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THE STANDARD STRESS SCALE (SSS): MEASURING STRESS IN THE LIFE COURSE

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The Standard Stress Scale (SSS): Measuring Stress in the Life Course

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The Standard Stress Scale (SSS): Measuring Stress in the Life Course

Abstract

This contribution presents the Standard Stress Scale (SSS); this is a new scale which has been specially developed to meet the requirements of multicohort panel studies, such as the National Educational Panel Study (NEPS), which refer to the whole life course. Accordingly, the SSS is consistently applicable for different age groups from 14 years old onwards and is also suitable for a wide range of people irrespective of their stage in life and employment situation; the items are applicable for old-age pensioners, unemployed, employed and self-employed, househusbands and –wives, for university students and so forth. To obtain the final 11-item Standard Stress Scale (SSS), 35 questions regarding stressful life situations, social stress, daily distress, anxieties about the future and other stresses and strains were developed following the theoretical approach of the effort-reward imbalance model (ERI) and the demand-control model. These 35 items were pretested with different subsamples—such as students in different school types, university students, and adults in different life stages—using self-administered questionnaires. The total sample of the pretest includes 372 respondents. All of the 35 original questions had a small item-nonresponse rate and a good variance among respondents. Using factor analyses, the questions with the highest factor loading on each of the dimensions were used to represent the final 11-item SSS. In some cases, when the questions with the highest loading did not perform well in the cognitive pretest, the item with the second highest loading was chosen instead. Although the most distinct items were selected, the final 11 items of the SSS show good reliability values. For all subsamples, the Cronbach's Alpha values vary in a range from 0.58 for the unemployed to 0.66 for students. In addition to this, further analyses show a high correlation of the final SSS with self-rated health.

Keywords

Stress, distress, scale, index

1. Introduction

Stress is one of the main determinants of health status (Backé, Seidler, Latza, Rossnagel, & Schumann, 2012; Steptoe, 1991); therefore an instrument to adequately measure stress is of prime interest not only in public health research but also for the examination of educational returns. School and workplace requirements are both essential sources of stress, and stress levels can also be affected by unemployment.

To provide excellent data on nonmonetary returns to education—such as health—is one focus of Pillar 5 (Returns to Education Over the Life Course) of the National Educational Panel Study (NEPS). NEPS aims to use a constant scale, which meets the standards of survey methodology, to measure stress for different age groups and living conditions. As none of the existing scales meets these requirements, we have developed the Standard Stress Scale (SSS) which is applied by NEPS but can also be used in further surveys. The SSS is applicable for different age groups (14 years and above) and is also suitable for all sorts of people irrespective of their stage in life and employment situation. The SSS will be applied in the NEPS Starting Cohort 3—Grade 5 (in Grade 8), Starting Cohort 4—Grade 9, Starting Cohort 5—First-Year Students, and Starting Cohort 6—Adults.

We first present previous stress scales to underline the need for development of a new instrument to measure stress in the life course (Section 2). Then we outline the theoretical dimensions of stress on which the Standard Stress Scale is based (Section 3), introduce the methods used to develop the scale (Section 4) and also the results of the cognitive pretest and factor analyses along with an explanation of how to build a stress index (Section 5). Finally we show some attributes of the resulting stress index based on the SSS (Section 6).

2. Previous Stress Scales

A variety of previous instruments to measure stress, available in a German version, are summarized in Table 1.

- (a) Possibly the most popular instrument is the “Effort-Reward Imbalance Scale (ERI)” (Siegrist, 1996; Siegrist, Starke, Chandola, Godin, Marmot, Niedhammer, & Peter, 2004), which is based on the theoretical concept of reciprocity. The model of effort-reward assumes that negative emotions occur when the effort made by a person is much higher than the reward the person receives, meaning that the main principle of reciprocity has been violated. Although the original scale was established to measure stress in the workplace only, Siegrist and colleagues developed further scales addressed to school (Li, Shang, Wang, & Siegrist, 2010) and university students (in preparation). The strength of the ERI-Scale—being well adapted for specific life circumstances such as being an employee or student—is a vital handicap for the application in multicohort panel studies but also for general cross-sectional surveys. There is no scale dedicated to unemployed, self-employed, pensioners or househusbands and -wives. Apart from that no version of an ERI-scale is applicable from school age through to old age.
- (b) The second stress scale—“Skala sozialer Stressoren am Arbeitsplatz” (Frese & Zapf, 1987)—is also limited to measuring stress in the workplace and in particular problems in in teams in the workplace.

- (c) “The Social Readjustment Rating Scale (SRRS)” provided by Holmes and Rahe (1967) focuses on the number and impact of life change events and is not limited to employees. But the SRRS is a product of its time containing items such as “wife begin or stop work”, which are addressed to heterosexual men only.
- (d) The “Stress-Reaktivitäts-Skala (SRS)” by Schulz, Jansen, and Schlotz (2005) is applicable for adult populations only and is mainly used in clinical research to evaluate coping strategies used for stressful situations.

The last two scales are for universal use:

- (e) The “Trierer Inventar zur Erfassung von chronischem Stress (TICS)” by Schulz, Schlotz, and Becker (2004) covers six dimensions of chronic stress: excess of work, dissatisfaction with work, social strains, lack of social approval, anxiety and incriminatory memories. Although the issue “work” is very present here the items could be used for other subgroups too when interpreting “work” in a wider sense. Nevertheless, the scale does not meet standards of survey methodology as it has items with two dimensions.
- (f) The “Perceived Stress Questionnaire (PSQ)” by Levenstein, Prantera, Varvo, Scribano, Berto, Luzi, and Andreoli (1993) is also available in a German version (Fliege, Rose, Arck, Levenstein, & Klapp, 2001; Fliege, Rose, Arck, Walter, Kocalevent, Weber, & Klapp, 2005). It focuses on stress as a result of perceived strains. The German version has been validated with a sample of women after giving birth or having had a miscarriage, and a sample of students of medicine (Fliege et al., 2001), and also in a general household survey (Kocalevent, Hinz, Brähler, & Klapp, 2011). To date there is no validation or cognitive pretest for school-aged children. In addition 30 items are a lot for a large survey.

As previous scales do not meet the acquirements of NEPS (a constant scale for many cohorts and all life situations of adults with a small number of items covering many dimensions of stress and having no methodological flaws) we developed the Standard Stress Scale (SSS) for use in NEPS and other general surveys.

Table 1

Previous Stress Scales

Scale	Theoretical focus/dimensions of stress	Target population	# Items¹	References	Comments
(a) Effort-reward imbalance scale (ERI)	Imbalance of effort and reward	Employees, (university) students	23	Siegrist (1996), Siegrist et al. (2004)	Suitable for surveys with special groups, no constant scale for all subgroups, lack of instruments for special subgroups such as unemployed
(b) Skala sozialer Stressoren am Arbeitsplatz	Social stress in the workplace	Employees	17 (8)	Frese and Zapf (1987)	Suitable for measuring employees' stress levels, especially social problems in teams in the workplace
(c) The Social Readjustment Rating Scale (SRRS)	Number and severity of life change events	Adults	43	Holmes and Rahe (1967)	For (male) adults only, obsolete items addressed to heterosexual men such as "wife begin or stop work"
(d) Stress-Reaktivitäts-Skala (SRS)	Stress reactivity, individual coping strategies, "the extent to which a person is likely to show emotional or physical reactions to a stressful event" (Bolger & Zuckerman 1995: 890)	Adults	29	Schulz et al. (2005)	For adults only, focus on clinical research
(e) Trierer Inventar zur Erfassung von chronischem Stress (TICS)	Six dimensions of chronic stress: excess of work, dissatisfaction with work, social strains, lack of social approval, anxiety and incriminatory memories	Universal	57 (12)	Schulz et al. (2004)	Items with two dimensions do not meet standards of survey methodology
(f) Perceived Stress Questionnaire (PSQ)	Stress as representation of perceived strains	Universal	30	Levenstein et al. (1993); Fliege et al. 2001, 2005	No validation for school-aged children, no short version available

¹ Number of items in short version in parenthesis.

3. Dimension of Stress in the Standard Stress Scale

Our theoretical concept of chronic stress is essentially based on the two most popular models in stress research: The demand-control model (Karasek & Theorell, 1990) and the effort-reward imbalance model (Siegrist, 1996; Siegrist et al., 2004); both were developed to measure stress in the workplace. The demand-control model assumes “a high risk of psychological strain and physical illness”, when “psychological demands” are high and “decision latitude (control)” is low (Karasek & Theorell, 1990: 32). The inverse situation with low demands and high control would lead to high learning motivation (Karasek & Theorell, 1990). The ERI-model is based on the concept of reciprocity and postulates negative affections of the coincidence of high efforts being made and low rewards in terms of low income, low social approval, etc. (Siegrist, 1996; Siegrist et al., 2004).

We adopted the theoretical dimensions of these models, such as overcommitment and social approval of the ERI-model and the control component of the demand-control model and developed items which are suitable for all subgroups, independent of their employment status and school attendance. The subdimensions of stress and the corresponding items of the original 35-item battery (see Table 3) are presented in Table 2.

Table 2

Dimensions of Stress

Subdimensions	Items (see Table 3)
Overcommitment, workload	1, 3, 5, 7, 10
Enjoyment of work, self-realization, empowerment	2, 4, 6, 8, 9, 11
Social distress, social support, social approval	12, 13, 14, 15 ,16 ,17 ,18, 19, 20, 21, 22, 34
Recreational capacities, exhaustion	23, 24, 26, 27, 28 ,29, 30, 32
Anxiety about the future, uncertainty	25, 31, 33, 35

For each dimension several items were developed resulting in a 35-item scale (Table 3). Each item was answered using a 5-point Likert scale ranging from 1 “not at all” to 5 “completely”.

Table 3

Original 35-Item Stress Battery

**Wenn Sie an einen normalen Tag denken, inwiefern treffen folgende Aussagen auf Sie zu?
[Regarding an average day, to which extent do the following statements apply to you?]**

(5-stufige Antwortskala: trifft überhaupt nicht zu, trifft eher nicht zu, teils-teils, trifft eher zu, trifft voll und ganz zu)

[5-point Likert scale: Not at all, to a small extent, somewhat, to a large extent, completely]

1. Ich habe mehr Aufgaben zu bewältigen als ich leisten kann.
2. In der Regel bin ich mit den Ergebnissen meiner Tätigkeiten sehr zufrieden.
3. Ich fühle mich oft wie ein Hamster im Rad.
4. Wenn mir eine Tätigkeit keinen Spaß macht, muss ich sie in der Regel auch nicht tun.
5. Wenn ich mich nicht selbst um etwas kümmere, tut es keiner.
6. Ich kann viele Dinge in meinem Leben selbst bestimmen.
7. Meistens bleibt die Arbeit dann doch wieder an mir hängen.
8. Ich bin oft völlig frustriert.
9. Die Aufgaben an einem gewöhnlichen Tag bereiten mir Freude.
10. Ich bräuchte mehr Zeit für die täglichen Tätigkeiten als ich habe.
11. Ich übe sinnvolle Tätigkeiten aus.
12. Meine Freunde erwarten mehr von mir als ich ihnen geben kann.
13. Meine Familie bereitet mir viel mehr Freude als Ärger.
14. Ich habe tolle Freunde.
15. Ich werde oft unfair behandelt.
16. Ich erfülle die Erwartungen meiner Familie nicht.
17. Ich habe viel mit Menschen zu tun, die mich stressen.
18. Ich fühle mich oft einsam.
19. Die meisten bewundern mich dafür, wie ich mein Leben meistere.
20. Meine Leistungen werden angemessen gewürdigt.
21. Egal was passiert, ich werde mit Problemen nicht allein gelassen.
22. Es gibt Menschen, auf die ich mich verlassen kann.
23. In der Regel habe ich einen erholsamen Schlaf.

- | |
|--|
| 24. Ich grübele oft. |
| 25. Vermutlich wird sich meine Lebenssituation verschlechtern. |
| 26. Im Allgemeinen kann ich Probleme gut lösen. |
| 27. Ich kann gut abschalten. |
| 28. Nach einem normalen Tag fühle ich mich glücklich. |
| 29. Ich denke viel über Probleme nach. |
| 30. Nach einem normalen Tag fühle ich mich erschöpft. |
| 31. Ich mache mir viel Sorgen um meine Zukunft. |
| 32. Nach zwei freien Tagen, fühle ich mich völlig erholt. |
| 33. Ich habe Angst davor, wie mein Leben in drei Jahren aussehen könnte. |
| 34. Ich mache mir viel Sorgen um meine Mitmenschen. |
| 35. Ich freue mich auf die Zukunft. |

To validate these items and generate a short version, the following methods were used.

4. Methods

To reach the goal of a short scale to measure diverse dimensions of stress, it was critical to select the right items—comprehensive for all subgroups of respondents—from the original 35-item stress battery. Therefore we conducted *cognitive pretests* to guarantee comprehensibility, and *factor analysis* to separate dimensions of stress and to choose the most diverse items for the short version of the SSS. Before referring to these two methods, we first describe the pretest subsamples. Pretests were conducted via Pen-and-Pencil-Interviewing (PAPI) using the 35-item battery of the SSS (see Table 3) in the following locations:

- (1) Respondents were interviewed while visiting the *registration office* of Nuremberg and waiting for their turn. Because for the pretest usability among all age groups and employment statuses was especially important, the city hall seemed to be a good setting. These interviews were conducted on different days of the week in June and August 2011.
- (2) A *university* sample of bachelor students (second semester) of the Department of Social Economics at the University of Erlangen-Nuremberg was interviewed in the class setting in the summer term of 2011.
- (3) The *school* sample contains five classes attending a “Gymnasium” [type of school leading to upper secondary education and Abitur] in the City of Kiel (n=110) and two classes of a “Berufsfachschule” [full-time vocational school] in the City of Ludwigshafen (n=31) covering a wide range of levels of competencies. The Gymnasium sample consists of two classes in Grade 9 and one class in each of Grades 10, 11 and 12. The subsample in “Berufsfachschule” covers two First Year classes. The students of these two classes strive for vocational degrees as lacquerers and painters and are known for their low level of

competencies within “Berufsfachschule”. The students of the whole school sample were 14 years old and above at the time of interviewing and were also interviewed in class setting.

Table 4 gives an overview over the different subsamples that were realized by location.

Table 4

Subsamples of the Pretests

Location of pretest	N	%
Registration office	159	42.7
University	72	19.4
School	141	37.9
Total	372	100.00

Although the settings of the subsamples were rather specific, a wide range of people in different employment statuses were able to be realized (see Table 5). For further analyses the employment status is aggregated into four groups (see columns three to six in Table 5).

Table 5

Employment Status of Participants

Status	N	%	Aggregated status	N	%
Full time employed	71	19.09	Employed	90	24.19
Part time employed	19	5.11			
University student	86	23.12	University student	86	23.12
School student	150	40.32	School student	150	40.32
Housewife, - husband	12	3.23	Other	46	12.37
Retired	18	4.84			
Unemployed	10	2.69			
Other	6	1.61			
Total	372	100.00	Total	372	100.00

Because of the focus on students in school and university, the age distribution among the respondents tends towards the younger age groups (see Table 6); nevertheless, the number of older people in the pretest should still be sufficient for the analyses.

Table 6

Age of Respondents

Age group	N	%
under 18	113	30.79
18–25 years	140	38.15
25–45 years	62	16.89
45–65 years	40	10.90
65 and over	12	3.72
total	367	100.00

Factor analyses are generally used to uncover structural dimensions within the data and extract factors for further use when generating an index (Backhaus, Erichson, Plinke, & Weiber, 2003). In addition, factor analyses can be conducted to reduce complex data structure by identifying important items within the data (Costello & Osborne, 2005; Wolff & Bacher, 2010). For each extracted factor, the included items load differently on the factor. In our analyses the item with the highest factor loading was considered as the best representative item for this factor. The item with the second highest factor loading was used instead when the item with highest loading did not perform well in the cognitive pretest. Therefore, the final index is based on those items retrieved from factor analyses that represent the factors best. The factor analyses with varimax rotation were carried out using both the whole sample and also using subsamples by employment status of participants (see Table 5, aggregated status).

The *cognitive pretests* were mainly targeted on comprehensibility of the items' wording. Questions during the interviews in school classes and the university class were noted and analyzed. The respondents in the registration office sample were able address their questions directly to the interviewer, who was instructed to note their questions. All questionnaires contained an open question at the end, which asked for feedback on the questionnaire and on problems of comprehensibility. The next section shows the result of the respondents' questions and remarks and the results of factor analyses.

5. Results

The selection of the final items was dependent on several criteria: no (or very few) missing values, high variance in the answers meaning that category 1 to 5 had been chosen as far as possible (see Section 5.1), no cognitive problems with the wording of the item (see Section 5.2), and finally high factor loadings on the item (see Section 5.3).

5.1 Descriptive Results

The descriptive results of the analysis show good variance of every item. Each category was answered at least twice. The number of missing values is reasonable. Only two items have an item-nonresponse rate greater than 2% (Item v03 and Item v27) (compare Table 7).

Table 7

Descriptive Statistics of 35-Item Stress Battery

Variable	N	Mean	SD	Min	Max
v01	370	2.805	1.031	1	5
v02	370	3.546	0.895	1	5
v03	352	2.466	1.159	1	5
v04	370	2.435	1.130	1	5
v05	371	3.011	1.098	1	5
v06	371	3.863	0.915	1	5
v07	370	2.981	1.029	1	5
v08	369	2.176	1.090	1	5
v09	371	3.226	0.905	1	5
v10	369	3.238	1.178	1	5
v11	367	3.621	0.967	1	5
v12	371	2.151	1.057	1	5
v13	368	3.856	1.155	1	5
v14	370	4.327	0.939	1	5
v15	365	2.227	0.920	1	5
v16	369	2.030	1.121	1	5
v17	373	2.654	1.117	1	5
v18	370	2.032	1.111	1	5
v19	367	3.172	1.017	1	5
v20	369	3.290	0.918	1	5
v21	371	3.650	1.048	1	5
v22	371	4.434	0.872	1	5
v23	371	3.288	1.134	1	5
v24	365	3.312	1.067	1	5
v25	368	2.114	0.975	1	5
v26	370	3.835	0.777	1	5
v27	362	3.262	1.131	1	5
v28	367	3.518	0.932	1	5
v29	370	3.554	1.056	1	5
v30	371	3.062	1.031	1	5

v31	370	3.105	1.151	1	5
v32	369	3.290	1.166	1	5
v33	369	2.447	1.201	1	5
v34	370	3.116	1.004	1	5
v35	369	3.726	0.972	1	5

5.2 Cognitive Pretests

The cognitive pretest among both school and university students showed that six questions were not comprehensible for some respondents and therefore were not considered for the final version of the SSS. The cognitive pretests revealed comprehension problems with single words or the wording of some items:

- with item number v03 (“Ich fühle mich oft wie ein Hamster im Rad”; there is no corresponding saying in English, which literally translated means “I often feel like I'm in a hamster wheel”) students particularly did not understand well the meaning of the saying, which refers to someone who keeps on running without moving on and without being able to stop.
- the negative connotation of item v08 (“Ich bin oft völlig frustriert.”; “I am often completely frustrated.”) was criticized by students.
- regarding item v13 (“Meine Familie bereitet mir viel mehr Freude als Ärger.”; “My family means much more joy/fun than trouble to me.”) respondents remarked that they do not have a family and therefore cannot answer the question.
- item v19 (“Die meisten bewundern mich dafür, wie ich mein Leben meistere.”; “Most people admire how I manage my life.”) was criticized especially by school students. They argued that ‘sometimes you do not know what other people think of you’ and therefore it is impossible to answer the question correctly.
- the shortcoming with item v24 (“Ich grübele oft.”; “I often ruminate/brood.”) was respondents not knowing the word “grübeln”.
- item v27 (“Ich kann gut abschalten.”; “It is easy for me to relax.”) confused students with the ambivalent meaning of “abschalten” (relax and switch-off). Mostly students thought of switching-off technical equipment such as computers, smartphones or televisions.

As a result of these comprehension problems, Items v03, v08, v13, v19, v24 and v27 were not considered for the final scale no matter what their performance in the factor analyses is like. In addition, the shortcomings of Items v03 and v27 already showed up in the descriptive analysis with a high item-nonresponse.

5.3 Factor Analysis

Factor analyses were carried out with subsamples of employed people, university students, school students and others (see Table 8). Every subsample led to slightly different results concerning the number of factors extracted. This is mainly due to the fact that factor analysis is in general sensitive to sample size and also that it is an exploratory method (see Costello & Osborne, 2005)

Table 8

Results of Factor Analyses on the Subsamples

Status	Number of observations	Number of factors	Items with highest factor loading
employed	90	11	v04, v05, v11, v18, v20, v22, v27, v29, v30, v31, v35
university student	86	11	v04, v05, v11, v18, v20, v22, v27, v29, v30, v31, v35
student	150	10	v04, v07, v10, v12, v14, v16, v19, v24, v31, v35
other	46	11	v04, v05, v11, v18, v20, v22, v27, v29, v30, v31, v35
Total	372	9	v02, v04, v07, v10, v16, v22, v24, v33, v35
Final Scale	v04, v05, v11, v18, v20, v22, v23, v29, v30, v33, v35		

In Table 8 the items with the highest loadings on the factors are presented. Depending on the subsample nine, ten or 11 factors were retrieved. We decided for an 11-factor solution and have chosen the items with the highest or second highest loadings. These 11 items represent the factors in the final standard stress scale (SSS). In the cognitive pretesting, Item v27 led to misunderstanding and shows a rather high number of missing values (2.8%), therefore in the final scale Item v27 was replaced by v23 which had the second highest loading in most of the factor analyses. Because of the similar wording of Items v31 and v35, Item v31 was replaced by v33, which always had the second highest loading on the specific factor². All groups seem to lead to similar results concerning the items with the highest factor loading. Only students seem to show a slightly different pattern, however, when considering also the items which have the second highest loading in the factor analysis of students³ (v02, v05, v06, v13, v22, v28, v29, v33) the results match better with those of the other subgroups.

6. Characteristics of the Index

The final index consists of 11 items of the initial 35-item-stress battery. These items cover all subdimensions of stress and meet the preconditions of selection (low missing values, high variance, no cognitive problems, and good representation of a stress dimension). The final scale is a short battery of 11 questions concerning the general life situation of the respondents.

² A detailed methodological report on the results of the factor analyses can be obtained from the authors (Gross & Seebaß, 2012).

³ In order to keep information content high, only factor loadings >0.5 are considered.

Table 9

The 11 Items for Measuring the Standard Stress Scale (SSS)

<p>Nun interessieren wir uns dafür, wie es Ihnen ganz allgemein geht. Denken Sie dabei bitte an alle Lebensbereiche. Inwiefern treffen folgende Aussagen auf Sie zu?</p> <p>[We are now interested in how you are in general. Please think of all areas of life. To which extent do the following statements apply to you?]</p> <p>(5-stufige Antwortskala: Not at all, to a small extent, somewhat, to a large extent, completely trifft gar nicht zu; trifft eher nicht zu; teils, teils; trifft eher zu; trifft völlig zu)</p> <p>[5-point Likert scale: Not at all, to a small extent, somewhat, to a large extent, completely]</p>	
Wording of item	Name of variable in NEPS dataset
1. Wenn mir eine Tätigkeit keinen Spaß macht, muss ich sie in der Regel auch nicht tun. (question 4) [If I do not enjoy doing something, I usually do not have to do it.]	t527003
2. Wenn ich mich nicht selbst um etwas kümmere, tut es keiner. (question 5) [If I do not take care of things by myself, nobody handles it.]	t527004
3. Ich übe sinnvolle Tätigkeiten aus. (question 11) [I am doing meaningful tasks.]	t527010
4. Ich fühle mich oft einsam. (question 18) [I often feel lonely.]	t527017
5. Meine Leistungen werden angemessen gewürdigt. (question 20) [My performance is appreciated adequately.]	t527019
6. Es gibt Menschen, auf die ich mich verlassen kann. (question 22) [There are people I can count on.]	t527021
7. In der Regel habe ich einen erholsamen Schlaf. (question 23) [Usually I have a restorative sleep.]	t527022
8. Ich denke viel über Probleme nach. (question 29) [I often think about problems.]	t527028
9. Nach einem normalen Tag fühle ich mich erschöpft (question 30). [After a normal day I am exhausted.]	t527029
10. Ich habe Angst davor, wie mein Leben in drei Jahren aussehen könnte. (question 33) [I am afraid about what my life will be like in three years.]	t527032
11. Ich freue mich auf die Zukunft. (question 35) [I am looking forward to my future.]	t527034

To build the 0-1-standardized SSS index, proceed as follows:

- (a) Recode Items 1, 3, 5, 6, 7, and 11 so that a high value indicates a stressful issue.
- (b) Generate a new variable by adding the 11 answer values, subtract 11 (minimum), and divide by 44 (maximum after subtraction). Alternatively you can use the routines implemented in your statistics software.
- (c) When missing values occur, adjust the procedure (for 2 missing values subtract 9 and divide by 36 and so forth). For a high number of missing values, balance the pros and cons for your purpose of having a missing value for the whole index or an index which does not represent all stress dimensions.

The SSS index should have a possible range from 0 to 1 with 1 indicating a maximum of stress and 0 a minimum of stress. With the data of our pretest sample the SSS index shows a good fit to a normal distribution (see Figure 1), which is a great advantage when using parametric methods of data analysis.

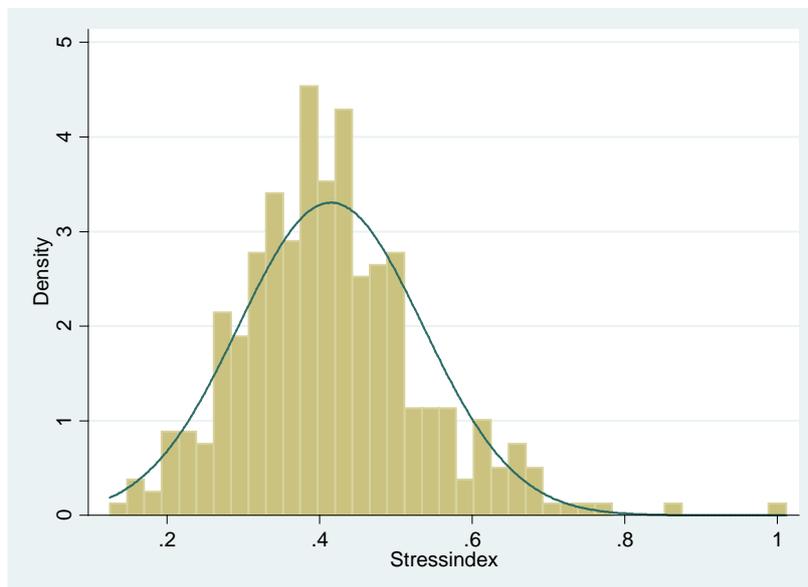


Figure 1. Distribution of the index

6.1 Reliability

Although the most distinct items were selected, the final 11 items of the SSS show good reliability values. Within the subpopulations Cronbach's alpha ranges between 0.58 for the "others" category and 0.66 for school students. The alpha for the total sample with 0.62 is still satisfactory (see Table 10).

Table 10

Reliability in the Subsamples

Employment status	N	Cronbach's Alpha
Employed	90	0.65
School student	150	0.66
University student	86	0.60
Other ^a	46	0.58
Total	372	0.62

^a Includes: unemployed, retired, housewife/househusband, maternity leave, etc.

6.2 Criterion validity

Stress scales are usually validated by showing a strong association between the stress index and self-rated health (Li et al., 2010; Niedhammer, Tek, Starke, & Siegrist, 2004; Siegrist, Wege, Pühlhofer, & Wahrendorf, 2008). The explanatory power of the Standard Stress Scale has also been examined for subjective health status. Within the pretest students were asked to rate their personal subjective health status (ranging from very good to very bad on a 5-point Likert scale). The stress index is highly significant in explaining health. The higher the measured stress, the lower is the likelihood of having a subjective (very) good health status (see Table 11). This result supports the high usability of the Standard Stress Scale.

Table 11

Logistic Regression on Subjective Health among Subsample of School Students

	Marginal Effects (z-value)
Gender (1=female)	-0.06 (-0.88)
Age (in years)	0.00 (0.23)
Stress scale	-1.33 (-4.16)***
N	124
Pseudo R ²	0.26

7. Conclusion

The SSS index has very positive attributes for further use in multivariate analyses: it is almost normally distributed, has a good reliability in despite of covering all main stress dimensions, and has a high association with self-rated health. Moreover the SSS has been pretested among different populations from adolescents through to retirees. Therefore the Standard Stress Scale is highly suitable for applications in general population surveys as well as panel studies among heterogeneous subgroups.

However the items are not adapted to specific life contexts such as working conditions, school environment, etc., so for special issue surveys without the acquirements of a constant instrument for all life situations, other scales such as the effort-reward imbalance scale are likely to be more appropriate.

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