

## Article

# Identification of Key Items Regarding Personality, Environment, and Life Events to Assess Risk and Resilience Factors for Harmful Alcohol Drinking in Adolescents

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## Abstract

**Aims:** Alcohol misuse often develops during adolescence involving interacting factors deriving from personality, environment and life events that can be assessed with well-established instruments. However, for specific research purposes, involving the assessment of large data sets, it may be beneficial having a short tool of key items representing the most important risk factors.

**Methods:** We identified a set of key items from standard questionnaires assessed in about 2000 adolescents. In our longitudinal study we identified important items on personality, environment, and life events explaining alcohol drinking behaviour at the age of 14 years and the increase of alcohol consumption 2 years later.

**Results:** The key items explained 33.4% of variance in alcohol drinking behaviour (vs. 34.8% for original battery) and can be completed in six minutes.

**Conclusions:** Our item list represents a powerful easy-to-use tool for the examination of alcohol drinking behaviour in adolescents.

## INTRODUCTION

Many variables influence whether alcohol use in adolescence develops into alcohol misuse or an alcohol use disorder (Swendsen *et al.*, 2009). The diathesis-stress model (Goldstein *et al.*, 2000) describes that an individual's vulnerability to substance use will be intensified by a negative environment such as stressful familial situations or poor social integration. In a resilience model (Fergus and Zimmerman, 2005), it is highlighted that individual factors can reduce the sensitivity to a negative environment and prevent substance misuse from developing.

Although genetic factors play an important role in the development of alcoholism with a heritability of about 50% (Goldman *et al.*, 2005; Morozova *et al.*, 2012), during adolescence external factors may be more important and set the course for the development of

alcohol problems (Guerrini *et al.*, 2014). In this context, the social environment with family and peers plays a decisive role (Oxford *et al.*, 2001). During childhood and early adolescence the parental influence is of utmost importance (Oxford *et al.*, 2001) with poor parental monitoring or a familial history of alcoholism leading to an early initiation of substance use (Chilcoat *et al.*, 1995; Conrod *et al.*, 1998). Later during adolescence the influence of peers on behavioural patterns becomes increasingly important (Oxford *et al.*, 2001). However, this influence of peers on drinking behaviour strongly depends on individual personality traits such as increased sensation seeking (Marschall-Levesque *et al.*, 2014), and many other facets of personality also show strong associations with alcohol drinking behaviour. For example, increased extraversion seems to be related to an early

initiation of harmful alcohol use (Ayer *et al.*, 2011). Augmented alcohol intake is also linked to impaired control as well as increased risk taking (MacPherson *et al.*, 2010; Leeman *et al.*, 2012). Moreover, risky behaviours along with low stress reactivity to aversive situations (e.g. sexual abuse) experienced before the age of 16 years may additionally promote alcohol misuse (Lovallo, 2013). Altogether, this implicates a complex interplay between personality traits, social environment, and (stressful) life events as predictors of alcohol drinking behaviour in adolescents. Thus it is important to identify and examine factors that lead to increased consumption or prevent alcohol misuse from developing.

Younger age at first alcohol consumption is a risk factor for subsequent alcohol misuse (Behrendt *et al.*, 2009). It can be assumed that earlier interventions might lead to a larger success in preventing alcohol misuse. For this purpose, a short examination tool applicable in large cohorts in real-life situations such as schools would be helpful to determine the respective influence of personality traits, social environment, and life events on alcohol drinking behaviour. The present study aims at identifying single items for these categories that are most important in explaining associations with harmful alcohol use.

## METHODS

### Sample

We used data from the IMAGEN study (IMAGEN; Schumann *et al.*, 2010), where adolescents were recruited from the general public in Germany, the UK, Ireland, and France via school visits, flyers and registration offices. We had the following exclusion criteria: serious medical conditions, pregnancy, previous head trauma with unconsciousness, and any contra indications for functional magnetic resonance imaging (fMRI) examinations. Participants in this longitudinal study answered several questionnaires (see 'Measures') at two time points: at the age of 14–15 years ( $N = 2215$  adolescents; mean age = 14.41 years,  $SD = 0.41$  years) and again at the age of 16–17 years ( $N = 1237$  participants; mean age = 16.44 years,  $SD = 0.50$  years, see Table 1 for demographic details). The study was approved by the local ethics committees and was conducted in accordance with the declaration of Helsinki of 1975 as revised in 1983. After complete description of the study to the subjects and their parents, written informed consent was obtained.

### Measures

Items were selected from the following well-established and validated questionnaires: The novelty seeking subscale of the Temperament and Character Inventory-Revised (TCI-R (Cloninger *et al.*, 1991)), Substance Use Risk Profile Scale (SURPS (Woicik *et al.*, 2009)), and the Neuroticism-Extroversion-Openness Five Factor Inventory (NEO-FFI (Costa and McCrae, 1997)) for various personality traits. For the examination of (stressful) life events and social environment (such as family situation, friendships or being bullied), a life events questionnaire (LEQ, according to (Newcomb *et al.*, 1981)), and the Bully/Victim Questionnaire (Olweus, 1996) were applied. Additionally, we employed one question on average school grade to further evaluate the individual functioning in the scholar environment and two questions on smoking behaviour (lifetime and 30 days before the examination from the European School Survey Project on Alcohol and Drugs (ESPAD (Hibell *et al.*, 1997)), as it is known that the consumption of alcohol and cigarettes is strongly related (e.g. Mintz *et al.*, 1985).

### Step one: item selection

In order to identify items which have a statistically significant association with alcohol drinking behaviour, we conducted separate linear regression analyses for each original questionnaire (see 'Measures'). We used the main outcome scores of the respective questionnaire as independent variables. For the bully questionnaire, school grade, and smoking this main outcome score was based on all items of the questionnaire, i.e. the sum of all item scores were the respective independent variables in our regression analyses. For the other questionnaires (TCI-R, SURPS, NEO-FFI, and LEQ) there are subscales existing (exploratory excitability vs. stoic rigidity, impulsiveness vs. reflection, extravagance vs. reserve, and disorderliness vs. regimentation for TCI-R; anxiety, negative thinking, impulsivity, and sensation seeking for SURPS; neuroticism, extraversion, openness, agreeableness, and conscientiousness for NEO-FFI; family/parents, accident/illness, sexuality, autonomy, deviance, relocation, distress, and events not subsumed under an event scale for LEQ). We used the sum of item scores of these respective subscales as independent variables. With these predictors assessed at the age of 14 years, we conducted two sets of regression analyses: In a first analysis the dependent variable was the total score of the Alcohol Use Disorders Identification Test (AUDIT (Saunders *et al.*, 1993)) at age 14. This questionnaire assesses

**Table 1.** Sample description and AUDIT score distribution

	Baseline ( $N = 2215$ , 1113 female)	Follow-up ( $N = 1237$ , 640 female)
Age (mean, SD, range)	14.41, 0.41, 12.55–16.03	16.44, 0.50, 14.60–18.79
AUDIT zone I ( $N$ )	2122	1019
Score 0	1081	0
Score 1	512	259
Score 2	186	180
Score 3	124	149
Score 4	82	157
Score 5	68	115
Score 6	45	82
Score 7	24	77
AUDIT zone II ( $N$ )	85	213
AUDIT zone III ( $N$ )	4	4
AUDIT zone IV ( $N$ )	4	1

AUDIT = Alcohol Use Disorders Identification Test (Saunders *et al.*, 1993); zone I (scores 0–7): low level of alcohol problems; zone II (scores 8–15): medium level of alcohol problems; zone III (scores 16–19) and zone IV (scores 20–40): high level of alcohol problems.

the amount of drinking but also the related behaviour and the value of alcohol for the adolescents. We chose the total score rather than a two-stage variable based on a cut-off value in order to analyse the course of drinking behaviour. Furthermore, this approach accounts for the fact that even lower scores in the AUDIT might indicate harmful drinking for adolescents (Chung *et al.*, 2000). In a second step we conducted the same regression analyses (same independent variables) with the increase in AUDIT score from 14 to 16 years as dependent variable (AUDIT score at the age of 16 years minus AUDIT score at the age of 14 years). This was done in order to identify the items, which might differentiate the factors underlying resilience against an increase in alcohol consumption during this period, i.e. against risky behaviour.

#### Step two: further item reduction

Following this first item selection (see step one) all statistically significant items (scores) were included in a factor analysis (rotation = varimax; maximum iteration for convergence = 250) using IBM SPSS Statistics 20 to exclude items which did not sufficiently explain additional variance. The scree plot served as a cut-off criterion for the determination of the final number of components. These components were employed to answer the question whether we had identified different constructs (components) or whether the reduced item set concerned only one global risk component. The final reduced item set included all items with the highest loading on the factors identified according to the scree plot.

#### Step three: final arrangement of items

Items belonging together on a conceptual level should not directly follow each other to avoid biases. We spread the items of one component in the way that two items of the same component never follow each other.

In the LEQ all questions comprise two parts (Has an event EVER occurred? How would this event make you feel?), which were implemented separately in the initial regression analysis. For the purpose of clarity in the final reduced item set, we completed those questions where only one part had become statistically significant after item selection (step one) and reduction (step two). Furthermore, the SURPS is the only original questionnaire with four-staged answer possibilities. Thus we adjusted it to five-staged answer possibilities in order to make it easier to handle for the participants. We chose to adapt the SURPS questions instead of adapting the other questions as SURPS questions represent only 10.9% of the original questions.

#### Comparison of the original questionnaires and the reduced summary of items

To classify the quality of the reduced set of key items, two major issues need to be addressed: (a) How much variance in alcohol drinking behaviour does the reduced items set explain compared to the complete set of original questionnaires? (b) What is the gain of time by using this reduced set instead of the standard questionnaire battery? In order to answer these questions we conducted regression analyses (the AUDIT score as dependent variable) using all items of all original questionnaires and with the reduced item set, respectively. Furthermore, the original questionnaire battery and the reduced set of items was completed by  $N = 5$  students each to see how long they need for completion.

## RESULTS

### AUDIT scores

At the first examination time point 1081 out of 2215 adolescents scored 0 in the AUDIT meaning that they had not consumed alcohol

during the past year (Table 1). Two years later all adolescents indicated having consumed at least one alcoholic drink before. See Table 1 for more details.

### Item selection

Regression analyses of the standard questionnaires revealed 90 items which have a statistically significant association with the AUDIT score at the age of 14 years. Regression analyses on the increase in AUDIT score up to the age of 16 years generated 22 statistically significant items. As some items appeared in both analyses, a total of 99 items was taken for the subsequent factor analysis. The scree plot then revealed 13 components comprising 60 items to be included for the final set of items. These 60 items include 23 (out of 60 original) NEO items, 10 (out of 35) TCI items, 8 (out of 23) SURPS items, 3 (out of 12) items from the Bully questionnaire, 14 (out of 78) items from the LEQ, and the two questions on smoking behaviour (ESPAD). For the purpose of clarity we completed those questions of the LEQ where only one of the two parts has become statistically significant after regression analyses and part of the included components after factor analyses. This was done in 12 cases. The complete list of the 72 items, the appropriate scoring of the respective items and further statistical information can be found in Table 2. Furthermore, this table shows the belonging of each statistically significant item to one of the 13 components after factor analysis (Table 2, 'latent factor'). To summarize, the items which are included within these 13 components, cover the following domains (according to latent factor number): mood, degree of impulsive behaviour, life organizational skills, sexual and smoking behaviour, degree of curiosity, active bullying, manipulative behaviour, rumination, law-abiding behaviour, degree of agreeableness, presence of love attachment, degree of personal energy, handling money.

### Arrangement of items

Due to the arrangement of the original questions, the final reduced item set was divided into three parts: in the first part, the participants had to indicate their agreement to statements on a five-point scale. In the second part they had to indicate whether an event had ever occurred and how they would feel in case it occurred, and in the third part, the participants had to mark the frequency of specific behavioural patterns (see Supplementary Material).

### Comparison of the original questionnaires and the reduced set of items

The reduced item list explained 33.4% of the variance in alcohol consumption (adjusted  $R^2$  for the regression on the AUDIT score) compared to 34.8% explained by the original questionnaire battery. At the same time, the reduced set can be answered in about 6 min (mean for five persons aged 18–20 = 6.09; range = 5.11–6.53) compared to about 15 min (mean for five different persons aged 18–20 = 15.37; range = 14.30–17.14) for the entire questionnaire battery.

## DISCUSSION

We aimed to identify a set of target items to quickly evaluate the impact of factors related to personality, environment and life events on alcohol consumption at a young age in large cohorts in real-life situations. We identified items associated with alcohol drinking behaviour at the age of 14 years and showed items related to the amount of increase in alcohol consumption during the next 2 years. These might represent important factors for the explanation of resilience against

**Table 2.** Key item list and results of regression analyses and factor analysis

Item number	Original questionnaire	P-value (regression)	Latent factor and factor loading	Item	Scaling
1	T-2	*0.008	2 (0.612)	I often follow my instincts, hunches, or intuition without thinking through all the details.	a
2	N-1	*0.040	1 (0.732)	Sometimes I feel completely worthless.	a
3	T-2	*<0.001	2 (0.592)	I often do things based on how I feel at the moment without thinking about how they were done in the past.	a
4	N-5	*0.001	3 (0.661)	I work hard to accomplish my goals.	a
5	N-3	*0.009	5 (0.703)	I often enjoy playing with theories or abstract ideas.	a
6	N-4	*<0.001	7 (-0.710)	If necessary, I am willing to manipulate people to get what I want.	b
7	S-4	*<0.001	9 (0.442)	I am interested in experience for its own sake even if it is illegal.	a
8	N-2	+0.015	10 (0.649)	I laugh easily.	a
9	N-2	*<0.001	12 (0.635)	I am a very active person.	a
10	T-3	+0.024	13 (0.715)	I enjoy saving money more than spending it on entertainment or thrills.	b
11	S-2	*0.031	1 (0.652)	I feel that I'm a failure.	a
12	T-1	*<0.001	2 (0.549)	I often try new things just for fun or thrills, even if most people think it is a waste of time.	a
13	N-5	*0.008	3 (0.581)	I try to perform all the tasks assigned to me conscientiously.	a
14	N-3	*<0.001	5 (0.646)	I have little interest in speculating on the nature of the universe or human condition.	b
15	S-3	*<0.001	7 (0.701)	I feel I have to be manipulative to get what I want.	a
16	N-2	+0.025	10 (0.594)	I am a cheerful, high-spirited person.	a
17	N-2	<0.001	12 (0.569)	My life is fast-paced.	a
18	T-3	*<0.001	13 (0.651)	I often spend money until I run out of cash or get into debt from using too much credit.	a
19	N-1	*0.031	1 (0.614)	When I'm under a great deal of stress, sometimes I feel like I'm going to pieces.	a
20	T-1	*<0.001	2 (0.512)	When nothing new is happening, I usually start looking for something that is thrilling or exciting.	a
21	N-5	+<0.001	3 (0.563)	I strive for excellence in everything I do.	a
22	N-3	*0.003	5 (0.603)	I have a lot of intellectual curiosity.	a
23	N-2	*0.003	7 (0.335)	I like to be where the action is.	a
24	N-2	+0.023	10 (0.503)	I am not a cheerful optimist.	a
25	N-2	*0.042	12 (0.461)	I often feel as if I'm bursting with energy.	a
26	N-1	+0.025	1 (0.539)	I am seldom sad or depressed.	b
27	S-3	*0.029	2 (0.480)	I usually act without stopping to think.	a
28	T-4	*<0.001	3 (-0.528)	Even when most people feel it is not important, I often insist on things being done in a strict and orderly way.	b
29	S-4	+0.047	5 (0.443)	I would enjoy hiking long distances in wild and uninhabited territory.	a
30	N-4	*0.006	10 (0.301)	I try to be courteous to everyone I meet.	a
31	N-1	*0.004	1 (0.490)	I rarely feel fearful or anxious.	b
32	S-3	*<0.001	2 (0.412)	Generally, I am an impulsive person.	a
33	N-5	+0.029	3 (0.468)	I never seem to be able to get organized.	b
34	T-1	*0.004	5 (0.377)	I like to explore new ways to do things.	a
35	N-4	*<0.001	1 (-0.373)	I often get into arguments with my family and co-workers.	b
36	T-4	*<0.001	2 (0.363)	I often break rules and regulations when I think I can get away with it.	a
37	S-2	+0.044	3 (-0.427)	I feel proud of my accomplishments.	a
38	S-3	*0.015	1 (0.371)	I often involve myself in situations that I later regret being involved in.	a
39	T-4	+0.029	2 (0.345)	I like it when people can do whatever they want without strict rules and regulations.	a
40	N-5	*0.008	3 (0.421)	I waste a lot of time before settling down to work.	b
41	N-4	*<0.001	2 (-0.307)	If I don't like people, I let them know it.	b
42	L-7			Has your face EVER broken out with pimples?	c
43		*0.010	8 (0.601)	How would this event make you feel/has it made you feel?	d
44	L-3	*<0.001	4 (0.587)	Have you EVER lost your virginity?	c
45		*<0.001		How would this event make you feel/has it made you feel?	d
46	L-1	+<0.001		Did your family EVER have money problems?	c
		*0.003			

Continued

**Table 2.** Continued

Item number	Original questionnaire	P-value (regression)	Latent factor and factor loading	Item	Scaling
47		*0.006	8 (0.573)	How would this event make you feel/has it made you feel?	d
48	L-5	*<0.001	4 (0.394)	Have you EVER got in trouble with the law?	c
49		+0.035			
50	L-7	*<0.001	9 (0.580)	How would this event make you feel/has it made you feel?	d
51		*0.003	8 (0.551)	Have you EVER got poor grades in school?	c
52	L-3	*0.002	4 (0.292)	How would this event make you feel/has it made you feel?	d
53				Have you EVER had a sexual experience with someone who is the same sex as you?	c
54	L-7	*0.017		How would this event make you feel/has it made you feel?	d
55		*0.003	8 (0.516)	Have you EVER gained a lot of weight?	c
56	L-3	*<0.001	11 (0.857)	How would this event make you feel/has it made you feel?	d
57				Have you EVER broken up with your boyfriend/girlfriend?	c
58	L-1	*<0.001		How would this event make you feel/has it made you feel?	d
59		*<0.001	8 (0.431)	Has one of your parents EVER abused alcohol?	c
60	L-3	*0.028	11 (0.853)	How would this event make you feel/has it made you feel?	d
61		*0.010		Have you EVER started going out with a girlfriend / boyfriend?	c
62	L-5	*<0.001		How would this event make you feel/has it made you feel?	d
63		+0.017		Have you EVER got in trouble at school?	c
64	L-7	*<0.001	8 (0.384)	How would this event make you feel/has it made you feel?	d
65		*<0.001	1 (0.435)	Have you EVER thought about suicide?	c
66	L-5	*<0.001		How would this event make you feel/has it made you feel?	d
67		*0.001	9 (0.590)	Have you EVER stolen something valuable?	c
68	B	+0.001		How would this event make you feel/has it made you feel?	d
69	B	*0.040	6 (0.778)	How often have the following situations occurred IN THE PAST 6 MONTHS?	
70	B	+0.038	6 (0.747)	I took part in bullying another student/peer at school.	e
71	E	*<0.001	6 (0.692)	I called another student/ peer mean names, made fun of, or teased him or her in a hurtful way.	e
72	E	*<0.001	4 (0.813)	I hit, kicked, pushed, shoved around, or locked a student/ peer indoors.	e
			4 (0.805)	On how many occasions during your lifetime have you smoked cigarettes?	f
				How frequently have you smoked cigarettes during the LAST 30 DAYS?	g

B = Bully questionnaire (Olweus, 1996); L = Life events questionnaire (LEQ (Newcomb *et al.*, 1981)), L-1 = LEQ-Family, L-2 = LEQ-Accident, L-3 = LEQ-Sexuality, L-4 = LEQ-Autonomy, L-5 = LEQ-Deviance, L-6 = LEQ Relocation, L-7 = LEQ Distress; N = Neuroticism-Extroversion-Openness Five Factor Inventory (NEO-FFI (Costa and McCrae, 1997)), N-1 = NEO-Neuroticism, N-2 = NEO-Extraversion, N-3 = NEO-Openness, N-4 = NEO Agreeableness, N-5 = NEO-Conscientiousness; S = Substance Use Risk Profile Scale (SURPS (Woicik *et al.*, 2009)), S-1 = SURPS-Anxiety Sensitivity, S-2 = SURPS-Negative Thinking/Hopelessness, S-3 = SURPS-Impulsivity, S-4 = SURPS-Sensation Seeking; T = Temperament and Character Inventory-Revised (TCI-R (Cloninger *et al.*, 1991)), T-1 = TCI-Exploratory excitability, T-2 = TCI-impulsiveness, T-3 = TCI-Extravagance, T-4 = TCI-Disorderliness, E = European School Survey Project on Alcohol and Drugs (ESPAD (Hibell *et al.*, 1997)); \* = statistically significant association with AUDIT score at the age of 14 years, + = statistically significant association with increase in AUDIT score from 14 years to 16 years; a: Five stage scaling: 0 = definitely false, 1 = mostly false, 2 = neither true or false, 3 = mostly true, 4 = definitely true; b: Five stage scaling: 4 = definitely false, 3 = mostly false, 2 = neither true or false, 1 = mostly true, 0 = definitely true; c: 1 = yes, 0 = no; d: Five stage scaling: 0 = very unhappy, 1 = unhappy, 2 = neutral, 3 = happy, 4 = very happy; e: Five stage scaling: 0 = none, 1 = only once or twice, 2 = 2 or 3 times a month, 3 = about once a week, 4 = several times a week; f: Five stage scaling: 0 = none, 1 = 1-5, 2 = 6-19, 3 = 20-39, 4 = 40 or more; g: Five stage scaling: 0 = not at all, 1 = less than 1 per day, 2 = 1-5 per day, 3 = 6-20 per day, 4 = more than 20 per day; Items showing no P-value (neither statistically significant association with AUDIT score at the age of 14 years nor increase in AUDIT score from 14 to 16 years in the regression analyses) and/or no factor loading (not within the 13 components after factor analysis) have been added for the purpose of clarity as they are part of two stage questions within the LEQ.

the initiation of hazardous alcohol use in adolescents. In order to have a quick and easy to use instrument we combined these two categories in one item set, which allows the joint examination of the interplay of these domains. The reduced set of items explains sufficient variance for alcohol drinking behaviour compared to the entire questionnaire battery. Furthermore, the gain in time makes this reduced set especially useful for research on a large number of adolescents in real-life contexts, for example in school, where it can easily be completed in a short time.

The reduced set of items contains items from all original questionnaires, suggesting an important relationship with alcohol drinking behaviour for all implemented questionnaires. Regarding the content of the distinct items we observed some interesting aspects. For

example, for the Bully questionnaire only active bullying parts were associated with alcohol drinking behaviour. All items related to being bullied fell out of the analysis within the first step of item selection (regression analysis). In relation to the 13 distinct components it can be seen that some components represent the same categories as in the original questionnaires. That is the case for bullying (component 6), sexual events (component 11), extraversion (component 12), and extravagance (component 13). On the other hand some components indicate the relationship between different categories which might interact in determining alcohol consumption behaviour in adolescents. For example, family and distress seem to represent one category (component 8) and impulsivity, exploratory excitability, and disorderliness another one (component 2). Altogether, the respective

13 components reflect the following domains (due to the items that represent each component): mood, degree of impulsive behaviour, life organizational skills, sexual and smoking behaviour, degree of curiosity, active bullying, manipulative behaviour, rumination, law-abiding behaviour, degree of agreeableness, presence of love attachment, degree of personal energy, handling money. Future research has to elucidate how these domains might possibly interact. However, although the formation of one component after factor analysis suggests a relation between the items included in one component, further research in new samples has to elucidate how the diverse traits are related to each other.

One limitation of our study is the loss of subjects from the first to the second examination time point (45% loss). However, we think that this doesn't affect our results too strongly as the sample is still quite large. Furthermore, only items based on the increase in AUDIT score (9 out of 99 items) would be affected by this subject loss. In this context it has to be additionally mentioned that no participant scored 0 at the second examination time point. This means each participant has at least once tried an alcoholic drink at the age of 16 years. Possibly we lost few complete abstainers from wave 1 to wave 2.

In sum, we could identify a short list of items derived from standard reliable and valid questionnaires which allow the examination of the interplay of personality, environment, and life events to identify risk and resilience for alcohol drinking behaviour in adolescents. The reduced item set was shown to be statistically significant in explaining alcohol consumption. Further validation in different populations might be very useful.

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## CONFLICT OF INTEREST STATEMENT

None declared.

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