumgarten, Lösel, & Ziegler, 2014). Such neuroenhancement (NE) has been defined as the "use of psychoactive substances by healthy individuals who expect the substance to be a functional means of enhancing their cognitive capacity (Wolff et al., 2014, p. 2)". Different NE variants have been classified according to the legal consequences that are associated with their use (Wolff, 2014): namely, *Lifestyle drug NE* (other researchers suggested the term soft enhancement; Maier & Schaub, 2015) using freely available substances (e.g., Red Bull®), *prescription drug NE* (e.g., Methylphenidate or Modafinil) and *illicit substance NE* (e.g., Speed). Research shows that all three NE variants are – to some extent – used in the Western world (Maier et al., 2015). To extend knowledge about the wider spread of NE, the present research focused on prescription drug NE in Jordan.

Aside from the ethical debate as to whether or not this societal trend is desirable (e.g., Faulmueller, Maslen, & de Sio, 2013; Greely et al., 2008), it is important to note that so far "no drug has been proven to be safe and effective" (Maier & Schaub, 2015, p. 162) and positive effects of substances are often overestimated (Repantis, Schlattman, Laisney, & Heuser, 2010). The risk of addiction, impaired health, and the legal implications associated with using prescription drugs and illicit drugs for NE purposes, can be severe. Long-term use of Methylphenidate has, for example, been associated with neuronal changes similar to those of cocaine use (Steiner & Van Waes, 2013). Cross-sectional studies have found NE to be associated with poor perceived health (Maier et al., 2015), test anxiety (Sattler & Wiegel, 2013), burnout (Wolff et al., 2014), and stress (Wolff & Brand, 2013). In order to assess the public

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health implications of NE, it is important to investigate its prevalence and whether or not this represents some kind of phantom debate (Partridge, Bell, Lucke, Yeates, & Hall, 2011).

Reported prevalence rates vary considerably because of differences in the assessed NE variant, the surveyed population and the method of assessment (Maier & Schaub, 2015; Wolff et al., 2014). Our investigation focused on the frequency of prescription drug NE in a sample of Jordan employees, so our review of the epidemiological research was limited to this NE variant (for a comprehensive review of NE in Europe please see; Maier & Schaub, 2015).

Benson and colleagues, in their review, estimated the prevalence of stimulant medication among college students to be 17% (Benson, Flory, Humphreys, & Lee, 2015). However, this estimate was based on varying timeframes (e.g., lifetime, 12-month) for the measurement of use and was not restricted to NE (i.e., drug use as a means to enhance cognitive performance). Restricting assessment to NE, Sattler and Wiegel (2013) found a 12-month prevalence of prescription drug NE of 3.2% in a sample of 5882 university students. Similarly, in the study from which we derived our NE definition, the 12-month prevalence for prescription drug NE was 3% among a sample of 1007 German university students (Wolff et al., 2014). So far most research on NE has been conducted among university students (for some notable exceptions please see; DAK, 2015; Maier et al., 2015). In a representative sample of the Swiss population, Maier and colleagues (2015) found an even lower 12-month prevalence of 2.1% for prescription drug NE.

Recent findings indicate that NE might be subject to cultural variation (Kudlow, Naylor, Xie, & McIntyre, 2013; Mazanov, Dunn, Connor, & Fielding, 2013; Schelle et al., 2015) and there has been a call to investigate further, possible cultural differences in patterns of use (Wolff et al., 2014). To our best knowledge no research has investigated NE in Arab countries. In light of the differences that exist in rates of NE use between Western countries, it is probable that prevalence estimates cannot be transferred from one country to another. This is even more likely for Arab countries, where there is even greater cross-country variation in substance use behavior (Neumark, Lopez-Quintero, Grinshpoon, & Levinson, 2007).

With regard to socially sensitive topics like drug use, the possibility of reporting bias needs to be taken into account (Tourangeau & Yan, 2007). In Western as well as in Arab countries, the nonmedical use of prescription drugs (not only for NE purposes) is prohibited. Further, Muslim faith strongly constrains consumption of psychoactive substances (AlMarri & Oei, 2009). This is, for example, associated with lower rates of alcohol consumption for Arabs (predominantly Muslim) compared to Jews living in Israel (Neumark et al., 2007). While this could reflect actual differences in substance (mis)use behavior, such variations might result from the under-reporting of substance misuse because of religious restrictions (Neumark et al., 2007). To reduce a respondents' fear of exposure, protection beyond anonymity can be helpful to achieve a more valid estimate of prevalence (Nepusz, Petroczi, Naughton, Epton, & Norman, 2014). This protection can be provided by indirect estimation models (James, Nepusz, Naughton, & Petroczi, 2013). For example, Dietz, Striegel, et al. (2013), using one such a model – Randomized Response Model (RRM) – found a 12-month prevalence rate of 20% for prescription drug NE among German students. Although, some researchers have attributed this high prevalence to the broad definition of NE used in the study, as it included caffeine tablets (Maier & Schaub, 2015) and these are freely available in Germany. The single sample count (SSC; Petroczi et al., 2011) is another indirect estimation model which – compared to a RRM – displays better concurrent validity (James et al., 2013). Further, participants preferred the SSC over the RRM and rated it better at protecting their anonymity (James et al., 2013). In this study we use the SSC to get a first estimate of prescription drug NE use in the Arab country of Jordan.

Method

Sample, settings and procedure

Sample characteristics are depicted in Table 1. All participants came from the Amman Governorate in Jordan. The teachers were recruited from 15 (out of 19) schools in the 14th district of the Amman Governorate. Participants from the group of academic staff were recruited from the University of Jordan and the medical staff from two hospitals in Amman. All remaining participants were recruited in Amman via personal contacts of one of the authors (YS). To calculate the minimum sample size needed, we used the tabulated values provided by Petróczi and colleagues (2011). Our sample size exceeded the projected minimum sample size of 294 that would be needed to detect a 10% prevalence, given our a priori prevalence estimate of 10%.

One of the authors (YS) distributed the questionnaires among the participants' supervisors in the Amman Governorate and ascertained that supervisors understood the aims of the survey. Participants were asked to complete the questionnaires at work, at a time they deemed convenient. Participants then returned their questionnaires anonymously to a mailbox at the offices of their respective secretariats. The questionnaires consisted of a consent form, where participants were provided with a definition of prescription drug NE ("Neuroenhancement is the use of drugs, e.g. like Ritalin or Modafinil, in order to improve cognitive capacity, e.g., alertness, concentration, without a medical indication to do so"), the SSC and demographic questions. Contact details of one of the authors (YS) were provided on the consent form in case participants needed further clarification. The study was authorized by the Jordan Ministry of Education.

Measures

The SSC is a fuzzy response model (as opposed to a RRM), where innocuous questions add noise to the response and thus protection beyond anonymity is secured (Nepusz et al., 2014). Specifically, in a 4 + 1 SSC, participants indicate how many of five questions (four innocuous and one sensitive question) they affirm (possible answers from 0 to 5) (Petroczi et al., 2011). For the innocuous questions, the population prevalence is known to be 50%. The expected population mean for these questions is 2. The sensitive

Table 1
Sample characteristics.

	N	Response format		Age		Sex		
		Direct	SSC	Mean	SD	Female	Male	Missing
Total	1186	337	849	37.11	8.37	495	425	266
Teachers	723	226	497	35.65	7.53	396	325	2
Non-teachers[a]	458	109	349	39.16	9.05	95	99	264

[a] The non-teachers occupations are researcher/lecturer at university ($n = 84$), medical staff ($n = 90$), engineer ($n = 88$), administration ($n = 122$), lawyer ($n = 74$), no occupational status reported ($n = 5$).