CHRIS Study

Neurological tests – Olfaction test

Version 1.1

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1. Introduction

This module stores results of the olfaction test Sniffin' Sticks, part of the neurological tests set that were performed at the CHRIS study center.

Participants book a morning appointment at the CHRIS study center, ranging from 7.45 to 8.45 a.m. Each study participant is assigned a workflow at the reception. If there are ten study participants (maximum capacity), there are ten different workflows, marked with the letters from "A" to "K". The current workflow is as follows: A-B-C-D-E-F-G-H-I-K. All the workflows can be found in the documentation of CHRIS Baseline/General information/Administrative data, in the file named "Workflows at baseline assessment". The neurological tests set occurs always right after the interview and it is executed from the same operator conducting the interview.

The Sniffin' Sticks test was developed to assess olfaction by the German Society for Otorhinolaryngology, Head and Maxillofacial Surgery. Here the ability is examined to identify everyday smells based on a card with 4 terms each. This is a "multiple-forced-choice" procedure, in which the participant must select one of the 4 terms. In the identification test, a total of 16 odors are offered. Participants with severely impaired smell due to current cold or hay fever or sinusitis are exempted to perform the test. The maximum total score is 16.

For olfactory testing, only the cap of one pen should be removed at a time. The cap must be replaced on the olfactory pen immediately after the odor is presented. The olfactory bulb should then be immediately returned to the holder, with the tip downwards.

For the test, the open smelling stick is held with its tip at a distance of 2 cm in the middle in front of both nostrils and the participant is then asked to smell, e.g. by the word "Attention!". Each breath should be offered for no longer than 3-4 seconds, and the interval between the different odors should be approximately 30 seconds.

The smelling sticks must not touch the skin of the participant during the smell presentation. If the olfactory sticks do accidentally touch the participant's skin, the corresponding stick must be discarded for hygienic reasons and replaced with a new one.

In order to obtain the best possible results, participants should not drink anything other than water for at least ten minutes before the measurement is taken. They should also refrain from chewing gum, sweets or cigarettes. The test itself should take place in a quiet, well-ventilated room. During the examination, patients should not receive any indication about the accuracy of their statements. The examiner should also avoid giving the patient unwanted hints about the correctness of their decisions.

The Sniffin' Sticks manual and the answer choices for each stick are available at CHRIS Baseline/Neurological tests/Olfactory test and online (see References section).

2. History version changes

This olfaction test was in use since September 1st, 2014 and no version change occurred.

The cleaning process added the variables x0ol00, x0ol01a, x0ol02a, x0ol03a, x0ol04a, x0ol05a, x0ol06a, x0ol07a, x0ol08a, x0ol09a, x0ol10a, x0ol11a, x0ol12a, x0ol13a, x0ol14a, x0ol15a, x0ol16a, x0ol17.

3. Data cleaning

1. The main CHRIS dataset was loaded.
2. A variable storing the changes of sniffin' stick kits was created, according to the examination date x0_examd:
    a) The first kit was in use since September 1st, 2014,
    b) The second kit was in use since October 22nd, 2015,
    c) The third kit was in use since 9th May, 2017,
    d) The fourth kit was in use since September 22nd, 2018.
3. The three questions on current cold, hay fever, and sinusitis, x0ol00a, x0ol00b, and x0ol00c had their missing observations set to:
    a) "Not in use" (-98) is the test version was missing, i.e. before September 9th, 2014,
    b) "Unexpected missing" (-89) if they were still missing.
4. A new variable on the inclusion criteria for performing the olfaction test was created with values:
    a) "Yes" if nor current fever neither hay fever, nor sinusitis were reported (x0ol00a="No" and x0ol00b="No" and x0ol00c="No"),
    b) "No" if current fever or hay fever or sinusitis were reported (x0ol00a="Yes" or x0ol00b="Yes" or x0ol00c="Yes"),
    c) "Unexpected missing" (-89) if either one of the inclusion criteria was "Unexpected missing" (x0ol00a=" Unexpected missing" or x0ol00b=" Unexpected missing" or x0ol00c="Unexpected missing").
5. The remaining questions of the module, x0ol01-x0ol16, x0ol22-x0ol24, had their missing observations set to:
    a) "Not in use" (-98) is the test version was missing, i.e. before September 9th, 2014,
    b) "Missing by design" (-99) if the participant did not fulfill the inclusion criteria (x0ol00="No"),
    c) "Unexpected missing" (-89) if they were still missing.
6. For any stick, an additional variable was created to store if the odor was correctly identified. In table 1 of the fourth section of the document the correct odors are written in bold. For instance, for the first stick variable, x0ol01, its correct identification variable, x0ol01a, had values:
    a) "Yes" if the chosen odor was "Orange",
    b) "No" if the chosen odor was not "Orange",
    c) "Not in use" (-98) if the inclusion criteria variable x0ol00 was "Not in use",
    d) "Missing by design" (-99) if the inclusion criteria variable x0ol00 was "No".
7. The total score was computed and saved as x0ol17. Its missing observations were set to:
    a) "Not in use" (-98) if the inclusion criteria variable x0ol00 was "Not in use",
    b) "Missing by design" (-99) if the inclusion criteria variable x0ol00 was "No",
    c) "Unexpected missing" (-89) if at least one stick among x0ol01-x0ol16 was variable was "Unexpected missing".
8. The variables on smell decrease and its possible explanations, x0ol22, x0ol23a-x0ol24, had their observations set to:
    a) "Don't know" if the option "I do not know" option was chosen,
    b) "Unexpected missing" if they were missing.

9. The variable on smell decrease after virus infection or paranasal infection, x0ol22a, had its observations set to:
    a) “Don’t know” if the option “I do not know” option was chosen,
    b) “Missing by design” if the smell was not considered decreased (x0ol22=”Normal”, “Increased” or “Missing by design” or ”Don’t know”),
    c) “Unexpected missing” if they were missing.
10. The description variable of the skull fracture, x0ol24a, has been translated and categorized when possible. Any identifiable information or circumstance of the injury was not reported in the available version.
11. The variables storing the notes additional information on the olfaction test, x0oln1, x0oln2, were translated and categorized when possible.
12. The baseline dataset was saved.

4. Advices for the analysis

The content of the nurse’s notes includes information on acute smell problems and other causes for loss of smell, that did not fit the ones mentioned in the questions or needed a longer explanation.

The occurrence of paranasal sinusitis, nasal polyp surgery or skull fractures are also reported in the x0ot module on other diseases and could complement the answers to the questions x0ol23a-x0ol24a. Furthermore, also the exposure module x0ex and the smoking module x0sm of the interview may provide additional reasons for smell sensitivity changes.

Furthermore, there were four specific sticks that were often misidentified by 45%-70% of the participants, specifically the sticks 6, 8, 11, and 13: this can be due to cultural reasons, i.e. the odors being not common or differing from the usual.

Finally, the analyst should always take into account that the operator in charge of carrying out the neurological tests and the kit used might have influenced how the participant reported their answers. The analyst should therefore adjust for the operator variable, x0_optestc, and the kit used, x0olpc, when possible.

5. References

Hummel T, Sekinger B, Wolf SR, Pauli E, Kobal G. 'Sniffin' sticks': olfactory performance assessed by the combined testing of odor identification, odor discrimination and olfactory threshold. Chem Senses. 1997; 22(1):39-52. DOI: 10.1093/chemse/22.1.39

Gögele M, Emmert D, Fuchsberger C, Frasnelli J. Factors influencing olfactory function in an adult general population sample: the CHRIS study. Chem Senses. 2024 Jan 1;49:bjae011. DOI: 10.1093/chemse/bjae011

Sniffin’ Sticks description: https://www.smelltest.eu/en/product/burghart-sniffin-sticks-identification-test-16-blue/

Sniffin’ Sticks manual: https://www.smelltest.eu/en/smell-and-taste/how-to-use-the-sniffin-sticks/