

Detailed note to calculate the Social Frailty Index with user input

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See online tool: https://sachinjshah.shinyapps.io/Social_Frailty_Index/
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1. Collect user input and code responses.

#	Variable name	Descriptor	Values and coding	Notes
1	age	How old are you?	65 to 120 If missing then 75	
2	gender	What is your gender?	"Man" = 0 "Woman" = 1 If missing then = 1	
3	living_child	Do you have any living children?	"Yes (Go to question 4)" = 1 "No (Skip to question 5)"=0	This question is not used to calculate the social frailty index but rather determine if the user should answer question 4
4	meetup_child	Thinking about all of YOUR LIVING CHILDREN. How often do you meet up (include both arranged and chance meetings)?	Missing = 0 "Three or more times a week" = 0 "Once or twice a week" = 0 "Once or twice a month" = 0 "Every few months" = 0 "Once or twice a year"= 0 "Less than once a year or never" = 1	Provide all options to participant
5a	activity1	Please tell us HOW OFTEN YOU DO EACH ACTIVITY Do activities with grandchildren, nieces/nephews, or neighborhood children?	Missing = 5 "Daily"=1 "Several times a week"=2 "Once a week"=3 "Several times a month"=4 "At least once a month"=5 "Not in the last month"=6 "Never/not relevant"=7	activity1 and activity2 have the same header and same response levels so group together
5b	activity2	Please tell us HOW OFTEN YOU DO EACH ACTIVITY Do any other volunteer or charity work?	Missing = 1 "Daily"= 0 "Several times a week"=0 "Once a week"=0 "Several times a month"=0 "At least once a month"=0 "Not in the last month"= 0 "Never/not relevant"= 1	Provide all options to participant

6	isolate	How much of the time do you feel isolated from others?	Missing = 2 "Often"=0, "Some of the time"=1 "Hardly ever or never"=2	
7	area	<p>This next question asks how you feel about your local area, that is everywhere within a 20-minute walk or about a mile of your home. The closer your mark is to a statement the more strongly you agree with it.</p> <p>1 means "This area is kept very clean" and 7 means "This area is always full of rubbish and litter"</p>	<p>1 to 7 by 1</p> <p>If user response is ≥ 4 or is missing then value = 1</p> <p>If user response is < 4 then value = 0</p>	Provide all options to participant
8	finance	Using a 0 to 10 scale where 0 means 'no control at all' and 10 means 'very much control,' how would you rate the amount of control you have over your financial situation these days?	<p>0 to 10 by 1</p> <p>If use response is ≥ 4 or is missing then value = 1</p> <p>If use response is < 4 then value = 0</p>	Provide all options to participant
9	treat	In your day-to-day life, HOW OFTEN HAVE ANY OF THE FOLLOWING THINGS HAPPENED TO YOU? You are treated with less courtesy or respect than other people	<p>Missing = 0</p> <p>"Almost every day"=0</p> <p>"A few times a month"=0</p> <p>"A few times a year"=0</p> <p>"Less than once a year"=1</p> <p>"Never/not relevant"=1</p>	Provide all options to participant
10	work	Are you currently working for pay?	<p>Missing = 0</p> <p>"Yes" =1</p> <p>"No" = 0</p>	

2. Calculate probability

- a. Use the formula to calculate the log odds (lp):

$$lp = -9.210517 + 0.112097 * age - 0.553411 * gender + 0.497577 * meetup_child + 0.107782 * activity1 + 0.48419 * activity2 \\ - 0.255202 * isolate + 0.351463 * area - 0.438733 * finance - 0.291638 * treat - 0.553316 * work$$

- b. Convert the log odds to a probability (pr)

$$pr = \frac{e^{lp}}{1 + e^{lp}} * 100$$

- c. Optionally you can convert the probability to a percentile

The probability obtained from 2b can be converted to a percentile which is often the most useful measure of social frailty. This can be done using the table at the end of this document.

3. Worked example

a. User input

#	Variable name	Descriptor	Values	Coding
1	age	How old are you?	80	80
2	gender	What is your gender?	Woman	1
3	living_child	Do you have any living children?	Yes	1
4	meetup_child	Thinking about all of YOUR LIVING CHILDREN. How often do you meet up (include both arranged and chance meetings)?	Once or twice a month	0
5a	activity1	Please tell us HOW OFTEN YOU DO EACH ACTIVITY Do activities with grandchildren, nieces/nephews, or neighborhood children?	Missing (i.e., user did not provide a response)	5
5b	activity2	Please tell us HOW OFTEN YOU DO EACH ACTIVITY Do any other volunteer or charity work?	At least once a month	0
6	isolate	How much of the time do you feel isolated from others?	Often	0
7	area	This next question asks how you feel about your local area, that is everywhere within a 20-minute walk or about a mile of your home. The closer your mark is to a statement the more strongly you agree with it. 1 means "This area is kept very clean" and 7 means "This area is always full of rubbish and litter"	2	0
8	finance	Using a 0 to 10 scale where 0 means 'no control at all' and 10 means 'very much control,' how would you rate the amount of control you have over your financial situation these days?	3	0
9	treat	In your day-to-day life, HOW OFTEN HAVE ANY OF THE FOLLOWING THINGS HAPPENED TO YOU? You are treated with less courtesy or respect than other people	Less than once a year	1
10	work	Are you currently working for pay?	No	0

b. Calculate log odds using user responses

$$lp = -9.210517 + 0.112097 * age - 0.553411 * gender + 0.497577 * meetup_child + 0.107782 * activity1 + 0.48419 * activity2 \\ - 0.255202 * isolate + 0.351463 * area - 0.438733 * finance - 0.291638 * treat - 0.553316 * work$$

$$lp = -9.210517 + 0.112097 * 80 - 0.553411 * 1 + 0.497577 * 0 + 0.107782 * 5 + 0.48419 * 0 \\ - 0.255202 * 0 + 0.351463 * 0 - 0.438733 * 0 - 0.291638 * 1 - 0.553316 * 0$$

$$lp = -0.548896$$

c. Convert the log odds to a probability (pr)

$$pr = \frac{e^{lp}}{1 + e^{lp}} * 100$$

$$pr = \frac{e^{-0.548896}}{1 + e^{-0.548896}} * 100$$

$$pr = 36.6\%$$

d. Convert the probability to a percentile

Using the table, 36.6% corresponds to the 81st percentile

4. Table to convert probability to percentile

Percentile	Probability
1%	2.3%
2%	3.1%
3%	3.6%
4%	4.0%
5%	4.4%
6%	4.7%
7%	5.0%
8%	5.3%
9%	5.5%
10%	5.8%
11%	6.0%
12%	6.3%
13%	6.6%
14%	6.7%
15%	6.9%
16%	7.2%
17%	7.4%
18%	7.6%
19%	8.0%
20%	8.2%
21%	8.5%
22%	8.8%
23%	9.1%
24%	9.3%
25%	9.6%
26%	9.9%
27%	10.2%
28%	10.4%
29%	10.8%

30%	11.1%
31%	11.3%
32%	11.6%
33%	12.0%
34%	12.2%
35%	12.5%
36%	12.7%
37%	13.2%
38%	13.4%
39%	13.7%
40%	13.9%
41%	14.5%
42%	14.8%
43%	15.2%
44%	15.5%
45%	16.1%
46%	16.4%
47%	16.6%
48%	16.8%
49%	17.3%
50%	17.9%
51%	18.3%
52%	18.7%
53%	19.3%
54%	19.8%
55%	20.1%
56%	20.6%
57%	21.2%
58%	21.7%
59%	21.9%

60%	22.5%
61%	23.2%
62%	23.7%
63%	24.1%
64%	24.8%
65%	25.4%
66%	25.9%
67%	26.2%
68%	26.8%
69%	27.5%
70%	28.1%
71%	28.6%
72%	29.5%
73%	30.4%
74%	30.9%
75%	31.7%
76%	32.4%
77%	33.0%
78%	33.8%
79%	34.9%
80%	35.7%
81%	37.1%
82%	38.2%
83%	39.4%
84%	40.6%
85%	41.8%
86%	43.2%
87%	44.5%
88%	46.0%
89%	47.5%

90%	49.1%
91%	50.9%
92%	52.8%
93%	54.7%
94%	56.6%
95%	59.0%
96%	61.7%
97%	64.9%
98%	69.0%
99%	73.9%
100%	80.4%