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Article:

Conscientiousness and engagement with national health behaviour guidelines

Nicola Gartland[1], Antonia Wilson[1], Rebecca Lawton[1,2], Daryl B. O'Connor[1*]

[1]School of Psychology, University of Leeds, Leeds UK
[2]Bradford Institute for Health Research, Bradford Royal Infirmary, UK

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*Correspondence to:
Daryl B. O'Connor
School of Psychology
University of Leeds,
Leeds, UK
e: d.b.oconnor@leeds.ac.uk
t: ++44 113 3435727

Abstract

High conscientiousness is associated with better health and longer life. This relationship is partly accounted for by the performance of health behaviours. The current study aimed to investigate whether conscientiousness was associated with adherence to national health behaviour guidelines as an indicator of healthy lifestyle. A cross-sectional design was used, where participants (N = 886) completed online questionnaires to assess conscientiousness and the facets of conscientiousness (order, virtue, traditionalism, self-control, responsibility, industriousness) and the performance of four health behaviours (fruit and vegetable consumption, alcohol intake, smoking, and physical activity). An index was calculated to combine the health behaviours. Conscientiousness and all its facets significantly predicted the health behaviour guideline index. In comparing high and low conscientious sub-groups, the low conscientious group had lower levels of adherence to all health behaviours guidelines measured. Strikingly, the number of high conscientious participants meeting *all* health behaviour guidelines was nearly twice the number of low conscientious participants meeting all guidelines. Conscientiousness is associated with adherence to multiple national health behaviour guidelines. Therefore, the positive associations between conscientiousness and health/longevity may be accounted for, in part, by the adoption of a healthy lifestyle across multiple health domains.

Keywords: personality, adherence, health behaviour, longevity

INTRODUCTION

Conscientiousness has been defined as the propensity to follow socially prescribed norms, control impulses and to be goal directed, planful, and able to delay gratification (John & Srivastava, 1999). It is well established that high conscientiousness is associated with positive outcomes, such as job performance and marriage success (Ozer & Benet-Martınez 2006; Hampson, 2012; Barrick & Mount, 1991; Dudley et al., 2006; Roberts et al., 2007), but conscientiousness also has a remarkable effect on health and longevity (Friedman et al., 1995; Bogg & Roberts, 2004; Hagger-Johnson & Whiteman, 2007; Bogg & Roberts; 2012). Recent research has also shown positive associations between the facets of conscientiousness and objective markers of health status including adiposity, blood markers and physical performance (Sutin et al., 2018).

One of the most popular and widely accepted explanations of the conscientiousness-longevity relationship comes from the consideration of the role of health behaviours. Bogg and Roberts (2004) carried out an influential meta-analysis of 194 studies, demonstrating that conscientiousness was positively correlated with physical activity and negatively correlated with excessive alcohol use, unhealthy eating, tobacco use, drug use, risky driving, risky sex and suicide. Longitudinal research has also supported these findings. In a study of 1054 participants spanning forty years, the mechanisms through which childhood personality traits influence health status in adulthood were assessed (Hampson et al., 2007). Results indicated that conscientiousness influenced health status in adulthood indirectly via educational attainment, healthy eating habits and smoking. Likewise, in a similar study, longitudinal data for 1253 participants was assessed over seven decades from 1930 to 2000 (Martin et al., 2007): results showed that the relationship between adult personality and mortality was mediated by health behaviours such as smoking and alcohol consumption. However, most studies linking conscientiousness to health behaviours have focussed upon individual health behaviours (Bogg & Roberts, 2004), and therefore less is known about the relationship between conscientiousness and the adoption of a healthy lifestyle more generally. Few studies

have considered the cumulative effect of engaging in a range of unhealthy behaviours, meaning that even if the effects of individual behaviours are small, the combined effect of a number of behaviours together may be particularly detrimental to one's health and longevity.

Research into the factor structure of conscientiousness provides evidence for six lower order facets: Order, Virtue, Traditionalism, Self-control, Responsibility, and Industriousness (Chernyshenko, 2002; Green *et al*., 2016; Hill & Roberts, 2011; Roberts, Chernyshenko, Stark, & Goldberg, 2005). Examining facet-level effects of conscientiousness is essential because lower-order facets can have differential effects on outcomes, that cannot be detected at trait level (Roberts *et al.*, 2005; 2014). Previous research has indicated specific associations between conscientiousness and its lower order facets and health behaviours (Bogg & Roberts; O'Connor et al., 2009).

Within the conscientiousness and health behaviour literature, it is evident that the methods employed to measure health behaviours have widely varied between studies (Schall *et al*., 1992; Nagoshi, 1999; Vollrath *et al*., 1999; Stewart *et al*., 2001). As a result of such variations in measurement, it is unclear whether individuals high in conscientiousness are meeting the national guidelines for health behaviours. Although previous research has indicated that individuals scoring high in conscientiousness engage in more beneficial health behaviours, for example, they consume more portions of fruit (O'Connor *et al*., 2009; de Bruijn, Brug & van Lenthe, 2009), it is not clear whether they meet the United Kingdom (UK) guidelines, or whether they simply consume more than their low conscientiousness counterparts.

The UK has a number of government-issued specific guidelines for health behaviours, which help individuals to determine whether they reach adequate levels of certain behaviours to maintain good health. The behaviours focussed on in the present research include: (1) eating at least 5 portions of a variety of fruit and vegetables every day (www.nhs.uk/livewell/5aday); (2) not consuming more than 14 units of alcohol over the course of the week (same for men and women; www.nhs.uk/live-well/alcohol-support); (3)

not smoking (www.nhs.uk/smokefree); and (4) performing 150 minutes of moderate aerobic activity OR 75 minutes of vigorous aerobic activity every week (www.nhs.uk/live-well/exercise). Taken together, these behaviours can provide an overall health behaviour guideline adherence index which quantifies the number of guidelines an individual adheres to and provides an indication of whether the individual has a 'healthy lifestyle'. Meeting U.K. health behaviour guidelines is important, as failure to meet such guidelines may have deleterious effects on health and wellbeing. The 'Living well for longer' government report (Department of Health, 2014) highlighted the 'five big killer diseases' as cancer, heart disease, stroke, respiratory disease and liver disease, and suggested that of the 150,000 deaths attributable to these health problems, two-thirds of them were avoidable. Smoking, drinking too much alcohol, a poor diet and a lack of physical activity were all identified as contributors to early death.

Therefore, the first aim of this study was to examine whether conscientiousness and its facets can predict alcohol intake, smoking, physical activity and fruit and vegetable consumption guideline adherence when examined as individual health behaviours as well as when they were combined to create an overall health behaviour guideline adherence index. The second aim of this study was to explore the extent to which the effects of conscientiousness on health behaviour guideline adherence differed in individuals scoring high or low in conscientiousness.

METHOD

Participants

A sample of 886 participants was recruited from within the UK, (756 women) with a mean age of 27 years (range 18 to 79 years). Participants were largely of a Caucasian ethnicity (90.5%). The majority of the participants were students (64.8%), while 33.4% were employed or retired. Participants were recruited via opportunity sampling through university based participant pool schemes, advertisement posters and social media websites.

Measures

Conscientiousness

Conscientiousness was assessed using the 60-item Chernyshenko Conscientiousness Scales (CCS; Chernyshenko, 2002; Green *et al.*, 2016; Hill & Roberts, 2011). The scale consists of 60 items assessing each facet of conscientiousness (industriousness, order, traditionalism, self-control, responsibility and virtue). *Industriousness* can be described as the propensity to work hard, to strive for achievement and to be persistent. *Order* concerns the ability to be organised, efficient and plan. *Traditionalism* refers to the degree to which individuals follow socially prescribed norms and rules, alongside levels of adherence to authority. *Self-Control* concerns the ability of individuals to delay gratification and inhibit impulsive tendencies. *Responsibility* refers to how reliable and dependable a person is considered. This facet also refers to the degree to which an individual contributes time and money to their community. Virtue describes the propensity to be moral, honest and grounded. Items were scored on a four point Likert scale with responses of disagree strongly, disagree somewhat, agree somewhat and agree strongly provided as options. The overall scores of the six facets were averaged to create an overall score of conscientiousness (Cronbach's α = 0.91), with scores ranging on a scale of 0 - 4. A high score indicated a high level of conscientiousness.

<u>Health Behaviours</u>

1. Fruit and Vegetable Consumption

Fruit and vegetable consumption was assessed using the items 'on average, how many portions of fruit do you eat a day?' and 'on average, how many portions of vegetables do you eat a day?' The responses to these items were summed to create a total number of portions of fruit and vegetables consumed on an average day. These responses were also then coded as 'yes' or 'no' in terms of whether they met the current U.K. guidelines, which state that five portions of fruit and vegetables should be consumed per day (www.nhs.uk/livewell/5aday).

2. Alcohol Intake

Alcohol intake was assessed via the item 'during a typical 7-day period (a week), how many of the following drinks do you drink?' Participants were then asked to indicate 'how many pints of beer/lager/cider?', 'How many measures of spirits? (1 = single shot, 2 = double shot)' and 'How many glasses of wine? (Standard glass = 175ml)'. The total for the three types of drink were then summed to create an average number of units of alcohol consumed on an average week. U.K. guidelines determine that it is safest not to drink more than 14 units a week on a regular basis (https://www.nhs.uk/live-well/alcohol-support). Participant's responses were coded as 'yes' (1) or 'no' (0) in terms of whether they met the current U.K. guidelines.

3. Smoking

Smoking behaviour was assessed using the item 'Do you smoke?' Responses were entered as 'yes' (1) or 'no' (0). Participants were regarded as adhering to U.K. smoking guidelines if they responded 'no' (www.nhs.uk/smokefree).

4. Physical Activity

Physical activity was assessed in terms of strenuous activity, moderate activity and mild activity. Items were adapted from the International Physical Activity Questionnaire (www.ipaq.ki.se). The following item was initially delivered 'During a typical 7-day period (a

week), how many times on average do you do the following kinds of exercise?' followed by 'Strenuous exercise (heart beats rapidly) e.g., running, jogging, hockey, football, squash, basketball, judo, roller skating, vigorous swimming, vigorous long distance bicycling', 'Moderate exercise (not exhausting) e.g., fast walking, baseball, tennis, easy bicycling, volleyball, badminton, easy swimming' and 'Mild exercise (minimal effort) e.g., yoga, archery, fishing from river bank, bowling, golf, easy walking'. Participants reported the number of times per week they performed each type of exercise, and the number of hours/minutes per day. The total number of minutes spent undertaking each type of activity per week was then calculated. Physical activity guidelines (www.nhs.uk/live-well/exercise/) state that 150 minutes of moderate exercise, or 75 minutes of strenuous (intense) exercise should be undertaken per week. Participants were then coded as 'yes' (1) or 'no' (0) in terms of whether they met the guideline.

5. *Health Behaviour Guideline Adherence Index*

A health behaviour guideline adherence index was created to measure the cumulative effect of adherence to each of the four behaviour guidelines. Participants were given a score of 0 to 4, indicating the number of guidelines they adhered to.

Procedure

Questionnaires were delivered to participants in an online format and all entries were anonymous. Participants were asked to complete a demographic questionnaire, the Chernyshenko Conscientiousness Scales (Hill & Roberts, 2011; Green *et al.*, 2016), and a questionnaire examining health behaviours. The battery of questionnaires took approximately fifteen minutes to complete. Participants were entered into a £50 prize draw for completing the questionnaires. This study received ethical approval from the University Ethics Committee.

RESULTS

Descriptive statistics

Descriptive statistics for conscientiousness (plus each of its facets) and for each of the health behaviours are presented in Table 1 and Table 2, respectively.

[Insert Table 1 and 2 about here]

Preliminary correlation analysis

Table 3 displays the point-biserial correlation coefficients for each study variable. It was demonstrated that total conscientiousness was most strongly associated with guideline adherence for alcohol consumption $r_{pb} = .17$, p < .01, followed by smoking guideline adherence $r_{pb} = .15$, p < .01 and fruit and vegetable guideline adherence $r_{pb} = .10$, p < .01 but was not associated with physical activity guideline adherence $r_{pb} = .02$, p = *ns*. The facet of traditionalism was most highly correlated with smoking guideline adherence $r_{pb} = .17$, p < .01, whereas the facet of industriousness was most highly correlated with fruit and vegetable guideline adherence, $r_{pb} = .15$, p < .01, and the facet of self-control was most highly correlated to guideline adherence for alcohol intake, $r_{pb} = .20$, p < .01. Furthermore, total conscientiousness and each of its facets were positively correlated to the health behaviour guideline adherence index, total conscientiousness $r = .19$, p < .01. The facet of industriousness was most highly correlated to the overall index, $r = .18$, p < .01.

Hierarchical Regression Analyses

Results displayed in Table 4 show that after controlling for age, gender and education, total conscientiousness alongside the facets of order, virtue, traditionalism, self-control, responsibility and industriousness were all able to predict the health behaviour guideline adherence index. Total conscientiousness was able to explain the most variance of the seven predictors, followed by industriousness and responsibility. Results presented in Table 5

demonstrate that when all of the facets were entered into the same regression model, only industriousness remained significant predictor of the health behaviour guideline adherence index, and thus suggests that industriousness is the preeminent facet at predicting the guideline adherence index.

Low Conscientiousness versus High Conscientiousness

To address the second aim of the study, two sub-groups were created to represent low conscientiousness and high conscientiousness, based on scores in the top and bottom 25% of the sample. Scores of 2.68 and below represented low conscientiousness and scores of 3.13 and above represented high conscientiousness. Descriptive statistics for fruit and vegetable consumption, alcohol intake, smoking and physical activity by the sub-groups can be found in Table 6.

Descriptive statistics indicated that in comparison to those high in conscientiousness, individuals scoring low in conscientiousness consumed fewer portions of fruit and vegetables, consumed more alcohol, smoked more, and participated in physical activity less, apart from when physical activity was examined solely in terms of strenuous activity (when those low in conscientiousness exercised marginally more, 5.97 minutes more per week). These results indicated that with the exception of physical activity, the mean scores for each behaviour within the low conscientious group were below the total sample average, and the mean scores for each behaviour within the high conscientious group were above the sample average.

Figure 1 presents the percentage of health behaviour guidelines adhered to in those scoring low and high in conscientiousness. In individuals scoring low in conscientiousness, 3.6% met no guidelines, 12.2% met only one guideline, 28.4% met only two guidelines, 37.4% met only three guidelines and 18.5% met all four guidelines. In those scoring high in conscientiousness, none failed to meet any guidelines, 4.8% met only one guideline, 26.5% met only two guidelines, 35.2% met only three guidelines and 33.5% met all four guidelines.

DISCUSSION

The main findings of this study showed that total conscientiousness and each of its facets were positively associated with adherence to the health behaviours of smoking, fruit and vegetable consumption and alcohol intake but were not associated with physical activity. The latter result is not particularly surprising given the previously observed modest relationship between conscientiousness and physical activity in Bogg and Roberts' (2004) meta-analysis. Of the behaviours examined, total conscientiousness was most strongly associated with alcohol intake, followed by smoking and fruit and vegetable consumption. The strength and order of these relationships is in agreement with those of Bogg and Roberts (2004). Therefore, it seems that conscientiousness may have differential effects and be more important for some health behaviours compared to others. Total conscientiousness and each of its facets were also positively associated with the health behaviour adherence guideline index, with the facet of industriousness emerging as the pre-eminent predictor of the index.

When examined independently, conscientiousness and each of its facets predicted the health behaviour guideline adherence index, after controlling for age, gender and education. Total conscientiousness was found to account for 4% of the variance in the health behaviour guideline adherence index. Although this was only a small percentage, it is still important as even small effects over the lifetime could have a significant impact upon health. After the effects of total conscientiousness, the facet of industriousness was visible as the strongest predictor of the health behaviour guideline adherence index. When each facet of conscientiousness was examined simultaneously as predictors of the health behaviour guideline adherence index, industriousness was the only significant predictor. This not only suggests that those scoring higher on levels of conscientiousness are more likely to meet health behaviour guidelines, which in turn may have a positive effect upon physical health, but that the facet of industriousness is particularly important for meeting important health behaviour guidelines. One possible explanation for this may be the effortful, goal-achieving

and hard-working nature of industriousness. In order to meet health behaviour targets, one would need to exert frequent effort, particularly for behaviours such as fruit and vegetable consumption; alongside having high standards and setting goals.

This study also found that nearly twice as many high conscientious individuals met all four health behaviour guidelines in comparison to those low in conscientiousness (18.5% vs. 33.5%). This suggests that even in a young and healthy sample, differences in the overall adherence to a healthy lifestyle between high and low conscientious groups are observable. It is plausible that the early adoption of an overall healthy lifestyle will have a protective effect on health in the years to come and is a likely mechanism by which conscientiousness exerts its protective effect. While research has demonstrated that conscientiousness is related to many individual health behaviours (e.g. Eustace *et al*., 2018; Furnham & Cheng, 2018; Steptoe, Easterlin & Kirschbaum, 2017; Wilson *et al*., 2016), and a few have created summary health behaviour variables which can give an indication of a healthy lifestyle more broadly (Hampson *et al.,* 2015; Joyner *et al.,* 2018; Takahashi *et al.,* 2013), we are not aware of any studies which have assessed participants' adherence to national health guidelines as a benchmark for health behaviour. Therefore, this is an important finding because it highlights the value of health behaviour guideline adherence indexes for future research.

There are a number of limitations of the current research. Primarily, the data are cross-sectional and therefore we are limited in the conclusions that can be drawn regarding the causal direction of the findings. Additionally, due to the scope of the current research, health behaviour measures were limited to retrospective self-reports and thus this data is susceptible to inaccurate reporting, demand characteristics, and socially desirable reporting. Nevertheless, the large sample size of the current study lends weight to the findings and to the health behaviour guideline adherence index as a way of operationalising the adoption of a broad healthy lifestyle.

In conclusion, the findings of the current study suggest that conscientiousness and each of its facets were positively associated with adherence to the health behaviour guidelines

for smoking, fruit and vegetable consumption and alcohol intake but were not associated with

physical activity guideline adherence.

Table 1. Descriptive statistics for total conscientiousness and each of its facets

	Mean	**SD**	**Cronbach's α**
Total conscientiousness	2.90	.31	.91
Order	2.89	.59	.86
Virtue	2.85	.43	.71
Traditionalism	2.60	.43	.75
Self-control	2.87	.49	.81
Responsibility	3.11	.41	.70
Industriousness	3.12	.50	.86

Table 2. Descriptive statistics and percentage adherence to UK guideline for fruit and vegetable consumption, alcohol intake, smoking and physical activity

	Mean (SD)	Adherence %
Fruit and Veg (portions/day)	4.80 (2.35)	51.9 %
Alcohol (units/week)	10.90 (11.70)	71.2 %
Smoking	----	88.8 %
Physical Activity (mins/week)		
Moderate	171.43(195.73)	68.6 %
Strenuous	100.07 (126.82)	
Guideline Adherence Index	2.68 (0.93)	

Note: Adherence % relates to the number of participants meeting the U.K. guideline for the given behaviour.

Table 3. Point–biserial correlation coefficients for each study variable (*N* = 886).

		1	2	3	4	5	6	7
1.	Conscientiousness	__						
2.	Order	.65*	__					
3.	Virtue	.56*	.12*	__				
4.	Traditionalism	.60*	.24*	.31*	__			
5.	Self-Control	.65*	.30*	.24*	.30*	__		
6.	Responsibility	.74*	.33*	.39*	.31*	.38*	__	
7.	Industriousness	.71*	.36*	.26*	.26*	.31*	.57*	__
8.	Smoking	.15*	.04	.10*	.17*	.10*	.10*	.11*
9.	Fruit and Veg	.10*	.06	.09	-.01	.00	.09	.15*
10.	Alcohol	.17*	.08	.05	.14*	.20*	.09*	.11*
11.	Physical Activity	.02	.03	.02	-.03	-.02	.02	.04
12.	Guideline Adherence Index	.19*	.10*	.11*	.11*	.11*	.13*	.15*

Note * = the correlation coefficients were significant at the .01 level (two-tailed)

Table 4. Hierarchical regression analyses testing the individual effects of conscientiousness and its facets on the health behaviour guideline adherence index (N =886)

		β (step 1)	β (step 2)	ΔR^2 for step	Total R^2
Total C					
Step 1	Age	-.01	-.05		
	Gender	.06	.05		
	Education	.12*	.12*	.02*	
Step 2	Total C		.19*	.03*	.05
Order					
Step 1	Age	-.01	-.02		
	Gender	.06	.06		
	Education	.12*	.12*	.02*	
Step 2	Order		.10*	.01*	.02
Virtue					
Step 1	Age	-.01	-.03		
	Gender	.06	.06		
	Education	.12*	.12*	.02*	
Step 2	Virtue		.10*	.01*	.03
Traditionalism					
Step 1	Age	-.01	-.02		
	Gender	.06	.05		
	Education	.12*	.12*	.02*	
Step 2	Traditionalism		.11*	.01*	.03
Self-Control					
Step 1	Age	-.01	-.03		
	Gender	.06	.06		
	Education	.12*	.12*	.02*	
Step 2	Self-Control		.11*	.01*	.03
Responsibility					
Step 1	Age	-.01	-.04		
	Gender	.06	.06		
	Education	.12*	.12*	.02*	
Step 2	Responsibility		.13*	.02*	.03
Industriousness					
Step 1	Age	-.01	-.03		
	Gender	.06	.05		
	Education	.12*	.11*	.02*	
Step 2	Industriousness		.17*	.03*	.05

Note: Total C = total conscientiousness

Table 5. Hierarchical regression analyses testing the simultaneous effects of conscientiousness on the health behaviour guideline adherence index (N =886)

		β (step 1)	β (step 2)	ΔR^2 for step	Total R^2
Step 1	Age	-.01	-.05		
	Gender	.06	.05		
	Education	.12*	.12*	.02*	
Step 2	Order		.03		
	Virtue		.05		
	Traditionalism		.04		
	Self-Control		.05		
	Responsibility		.01		
	Industriousness		.13*	.04*	.05

Note: * = p < 0.01

Table 6. Descriptive statistics for fruit and vegetable consumption, alcohol intake, smoking and physical activity in individuals scoring high and low in conscientiousness

	Low Conscientious (*N* = 227)		High Conscientious (*N* =233)	
	Mean (SD)	Adherence %	Mean (SD)	Adherence %
Fruit and Veg (portions/day)	4.75 (3.21)	48.0%	5.06 (2.06)	57.9%
Alcohol (units/week)	13.60 (12.44)	61.8%	7.89 (8.96)	80.1%
Smoking	---	81.4%	---	93.6%
Physical Activity (minutes/week)				
Moderate	149.48(158.97)	64.2%	171.84(197.55)	65.9%
Strenuous	99.39 (134.54)		93.42 (126.79)	
Guideline Adherence Index	2.55 (1.04)		2.97 (.89)	

Note: Adherence % relates to the number of participants meeting the U.K. guideline for the given behaviour. There is no mean score for smoking as responses were 'yes' or 'no'.
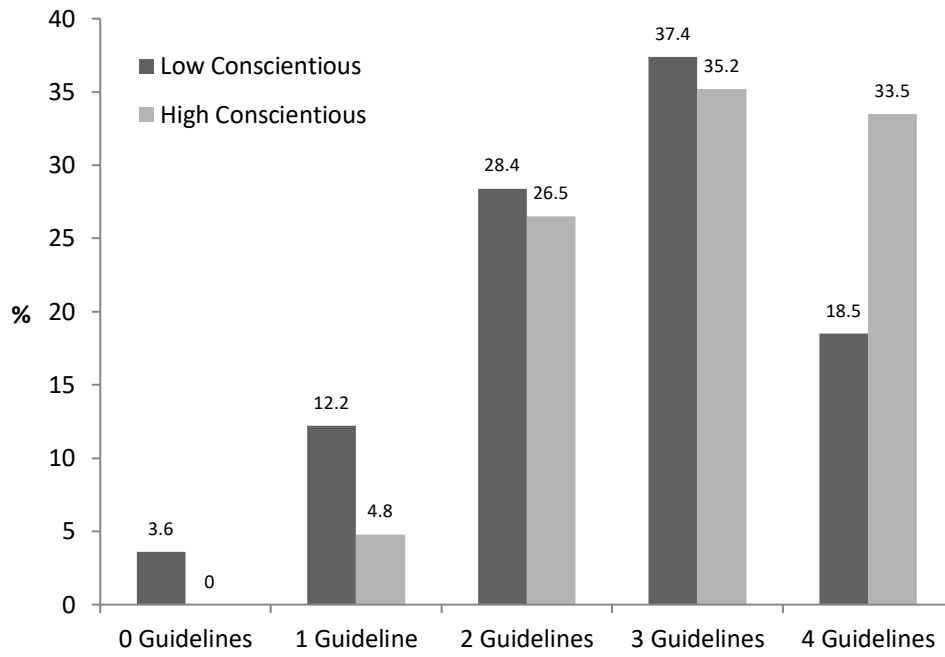
Figure 1. Percentages of adherence to health behaviour guidelines in low and high conscientiousness groups

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