SIPHER

Consortium

Systems science
In Public Health and
Health Economics Research

Review of SIPHER-7 wellbeing indicators

December 2022

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Abstract

The SIPHER (Systems Science in Public Health and Health Economics Research) Consortium examines the complex causal relationships between upstream policies and wellbeing, economic and equality outcomes, and in so doing, it needs a common set of wellbeing indicators. SIPHER-7 is a suite of seven wellbeing indicators developed for this purpose between October 2019 and February 2020. This note reports on a subsequent review conducted in March 2022, to improve the clarity of the item wording, and the link between SIPHER-7 and the UK Household Longitudinal Study ("Understanding Society").

1. Introduction

1.1. SIPHER-7

The research consortium on Systems Science in Public Health and Health Economics Research (SIPHER) will build models to predict the causal relationships between policy interventions and outcomes (Meier et al, 2019). SIPHER-7 is a suite of wellbeing indicators selected by the SIPHER team to capture multi-dimensional wellbeing outcomes of different policies. Its development process that took place between October 2019 and February 2020 is reported in Tsuchiya and Wu (2021).

The main objective of SIPHER-7 is to provide a suite of outcome indicators that can capture the multi-dimensional wellbeing of individuals, in one of two ways. The first is to survey individuals *de novo* and to ask them to self-report their situation across the seven wellbeing indicators. The second builds on existing secondary social survey datasets, by focusing on specific questions in those surveys that allow the researcher to construct a SIPHER-7 profile for each individual respondent of the social survey.

The wellbeing indicators of the original SIPHER-7 are listed in Table 1 along with the response categories in the self-reporting form.

Table 1: The original SIPHER-7 wellbeing indicators (self-reporting form)

Domain	Indicator	Response categories
Income	Disposable§ income of your household is …	Median values of deciles of household disposable income after housing costs.
Employment	Your employment situation is….	FT employment†; PT employment; job seeking; long term sick or disabled; taking care of a family member with chronic illness or disability; looking after the home and family; retired; FT education / training / apprenticeship; other
Effects of physical health	You accomplish less because of your physical health …	None of the time / a little of the time / some of the time / most of the time / all the time
Effects of mental health	You accomplish less because of your emotional problems …	
Neighbourhood safety	You are concerned about the safety of the neighbourhood you live in …	Hardly ever / some of the time / often
Housing	Your home is in a reasonable state of repair, has reasonable facilities	Yes to all of these / yes to some of these / none of these

	(cooking/washing) and provides reasonable warmth …	
Social isolation	You feel isolated from others …	Hardly ever / some of the time / often

§ Monthly (or weekly) income after tax, national insurance, any occupational pension contributions, and after deducting your rent, mortgage payments or other housing costs.

‡ Employment includes self-employment. Employment includes being on maternity / parental / sick / furlough leave.

Of the seven indicators of wellbeing, Neighbourhood safety, Housing, and Social isolation have three response categories each; Effects of physical health and Effects of mental health have five categories each; Employment has 11 categories; and Income is continuous. To illustrate, leaving the Income indicator aside (since it is a continuous variable), the remaining six indicators would allow 7,425 different combinations, or profiles, to classify individuals into.

One further use of SIPHER-7 beyond the two mentioned above is to derive a preference-based single index of overall wellbeing. Relative to using a single indicator (e.g. income) to represent individual wellbeing, an advantage of using a standardised suite of outcome indicators to capture wellbeing across multiple dimensions of life is that it achieves a more detailed and nuanced picture. But if a policy intervention improves one dimension of wellbeing but harms another, how would we decide which intervention delivers the largest wellbeing improvements overall, across the wellbeing dimensions and across individuals? To answer this question, the relative importance of the multiple indicators of wellbeing needs to be known, and SIPHER addresses this through a valuation study. A typical valuation study presents hypothetical SIPHER-7 profiles to respondents. An example is shown in Figure 1.

Figure 1: an example SIPHER-7 (original) profile

Disposable income of your household is £1,000 per month. You are in full time employment. You accomplish less because of your physical health most of the time, and because of your mental health some of the time. You are concerned about the safety of the neighbourhood you live in often. It is not the case that your home is in a reasonable state of repair, has reasonable facilities (cooking/washing) and provides reasonable warmth. You feel isolated from others and left behind hardly ever.

The original SIPHER-7 was valued in SIPHER Work Stream 6, sub-study 6.1.1 (WS6.1.1) – the study design and findings are reported in (Ta et al, 2021). The valuation study used SIPHER-7 as the attributes and levels of a Discrete Choice Exercise (DCE), designed to elicit *personal* preferences of the UK general public – respondents were asked to choose between imaginary SIPHER-7 profiles, if they were to happen to themselves. To achieve this, the Employment categories shown in Table 1 were adjusted, because nine categories is too many for a valuation exercise. Thus, retired, long term sick or disabled, looking after the family, and other were grouped under "Not working and not looking for paid work".

1.2. Aims of the review and practical constraints

In March 2022, a review of SIPHER-7 was conducted as part of WS6.1.2. The aim of WS6.1.2 is to conduct another DCE survey to elicit *social* preferences – respondents were asked to imagine they are asked to advise policy

makers between imaginary SIPHER-7 profiles, if they were to happen to fellow citizens (the findings are reported in Wickramasekera et al, 2022).

The aims of the current review of SIPHER-7 are: to improve the clarity of the item wording for the DCE respondents in WS6.1.2; and to improve the link between SIPHER-7 and the UK Household Longitudinal Study[1] (UKHLS, or "Understanding Society"; University of Essex, 2022).

Four specific areas of improvement were identified in the preparatory work for WS6.1.2:

1. Some survey respondents struggle to think about household income independently of employment;
2. "Not working and not looking for paid employment" in the Employment category is unclear;
3. The wording of the Housing quality item is awkward and there is no direct link to UKHLS; and
4. There are no questions in the UKHLS that map directly on to the Neighbourhood safety item.

Since the WS6.1.2 DCE design used the existing DCE design for WS6.1.1, this review was constrained in terms of the number of items and the number of response categories within each.

2. The changes

1.1. Household income

The original wording read: "Disposable income of your household excluding housing costs is …".

The aim of the Household income item is to capture the material standard of living of a household through household finances. The focus should be on what the household can afford to consume in the short run. Housing costs are deducted, since rent and mortgage payments are fixed in the short run. Utilities and bills are not deducted, since these are not fixed and are, in theory, subject to individual choice.

Preparatory qualitative work within WS6 with members of the public involved testing the DCE through cognitive interviews and consultation with the SIPHER community panels. This revealed that participants often interpreted household income as the reward for individual labour. For example, respondents talked about some jobs being deserving of higher rewards, or certain valued jobs needing higher pay as incentives. It also became clear that many of them interpreted 'housing costs' to include utility bills.

Given these, this item was changed to "Household spending money". The WS6.1.2 DCE gave a description of this as: "the amount of spending money that the whole household has left to spend each month, including on bills, groceries and leisure activities."

For the purpose of linking with UKHLS, while the UKHLS has questions on savings, since the objective is to capture the households' ability to consume (as opposed to the level of actual consumption), savings are not considered, and there is no change from the original version. The amount is derived by subtracting monthly housing costs (*i_houscost1_dv*) from monthly net income (*i_fihhmnnet1_dv*).

1.2. Employment – Not working

The self-reporting form of SIPHER-7 does not have "Not working" as a category under the Employment item. The valuation form of SIPHER-7 used in the 6.1.1 DCE did not explicitly state what "Not working and not looking for paid employment" consists of. Subsequent qualitative work suggested that respondents found this unclear.

However, listing the categories from the self-reporting form that were merged under this heading ("for example retired; long term sick or disabled; looking after the home and family, etc") lead to confusion when not working was combined with little or no effects of physical health and emotional problems. Therefore, the decision was made to indicate "for example, retired, looking after the family/home, volunteering, etc", and to remove the reference to long term sick or disabled, from the description of the valuation exercise only.

1.3. Housing quality

The original item read "Your home is in a reasonable state of repair, has reasonable facilities (cooking/washing) and provides reasonable warmth ….", to which the response categories were: Yes to all of these / Yes to some of these / None of these.

This was not only cumbersome to fit in a DCE exercise, there were no clear UKHLS questions to map them onto. In addition, some participants found the term 'reasonable' to be ambiguous.

The decision was made to change the DCE attribute to: "The quality of your home in terms of the state of repair, facilities (cooking/washing) and warmth is …" [Good / Fair / Poor]. The revised description of this item reads "this is about whether somebody's home (a) is in a good state of repair, (b) has reasonable facilities for cooking and washing, and (c) provides reasonable warmth when it is cold outside."

To aid the link to UKHLS, the self-reporting item was changed to use four UKHLS questions and an overall item:

- Your home is in a good state of repair [yes / no]
- You are able to keep your home warm in winter [yes / no]
- Your home has a washing machine [yes / no]
- Your home has a microwave oven [yes / no]
- Overall, the quality of your home is [yes / no]

WS6.1.2 has c.4000 respondents answering these five questions, thus, allowing the estimation of a mapping function from the UKHLS questions to the SIPHER-7 item. The estimated mapping algorithm is reported in Section 4 below.

1.4. Neighbourhood safety

The original item read "You are concerned about the safety of the neighbourhood you live in … [Hardly ever / Some of the time / Often]

The only crime-related questions in the UKHLS are about the perceived frequencies of different kinds of things ranging from teenagers hanging around to car theft, with no questions relating to feeling of safety. The decision was made to keep the SIPHER-7 item on neighbourhood safety as is, but to include seven questions from the UKHLS in the WS6.1.2 survey and to model the relationship between these and the SIPHER-7 item.

- How common in your area is...
    - Teenagers hanging around in streets? [Very common / Fairly common / Not very common / Not at all common / Don't know]
    - Drunks or tramps on the streets? [*as above*]
    - Vandalism and deliberate damage to property? [*as above*]
    - Insults or attacks to do with someone's race or colour? [*as above*]
    - Homes broken into? [*as above*]
    - Cars broken into or stolen? [*as above*]
    - People attacked on the streets? [*as above*]
- You are concerned about the safety of the neighbourhood you live in… [Hardly ever / Some of the time / Often]

The estimated mapping algorithm for the Neighbourhood safety item is reported in Section 4 below.

3. The revised SIPHER-7 wellbeing indicators

Table 2 below illustrates the revised SIPHER-7 indicators, alongside the corresponding UKHLS questions.

Table 2: The revised SIPHER-7 wellbeing indicators (valuation form)

Domain	Indicator	Levels / categories	UKHLS questions
Spending money	Spending money[a] of your household is …	Median values of deciles of household disposable income after housing costs.	**fihhmnnet1_d** (total household net income - no deductions) *minus* **houscost1_dv** (monthly housing cost including mortgage principal payments)
Employment	Your employment situation is ….	FT employment[b]; PT employment; job seeking; FT education / training / apprenticeship; taking care of a family member with chronic illness or disability; Not working and not looking for paid employment (for example, retired,	**jbstat** (Current labour force status): "Which of these best describes your current employment situation? **pjbptft** (part-time or full-time): "Would you say that [NAME]'s current job is part-time or full-time?" **aidhh** (cares for sick/disabled/elderly in household): "Is there anyone living with you who is sick, disabled or elderly whom you look after or give special help to (for example, a sick, disabled or elderly relative, husband, wife or friend etc)?"

		looking after the home and family; volunteering, etc)	
Effects of physical health	You accomplish less because of your physical health …	None of the time / a little of the time / some of the time / most of the time / all the time	**scsf3a** (last 4 weeks: physical health limits amount of work): "During the past 4 weeks, how much of the time have you had any of the following problems with your work or other regular daily activities as a result of your physical health? Accomplished less than you would like…"
Effects of mental health	You accomplish less because of your emotional problems …		**scsf4a** (last 4 weeks: mental health meant accomplished less): "During the past 4 weeks, how much of the time have you had any of the following problems with your work or other regular daily activities as a result of any emotional problems (such as feeling depressed or anxious)? Accomplished less than you would like …"
Neighbourhood safety	You are concerned about the safety of the neighbourhood you live in …	Hardly ever / some of the time / often	**Crteen**[c] (extent of: teenagers hanging about) "(How common in your area is...) Teenagers hanging around in streets?" **Crdrnk**[c] (extent of: drunks/tramps on street): "(How common in your area is...)Drunks or tramps on the streets?" **crvand** (extent of: vandalism) : "(How common in your area is...) Vandalism and deliberate damage to property?" **crrace** (extent of: racial insults/attacks): "(How common in your area is...) Insults or attacks to do with someone's race or colour?" **crburg** (extent of: homes broken into): "(How common in your area is...)Homes broken into?" **crcar** (extent of: cars stolen/broken into): "(How common in your area is...) Cars broken into or stolen?" **crmugg** (extent of: people attacked on street): "(How common in your area is...) People attacked on the streets?"

Housing	The quality of your home in terms of the state of repair, facilities (cooking/washing) and warmth is…	Good / fair / poor	**pdepf1** (home good state of repair) "Is your home kept in a good state of repair?" **hheat** (keep accommodation warm enough): "In winter, are you able to keep this accommodation warm enough?" [*NB. This question is included in even-number waves only.*] **cduse** (Consumer durables in accommodation): "Could you please tell me which of the following items you have in your (part of the) accommodation." Washing machine (cduse6); microwave oven (cduse9)
Social isolation	You feel isolated from others …	Hardly ever / some of the time / often	**sclonely** (How often feels lonely): "How often do you feel lonely?"

a) The amount of money that a household has each month after their tax, national insurance, pension contributions, and their housing costs (e.g. rent, mortgage payments etc) have been paid. It is the amount of spending money that the whole household has left to spend each month, including on bills, groceries and leisure activities.

b) Employment includes self-employment. Employment includes being on maternity / parental / sick / furlough leave.

c) These questions are taken verbatim from the UKHLS. The SIPHER team would not have chosen to phrase these questions in these ways.

4. Mapping from UKHLS to the Neighbourhood safety and Housing quality items in SIPHER-7

This section outlines the mapping algorithm to predict the levels of the Neighbourhood safety and Housing quality items in SIPHER-7 from UKHLS data.

As is noted above, these two SIPHER-7 items do not have directly linked questions in the UKHLS. This section outlines a mapping algorithm based on the data collected in the WS6.1.2 survey (Wickramasekera et al, 2022). The survey included background questions where respondents were asked to answer the eleven UKHLS questions listed in Table 2 above, alongside the SIPHER-7 items. The data used for mapping are described in Table 3.

Table 3: Descriptive statistics of the data used

(n=4029)	No.	%
Quality of your home in terms of the state of repair facilities and warmth [SIPHER-7 Housing quality]		
Good	2,745	68.10%

Fair	1,118	27.70%
Poor	146	3.60%
I prefer not to answer	20	0.50%
Your home: is in a good state of repair? [UKHLS pdepf1] [R]		
Yes	3,600	89.40%
No	429	10.60%
Your home: has a washing machine? [UKHLS cduse6] [WM]		
Yes	3,926	97.40%
No	103	2.60%
Your home: has a microwave oven? [UKHLS cduse9] [M]		
Yes	3,749	93.10%
No	280	6.90%
Your home: is warm in winter? [UKHLS hheat] [H]		
Yes	3,428	85.10%
No	601	14.90%
Are you concerned about the safety of the neighbourhood you live in? [SIPHER-7 Neighbourhood safety]		
I prefer not to answer	31	0.80%
Hardly ever	2,585	64.20%
Some of the time	1,236	30.70%
All of the time	177	4.40%
How common in your area is: teenagers hanging around in streets [UKHLS crteen] [T]		
Very common	302	7.50%
Fairly common	920	22.80%
Not very common	1,341	33.30%
Not at all common	1,393	34.60%
Don't know	73	1.80%
How common in your area is: drunks or tramps on the streets [UKHLS crdrnk] [D]		
Very common	180	4.50%
Fairly common	435	10.80%

Not very common	1,018	25.30%
Not at all common	2,326	57.70%
Don't know	70	1.70%

How common in your area is: vandalism and deliberate damage to property [UKHLS crvand] [V]

Very common	158	3.90%
Fairly common	484	12.00%
Not very common	1,489	37.00%
Not at all common	1,788	44.40%
Don't know	110	2.70%

How common in your area is: insults or attacks to do with someone's race [UKHLS crrace] [RA]

Very common	87	2.20%
Fairly common	212	5.30%
Not very common	909	22.60%
Not at all common	2,435	60.40%
Don't know	386	9.60%

How common in your area is: homes broken into [UKHLS crburg] [H]

Very common	121	3.00%
Fairly common	490	12.20%
Not very common	1,582	39.30%
Not at all common	1,568	38.90%
Don't know	268	6.70%

How common in your area is: cars broken into or stolen [UKHLS crcar] [C]

Very common	173	4.30%
Fairly common	575	14.30%
Not very common	1,514	37.60%
Not at all common	1,494	37.10%
Don't know	273	6.80%

How common in your area is: people attacked on the streets [UKHLS crmugg] [S]

Very common	81	2.00%

Fairly common	269	6.70%
Not very common	1,060	26.30%
Not at all common	2,414	59.90%
Don't know	205	5.10%

There are four regression models: two for Housing quality and two for Neighbourhood safety. There are two models for Housing quality because the repair variable, which is an important predictor, is only included in even-number waves (4, 6, 8, 10, 12) of UKHLS. There are two models for Neighbourhood safety because two of the UKHLS items are questions which use what we consider to be stigmatising language. Whilst these two items (T and D) are included in the first model for completeness, they are excluded in the latter model. Thus,

$$Z_1 = \beta_1 R + \beta_2 WM + \beta_3 M + \beta_4 W + u \quad (1)$$

$$Z_2 = \beta_5 WM + \beta_6 M + \beta_7 W + u \quad (2)$$

$$Z_3 = \beta_8 T + \beta_9 D + \beta_{10} V + \beta_{11} RA + \beta_{12} H + \beta_{13} C + \beta_{14} S + u \quad (3)$$

$$Z_4 = \beta_{15} V + \beta_{16} RA + \beta_{17} H + \beta_{18} C + \beta_{19} S + u \quad (4)$$

where Z_1 and Z_2 represent the Housing quality item in SIPHER-7, while R, WM, M and W are vectors to represent the housing-related questions in UKHLS, and $\beta_1 - \beta_4$ and $\beta_5 - \beta_7$ are the coefficients to be estimated in Models 1 and 2, respectively. Similarly, Z_3 and Z_4 represents the Neighbourhood safety item in SIPHER-7, while T, D, V, RA, H, C, and S are vectors to represent the crime-related questions UKHLS, and $\beta_8 - \beta_{14}$ and $\beta_{15} - \beta_{19}$ are the coefficients to be estimated in Models 3 and 4.

In all four, an ordered probit model was fitted to explain the SIPHER-7 item in terms of a series of categorical dummies to represent the relevant UKHLS questions. Table 4 summarises the four regression results.

Table 4: Ordered probit regression results

	Model 1: Housing quality with R	Model 2: Housing quality without R	Model 3: Neighbourhood safety with items T and D	Model 4: Neighbourhood safety without items T and D
Home is in a good state of repair (R)				
Yes	0.000 (.)			
No	1.613*** (0.071)			
Home has a washing machine (WM)				
Yes	0.000	0.000		

	(.)	(.)		
No	0.562*** (0.126)	0.622*** (0.119)		
Home has a microwave oven (M)				
Yes	0.000 (.)	0.000 (.)		
No	0.077 (0.082)	0.125 (0.079)		
Home is warm in winter (W)				
Yes	0.000 (.)	0.000 (.)		
No	0.980*** (0.058)	1.246*** (0.054)		
Teenagers hanging around in streets (T)				
Very common			0.000 (.)	
Fairly common			-0.215* (0.089)	
Not very common			-0.445*** (0.093)	
Not at all common			-0.858*** (0.104)	
Don't know			-0.756*** (0.207)	
Drunks or tramps on the streets (D)				
Very common			0.000 (.)	
Fairly common			0.109 (0.114)	
Not very common			-0.160 (0.116)	
Not at all common			-0.305*	

			(0.121)	
Don't know			0.407 (0.212)	
Vandalism and deliberate damage to property (V)				
Very common			0.000 (.)	0.000 (.)
Fairly common			-0.070 (0.127)	-0.158 (0.122)
Not very common			-0.268[*] (0.131)	-0.526[***] (0.123)
Not at all common			-0.336[*] (0.141)	-0.802[***] (0.130)
Don't know			-0.301 (0.193)	-0.490[**] (0.177)
Insults or attacks to do with someone's race or colour (RA)				
Very common			0.000 (.)	0.000 (.)
Fairly common			0.046 (0.168)	0.001 (0.165)
Not very common			-0.056 (0.167)	-0.149 (0.164)
Not at all common			-0.205 (0.170)	-0.429[**] (0.166)
Don't know			-0.190 (0.177)	-0.305 (0.174)
Homes broken into (H)				
Very common			0.000 (.)	0.000 (.)
Fairly common			-0.144 (0.159)	-0.182 (0.156)
Not very common			-0.489[**] (0.167)	-0.533[**] (0.164)

Not at all common			-0.600***	-0.618***
			(0.176)	(0.173)
Don't know			-0.323	-0.309
			(0.204)	(0.201)
Cars broken into or stolen (C)				
Very common			0.000	0.000
			(.)	(.)
Fairly common			0.092	0.104
			(0.130)	(0.129)
Not very common			-0.227	-0.240
			(0.137)	(0.136)
Not at all common			-0.246	-0.289*
			(0.147)	(0.146)
Don't know			-0.291	-0.278
			(0.180)	(0.178)
People attacked on the streets (S)				
Very common			0.000	0.000
			(.)	(.)
Fairly common			-0.021	-0.009
			(0.176)	(0.175)
Not very common			-0.226	-0.299
			(0.182)	(0.179)
Not at all common			-0.543**	-0.719***
			(0.187)	(0.184)
Don't know			-0.148	-0.244
			(0.207)	(0.204)
cut1	0.825	0.711	-1.704	-1.681
	(0.025)	(0.024)	(0.158)	(0.156)
cut2	2.779	2.261	0.098	0.070
	(0.067)	(0.048)	(0.154)	(0.152)
Observations	4009	4009	3998	3998
Log-likelihood	-2357.52	-2645.26	-2384.00	-2465.51

The regression results can be used to predict the probability of each of the levels of the Housing quality and the Neighbourhood safety items in SIPHER-7, given an individual's response to the four or three housing-related questions and the seven or five neighbourhood-related questions in UKHLS, respectively.

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The conditions in which we are born, grow, live, work, and age are key drivers of health and health inequalities. Preventing illness related to these 'social determinants of health' requires well coordinated policies across many sectors, such as the economy, welfare, housing, education, and employment.

SIPHER's innovative systems science approach offers a powerful framework to explore the complex real world relationships and interdependencies of diverse policies that shape our public health and wellbeing.

A major research investment by UKPRP, the SIPHER Consortium is a collaboration of policy and academic experts working with practice partner organisations to create evidence based products that deliver improved public health policy.

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