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What health-related information does the EQ VAS capture? building on a self-rated health (SRH) model

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Objectives: The aim of this study was to understand the information captured by the EuroQol Visual Analogue Scale (EQ VAS) and to compare it with that captured by the general self-rated health (SRH) item by utilizing Jylhä's model of the health assessment process.
Methods: Data from the Health Survey for England (HSE) 2017 and 2018 were analyzed. The EQ VAS and the SRH served as the main dependent variables in the ordinary least squares regression models. Guided by Jylhä's model, the relevant predictor variables were classified into blocks. Full models were developed using forward stepwise approaches within each block and then combining the blocks.
Results: Among the individual blocks, functional limitations, symptoms, and presence of illness were the strongest predictors in the regressions. The largest effects were found between the pain item and both the SRH and the EQ VAS. The final regression explained 41% of the variance in the EQ VAS and 52% in the SRH, these values are the 2017 results, and similar patterns of coefficient estimates were found for both outcomes.
Conclusion: The study is a first step in understanding what information explains the EQ VAS. This study, based on secondary population data, also contributes to the accumulated evidence that Jylhä's model explains self-ratings of health regardless of response scale.

KEYWORDS
EQ VAS, Health Survey for England, Jylha's measurement model, overall health, self-rated health (SRH)

Introduction

The EQ VAS (EuroQol Visual Analogue Scale) is a single-item general self-rated health measure that uses a vertical thermometer on which respondents can rate their health today from 0 (worst health you can imagine) to 100 (best health you can imagine) [1–3], thus providing a numerical rating of their overall health. As part of the widely used health status measure EQ-5D, the EQ VAS has been implemented in many national health surveys to monitor population health and in cross-population and cross-country research [4–7]. As an outcome measure, the EQ VAS has also been used across a broad range of disease subgroups [8]. A recent review investigated the origin and the conceptual framework of the EQ VAS [2], pointing out that, although the EQ VAS is widely accepted and used as a self-reported overall health measure, its conceptual framework as a general self-rated health measure is not well developed. Furthermore, the EQ VAS was originally

designed to be used as a valuation tool to collect values for health states rather than as a self-reported health measure.

On the other hand, in the broader field of health-related quality of life (HRQoL), the single-item general self-rated health (SRH) measure is well studied. In general, wold you say your health is (e.g., "In general, what would you said your health is?") and generally has a five-level ordinal response format (e.g., very good, good, fair, bad, and very bad). Although the exact wording and levels of the item may vary, the different versions are considered parallel assessments that elicit comparable responses [1]. Due to its simplicity, the SRH item, with its five-level response format, has been included in a number of popular HRQoL instruments (e.g., SF-36/-12, PROMIS-10, and CDC Healthy Days). Additionally, the SRH has demonstrated a strong association with mortality and morbidity across disease types and populations [9–12].

Theoretical frameworks have been put forth to explain why the SRH is such a strong predictor of mortality. For example, a cognitive model, proposed by Jylhä (Figure 1), delineates how individuals interpret information about their own bodily sensations, social comparisons, and cultural norms and then translate this complex information into a summary response [13]. Jylhä's model also emphasizes the importance of understanding the pathways (both social and biological) through which information about the body and functioning is processed and translated into an individual's self-rated health. In essence, the model suggests that self-rated health is not a simple subjective opinion, but a multifaceted cognitive evaluation based on a wide range of information, making it a powerful indicator of overall health and mortality. The model (in part or more holistically) has been empirically assessed with the SRH item (see [14–16]), but it has not yet been applied to other single-item measures of self-rated health, such as the EQ VAS.

Both the EQ VAS and the SRH are broadly used measures of self-reported overall health, albeit with different recall periods (today versus in general/over a period) and response formats (numerical rating [0–100 marked thermometer] vs. ordinal responses). Considering that various SRH versions with different wordings and response formats generate similar results, one could argue that the EQ VAS and the SRH may share a similar conceptual framework for how individuals consider and rate their own general health. Previous research has shown that there is a high correlation between the EQ VAS and the five-level SRH [17]. Despite the observed high correlation, it remains unclear whether the same underlying factors drive responses to both measures. Thus, the main aim of this study was to understand the information captured by the EQ VAS and to compare it with the information captured by the SRH using a secondary general population dataset. Because no theoretical framework for the EQ VAS currently exists and the EQ VAS shares many similarities with the SRH item, we applied the model proposed by Jylhä in 2009 [13] to frame our data analyses.

Methods

Datasets: HSE 2017 and 2018

The Health Survey for England (HSE) is a high-quality, annual, cross-sectional survey based on a nationally representative, random sample of private households in England [18, 19]. It collects information on health, lifestyle, use of medication and social services, socioeconomic factors, physical measurements, and biological samples. In the years 2017 and 2018, both the EQ-5D-5L (including the EQ VAS) and the SRH item were included in the HSE. Therefore, the HSE 2017 and 2018 were selected as the data sources for our analyses.

The HSE consists of two data collection components: an interviewer visit (CAPI interview and self-completion booklet), followed by a nurse visit (biometric measurements), if participants consent, both taking place at the participants' households. The EQ-5D-5L and the SRH item were included in the self-completion component of the survey. In 2017, 60% of the sampled households participated in the survey, and 65% of the interviewed adults went on to complete the optional follow-up nurse visit. The numbers for 2018 were 59% and 59%, respectively. Full details of the HSE 2017 and 2018 can be found elsewhere [18, 19].

Measures

The EQ VAS asks respondents to provide a numerical rating of their general health "Today" on a vertical thermometer-like scale, with 100 and 0 on each end and labeled 'The best health you can imagine' and 'The worst health you can imagine', respectively. The SRH contained in the HSE asks respondents to respond to the question, "How is your health in general?" using five response categories: "very good", "good", "fair", "bad", or "very bad".

Variable blocks

Guided by Jylhä's model [20], as shown in Figure 1, all relevant available variables in both HSE datasets were classified into seven blocks: physiological indicators, presence of illness, functional limitations, medication use, symptoms, health behaviors, and socioeconomic/demographic factors. The variables and measurement levels contained within the blocks are listed in Supplementary Table 1. It should be noted that the seven items of the Chronic Pain Grade based on the GCPS Version 2.0 [21, 22] were included only in the 2017 dataset. The five items of the EQ-5D-5L were modeled separately from the item blocks due to potential ordering effects with the EQ VAS.

Not all of the data required for Jylhä's measurement model were available in the HSE datasets, and consequently we could not assess all the components that are important for the cognitive processes, both subjective and contextual, that interpret health information into a rating of general health. As shown in Figure 1, the components we were able to evaluate in this study are indicated in white. For instance, culture, environmental context, health history, reference group, and conventions/norms outlined in the model were not available in the HSE datasets. More discussion of this limitation can be found in the Discussion section.

Regression procedure

Ordinary least squares (OLS) regressions were used to investigate how a large set of variables relate to the main dependent variables, the EQ VAS and the SRH. To facilitate linear modeling, the SRH item was rescaled into a 0–100 rating with equal intervals, matching the range and direction of the EQ VAS (i.e., very good was 100, good was 75, fair was 50, bad was 25, and very bad was 0), and it was treated as a continuous variable. A sensitivity analysis of two alternative weighted SRH response scorings [17] was conducted (one scoring 5, 4.5, 2.7, 2, 1 and the

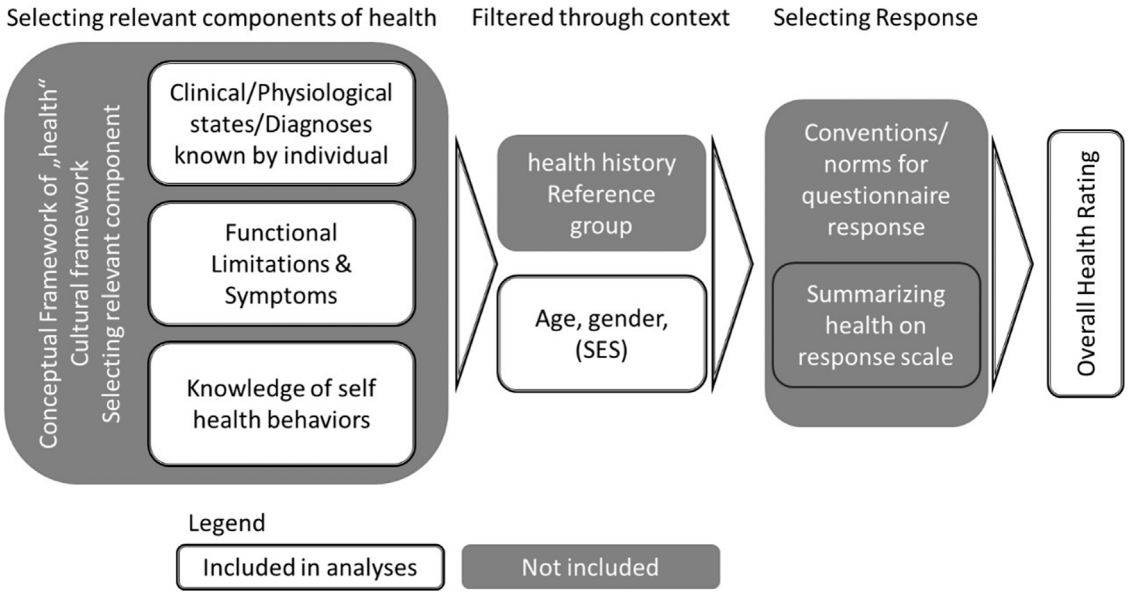


FIGURE 1
Jylhä's contextual model (What health-related information does the EQ VAS capture? building on a self-rated health (SRH) model, England, 2026).

other 5, 4.4, 3.4, 2, 1, and both re-scaled into a 0–100 rating) to provide a comparison of empirically derived weights (weighted) versus hypothetical weights (non-weighted/equal-interval).

Each variable block was first assessed in separate regression models to understand the predictive value of the items within the blocks by including all variables within the blocks as independent variables. In the next step, sociodemographic and socioeconomic items were added to each block. After this, items from the physiological indicators, behavior, and medication use blocks were added sequentially to the remaining blocks. Finally, all blocks were combined into a single regression model using block-level stepwise forward inclusion. For each step, items were excluded from the models if p-value >0.1. Items with p-values between 0.1 and 0.05 were assessed for further inclusion using the F-test. An exception was made for age and gender, which were retained in all models regardless of p-values to control for their effects in the model. Listwise deletion was applied when missing data were present for covariates. Adjusted R^2 was compared between the EQ VAS and the SRH models. A nonparametric bootstrap analysis (2,000 samples) was conducted to examine the significance of the difference in the adjusted R^2 between the models.

Due to the different focuses of the HSE each year, the variables collected in each year are not fully identical. Therefore, the 2017 and 2018 data were analyzed separately. Stata 17 served as the primary analytical software.

Results

Characteristics of the participants

A total of 7,023 and 7,056 participants from the HSE 2017 and 2018 (respectively), aged 18+ and who completed both the SRH item and the EQ VAS, were eligible for analysis. Respondent characteristics are presented in Table 1. Over 70% of respondents in both years had good to very good self-rated health. The mean EQ VAS was 78.5 (SD:19.3) in 2017 and 77.7 (SD: 18.5) in 2018.

Linear regressions: individual block results

As shown in Table 2, when assessing each block in separate regression models with EQ VAS, functional limitations due to specific health conditions were the strongest explanatory block (adjusted R^2 up to 0.33), followed by symptoms (adjusted $R^2 \approx 0.29$), presence of illness (adjusted $R^2 \approx 0.22$), medication use, and health behaviors (adjusted $R^2 \approx 0.15$). Socioeconomic/demographic and physiological-indicator blocks explained ≈8% and ≈1% of the variation in the EQ VAS, respectively. The patterns were similar for the 2017 and 2018 data, both in terms of absolute and relative magnitude. Similar patterns were found for the SRH models, but with consistently larger adjusted R^2s than the EQ VAS models. For example, the functional limitation block had an adjusted $R^2 \approx 0.41$, the symptom block had an adjusted $R^2 \approx 0.30$, the presence of illness block had an adjusted $R^2 \approx 0.33$, and the socioeconomic/demographic block had an adjusted $R^2 \approx 0.2$. Except for the symptom block and the symptom block with age and gender, all bootstrapped 95% confidence intervals did not include 0 and indicated that all differences in adjusted R^2 between the EQ VAS and the SRH models in Table 2 were statistically significant.

A closer examination of the parameter estimates in each block, as shown in Supplementary Tables 2, 3 for the 2017 and 2018 datasets, respectively, revealed that the largest coefficients were observed in the presence of the symptom block, for pain (Chronic Pain Grade based on the GCPS Version 2.0, available in the 2017 dataset only), with coefficient estimates up to 35 for the most severe level for the EQ VAS and 45 for the SRH scores. Again, a

TABLE 1 Characteristics of aged 18+ respondents with complete EQ VAS data, health survey for England (What health-related information does the EQ VAS capture? building on a self-rated health (SRH) model, England, 2026).

		2017		2018	
		n	(%)	n	(%)
Total		7,023		7,056	
Age	18–24	420	(5.98)	475	(6.73)
	25–34	956	(13.61)	1,017	(14.41)
	35–44	1,195	(17.02)	1,153	(16.34)
	45–54	1,212	(17.26)	1,247	(17.67)
	55–64	1,241	(17.67)	1,208	(17.12)
	65–74	1,139	(16.22)	1,193	(16.91)
	75+	860	(12.25)	763	(10.81)
Female gender		3,967	(56.49)	3,940	(55.84)
QIMD	Middle or higher	4,374	(62.28)	4,332	(61.39)
	2nd lowest quintile	1,361	(19.38)	1,481	(20.99)
	Lowest quintile	1,288	(18.34)	1,243	(17.62)
Education	NVQ4/NVQ5/Degree or equivalent	2,096	(29.90)	2,078	(29.53)
	Below degree	3,546	(50.58)	3,627	(51.55)
	No qualification	1,369	(19.53)	1,331	(18.92)
Employment	Managerial/professional	2,603	(37.59)	2,644	(38.13)
	Intermediate	1,689	(24.39)	1,697	(24.47)
	Routine/manual	2,477	(35.77)	2,418	(34.87)
	Other	155	(2.24)	175	(2.52)
Household income	NR	1,291	(18.38)	1,187	(16.82)
	Lowest quintile	1,065	(15.16)	1,120	(15.87)
	2nd lowest quintile	1,131	(16.10)	1,163	(16.48)
	Middle or higher	3,536	(50.35)	3,586	(50.82)
Marital status	Single	1,162	(16.55)	1,240	(17.57)
	Married/Partners/Cohabiting	4,702	(66.95)	4,730	(67.04)
	Separated/Divorced/Widowed	1,159	(16.50)	1,086	(15.39)
Religion	Christian	3,895	(55.46)	3,790	(53.71)
	None	2,427	(34.56)	2,546	(36.08)
	Non-christian	545	(7.76)	607	(8.60)
	Refused to answer, Don't know	156	(2.22)	113	(1.60)
Ethnicity	White	6,251	(89.15)	6,188	(87.70)
	Black	180	(2.57)	214	(3.03)
	Asian	459	(6.55)	480	(6.80)
	Mixed	122	(1.74)	174	(2.47)
Car or van normally available		5,795	(82.56)	5,773	(81.83)
House ownership	Own it	2,639	(37.67)	2,594	(36.86)

(*Continued*)

TABLE 1 Continued

		2017		2018	
		n	(%)	n	(%)
	Unde mortage	2,177	(31.08)	2,225	(31.61)
	Rent/free of use	2,189	(31.25)	2,219	(31.53)
Self-assessed health	Very good	2,275	(32.39)	2,146	(30.41)
	Good	2,906	(41.38)	3,031	(42.96)
	Fair	1,276	(18.17)	1,310	(18.57)
	Bad	401	(5.71)	428	(6.07)
	Very bad	165	(2.35)	141	(2.00)
EQ VAS, mean (SD)		7,023	78.53(19.35)	7,056	77.68 (18.5)

QIMD (Quintile Index of Multiple Deprivation): it represents the relative neighborhood deprivation based on the participant's residential postcode.

similar pattern was observed between the estimates from the SRH models and those from the EQ VAS models. However, the estimates from EQ VAS models consistently showed smaller absolute magnitudes.

Stepwise regression results

The models of gradually combining blocks are also shown in Table 2. First, adding the socioeconomic/demographic block to each functional limitation, symptom, presence of illness, medication use, and behavior block explained an additional 1%–5% of the variance in the EQ VAS. Next, adding the socioeconomic/demographic and physiological-indicator blocks to each of the remaining blocks did not increase the explained variance. Furthermore, adding the socioeconomic/demographic, physiological-indicator, and health behavior blocks increased the adjusted R^2 of the symptom, presence of illness, and medication-use blocks by 2%–7%. When all blocks, except the presence of illness block, were combined, the model explained 41% of the variance. Finally, with all blocks together, the adjusted R^2 only improved to 41.3% in the 2017 dataset (and to 37% in the 2018 data). We observed that adding the presence of illness block did not improve explained variance, likely due to its overlap with the symptoms and functional limitations already in the model. In addition, combining the functional limitation and medication use blocks did not substantially improve the adjusted R^2 in comparison with that of each individual block, suggesting potential overlap between these blocks. Similar patterns were observed in the SRH models. The final models explained 52% and 49% of the variance in the SRH in the 2017 and 2018 datasets, respectively, whereas for the EQ VAS the final models reached adjusted R^2 values of 0.41 and 0.37, respectively. The difference in adjusted R^2 between the 2 years was mainly due to the absence of symptom measures (chronic pain) in the 2018 data.

The parameter estimates of the final regression models for the EQ VAS and the SRH are shown in Table 3 for the 2017 dataset and Table 4 for the 2018 dataset. Despite some discrepancies found between the EQ VAS and the SRH models and between the datasets, there is substantial overlap. All models retained socioeconomic/demographic variables, including QIMD (Quintile Index of Multiple Deprivation), equivalized household income, and house ownership (in the 2017 dataset only): living in a less deprived area and having a higher income were associated with higher scores, and having a mortgage or paying rent was associated with lower scores. SRH models were further associated with education and employment. Physiological measures of cholesterol, blood pressure, and glycated hemoglobin levels had a large number of missing values, and none were retained in the final models. From the behavior block, current smoking, less vegetable/fruit consumption, non-active exercise, and obesity were associated with lower EQ VAS/SRH scores. Non-drinkers had lower EQ VAS/SRH scores than those who consumed 1 to 13 alcohol units per week (for the EQ VAS in 2018 only). Nearly all items in the functional limitation block were retained in the final model (hearing was excluded) and were associated with lower EQ VAS/SRH scores. The symptom block (available only in the 2017 dataset and consisting entirely of pain items) was a strong contributor to the final model. The retained long-standing illnesses included neoplasms and benign growths, mental disorders, nervous system conditions, heart and circulatory system disease, genitourinary system disease, and musculoskeletal system conditions, all of which were associated with lower scores in the 2017 and/or 2018 datasets. Similarly, medication use for gastrointestinal, respiratory, CNS, and endocrine conditions contributed to lower scores. The main discrepancy between the final models of the EQ VAS and the SRH concerned age and gender variables: both showed consistent patterns in the SRH models – lower scores for older age and male gender – whereas no obvious pattern was observed in the EQ VAS models.

We further examined the relationship between the SRH and EQ VAS. When the SRH was included as the sole independent variable, up to 41% of the variance in the EQ VAS could be explained.

Sensitivity analyses

Neither of the weighted rescaled SRH scorings impacted the findings, and the results were largely similar to those for the unweighted (equal intervals) SRH.

TABLE 2 Adjusted R^2 of tested models, health survey for England (What health-related information does the EQ VAS capture? building on a self-rated health (SRH) model, England, 2026).

	OLS regressions					
	2017			2018		
	EQ VAS	SRH	Bootstrapped R^2 difference	EQ VAS	SRH	Bootstrapped R^2 difference
Block						
Functional	0.325	0.410	(-0.121, −0.083)	0.315	0.411	(-0.134, −0.094)
Symptom	0.285	0.295	(-0.033, 0.012)	--	--	--
Illness	0.217	0.320	(-0.109, −0.062)	0.217	0.331	(-0.117, −0.073)
Medicine use	0.142	0.198	(-0.074, −0.038)	0.106	0.175	(-0.084, −0.054)
Health behaviors	0.145	0.196	(-0.068, −0.035)	0.148	0.187	(-0.056, −0.023)
Sociodemographic	0.082	0.151	(-0.083, −0.055)	0.074	0.143	(-0.084, −0.054)
Physiological indicators	0.008	0.020	(-0.017, −0.006)	0.011	0.024	(-0.019, −0.007)
Block + gender and age						
Functional	0.326	0.416	(-0.121, −0.082)	0.318	0.417	(-0.131, −0.091)
Symptom	0.289	0.312	(-0.045, 0.001)	--	--	--
Illness	0.222	0.323	(-0.114, −0.068)	0.223	0.334	(-0.121, −0.076)
Medicine use	0.144	0.203	(-0.076, −0.040)	0.111	0.185	(-0.090, −0.058)
Behavioral	0.149	0.218	(-0.086, −0.051)	0.150	0.214	(-0.081, −0.047)
Physiological indicators	0.026	0.065	(-0.049, −0.029)	0.017	0.068	(-0.061, −0.041)
Block + SED						
Functional	0.339	0.448	(-0.148, −0.106)	0.332	0.441	(-0.149, −0.105)
Symptom	0.307	0.352	(-0.067, −0.021)	--	--	--
Illness	0.247	0.371	(-0.131, −0.085)	0.250	0.376	(-0.074, −0.023)
Medicine use	0.178	0.264	(-0.108, −0.070)	0.153	0.241	(-0.110, −0.073)
Behavioral	0.167	0.251	(-0.104, −0.069)	0.172	0.235	(-0.085, −0.049)
Physiological indicators	0.081	0.159	(-0.097, −0.067)	0.079	0.150	(-0.089, −0.060)
Block + SED + Phys						
Functional	0.340	0.452	(-0.151, −0.109)	0.333	0.445	(-0.151, −0.107)
Symptom	0.308	0.357	(-0.076, −0.030)	--	--	--
Illness	0.248	0.375	(-0.135, −0.089)	0.252	0.380	(-0.138, −0.091)
Medicine use	0.178	0.267	(-0.109, −0.072)	0.154	0.245	(-0.113, −0.075)
Behavioral	0.167	0.254	(-0.107, −0.072)	0.173	0.240	(-0.089, −0.052)
Block + SED + Phys + Behavioral						
Functional	0.359	0.475	(-0.153, −0.110)	0.362	0.469	(-0.144, −0.101)
Symptom	0.339	0.399	(-0.083, −0.036)	--	--	--
Illness	0.290	0.418	(-0.141, −0.093)	0.298	0.420	(-0.134, −0.086)

(*Continued*)

TABLE 2 Continued

	OLS regressions					
	2017			2018		
	EQ VAS	SRH	Bootstrapped R^2 difference	EQ VAS	SRH	Bootstrapped R^2 difference
Medicine use	0.234	0.329	(-0.119, −0.078)	0.219	0.307	(-0.113, −0.072)
Block + SED + Phys + Behavioral + Medicine use						
Functional	0.369	0.490	(-0.153, −0.108)	0.367	0.479	(-0.144, −0.100)
Symptom	0.360	0.433	(-0.101, −0.052)	--	--	--
Illness	0.307	0.434	(-0.145, −0.098)	0.310	0.432	(-0.136, −0.088)
Functional + symptom +SED + Phys + Behavioral + Medicine use	0.410	0.512	(-0.128, −0.080)	--	--	--
Functional + symptom + illness +SED + Phys + Behavioral + Medicine use	0.413	0.523	(-0.135, −0.089)	0.374	0.494	(-0.145, −0.099)

SED: socioeconomic/demographic.
Phys: physiological indicators.

Discussion

The study aimed to understand what information is captured by the EQ VAS measure and compare it with that of the SRH, utilizing multivariable regressions and Jylhä's conceptual (cognitive) model of the SRH. To our knowledge, this is the first empirical application of a theoretical model of self-rated health to the EQ VAS.

The study results show that, based on Jylhä's model, the final regression model explained up to 52% of the variance in the SRH and 41% of the variance in the EQ VAS. Furthermore, similar patterns of coefficient estimates were found in both outcomes, with functional limitations, presence of illness, and symptoms being the most important predictors. These results suggest that both outcomes measure similar aspects of overall health and can be fairly explained by the variables/blocks defined by Jylhä's model. The higher variance explained in the SRH models may reflect the predictor blocks being derived from a model built specifically to explain the SRH. The results further provide evidence that Jylhä's model is stable across response scales and recall periods, despite the limitations of the current data.

The remarkable similarities observed between the SRH and EQ VAS models support the idea that the EQ VAS is a general self-rated health measure, potentially offering a possible solution for its relatively weaker theoretical basis. Despite both measures capturing similar information, the underlying conceptual process of the EQ VAS requires further investigation. As shown in Figure 1, Jylhä's model of the SRH emphasizes the pathways (both social and biological). For instance, cultural norms can influence an individual's consideration of what constitutes their health. Then, individuals assess all health components they consider important. This information is filtered through the context, such as the individual's age, other social demographics, reference groups, or positive/negative affect. Finally, an assessment of self-rated health using all available information is made. Whether this process is the same for the EQ VAS remains to be tested. Furthermore, the EQ VAS may also have features similar to those of the Likert-response SRH measures, which have demonstrated predictive value for mortality and morbidity [23–26]. Further research on the EQ VAS could examine its association with future mortality and morbidity. Additionally, the evidence supports testing other models of single-item self-rated health, classically applied to Likert response formats, on the EQ VAS.

Nevertheless, the current study observed differences between the models, including the magnitudes of coefficient estimates. Although studies in the literature have shown the limited impacts of response formats and recall periods on the results of self-rated measures [23–25], there are recent studies that have suggested potential sources of the observed differences. For example, previous research has found that respondents may find the end points of the EQ VAS thermometer scale to be too extreme (end-point avoidance) and/or interpret the extremes as two distinct concepts (bipolarity) [27, 28]. These issues associated with the EQ VAS end labels do not exist in the SRH. Additionally, Perruccio and colleagues previously found that the SRH possesses both enduring and spontaneous features [29]. Future research could focus on whether the EQ VAS, which emphasizes today, possesses the enduring feature.

Comparisons with other studies in the literature

As indicated in the results, functional limitations, presence of illness, and symptoms were the strongest independent variables for the SRH and the EQ VAS in the regression models. This finding aligns with other studies investigating the determinants of SRH in the literature [30–32]. Singh-Manoux and colleagues [27] also used stepwise regression with UK and French data and found that the main contributors to SRH variations were health status variables, including mental and physical health. Their final model explained

TABLE 3 Final regression model results from the health survey for England 2017 dataset (What health-related information does the EQ VAS capture? building on a self-rated health (SRH) model, England, 2026).

2017	EQ VAS			SRH		
	Beta coefficient	95% confidence interval		Beta coefficient	95% confidence interval	
Age: reference 18–24						
25–34	−0.565	−2.295	1.166	−1.282	−3.348	0.785
35–44	−0.572	−2.269	1.125	**−3.242**	**−5.280**	**−1.205**
45–54	−0.042	−1.754	1.670	**−3.718**	**−5.769**	**−1.668**
55–64	0.789	−0.957	2.535	**−2.778**	**−4.883**	**−0.673**
65–74	**2.040**	**0.173**	**3.908**	**−3.050**	**−5.330**	**−0.770**
75+	−0.119	−2.128	1.891	−1.686	−4.157	0.786
Gender -female	0.464	−0.259	1.187	**1.867**	**1.023**	**2.711**
QIMD: reference least deprived						
2nd lowest quintile	−0.443	−1.387	0.500	**−1.513**	**−2.590**	**−0.436**
Lowest quintile	**−1.094**	**−2.102**	**−0.086**	**−1.333**	**−2.485**	**−0.181**
Education: reference NVQ4/NVQ5/Degree or equivalent						
Below degree				−0.871	−1.911	0.169
No qualification				**−2.928**	**−4.419**	**−1.438**
Employment: Managerial/professional						
Intermediate				−0.221	−1.327	0.885
Routine/manual				**−1.428**	**−2.570**	**−0.287**
Other				**−3.086**	**−6.047**	**−0.125**
Income: reference lowest quintile						
NA	−0.402	−1.649	0.846	1.248	−0.196	2.691
2nd lowest quintile	0.513	−0.747	1.772	1.148	−0.300	2.596
Middle or higher	**1.185**	**0.079**	**2.292**	**2.684**	**1.383**	**3.985**
Ethnicity: reference white						
Black	1.457	−0.812	3.726			
Asian	**−2.167**	**−3.634**	**−0.700**			
Mixed	0.672	−2.007	3.350			
Car ownership - owns car	**1.503**	**0.471**	**2.535**			
House ownership: owns it						
Mortgage	**−1.143**	**−2.175**	**−0.112**	−0.728	−1.905	0.449
Rent/free	−0.972	−2.041	0.098	**−1.987**	**−3.190**	**−0.783**
Drinking						
1–13 units per week						
No drinks in the previous year				**−2.610**	**−3.762**	**−1.457**
14–21 units pw				0.421	−0.688	1.529
>21				0.208	−1.822	2.238

(*Continued*)

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TABLE 3 Continued

2017	EQ VAS			SRH		
	Beta coefficient	95% confidence interval		Beta coefficient	95% confidence interval	
Smoking status: Current smoker						
Former smoker	**1.352**	**0.195**	**2.508**	**2.722**	**1.391**	**4.053**
Never	**1.820**	**0.766**	**2.874**	**4.437**	**3.202**	**5.672**
Vegetable/fruit consumption: 0 to 1 per week						
2 to <3 pw				0.744	−0.536	2.023
3+ pw				**2.215**	**1.201**	**3.229**
Exercise: reference active						
Inactive below 30 min	**−4.053**	**−4.953**	**−3.153**	**−4.424**	**−5.466**	**−3.383**
Refused	0.286	−1.220	1.792	**−2.896**	**−4.616**	**−1.176**
BMI: reference normal weight						
NA	**−3.384**	**−4.573**	**−2.195**	**−3.842**	**−5.210**	**−2.474**
Overweight	−0.511	−1.431	0.408	−0.819	−1.868	0.230
Obese	**−2.686**	**−3.675**	**−1.696**	**−4.410**	**−5.548**	**−3.273**
Functional limitations						
Vision	**−2.376**	**−4.076**	**−0.677**	**−3.412**	**−5.393**	**−1.432**
Mobility	**−7.791**	**−9.110**	**−6.472**	**−8.695**	**−10.208**	**−7.182**
Dexterity	**−3.256**	**−4.695**	**−1.818**	**−5.316**	**−6.978**	**−3.654**
Learning	**−2.894**	**−4.830**	**−0.958**	**−3.722**	**−6.163**	**−1.280**
Memory				**−3.188**	**−5.418**	**−0.958**
Mental health	**−4.314**	**−6.350**	**−2.278**	**−4.694**	**−7.051**	**−2.338**
Stamina	**−4.791**	**−5.980**	**−3.602**	**−9.073**	**−10.549**	**−7.597**
Socially				**−5.111**	**−8.973**	**−1.249**
Other	**−3.949**	**−7.297**	**−0.600**			
Chronic pain grade v2: reference no pain						
Low intensity	**−2.475**	**−3.477**	**−1.472**	**−3.962**	**−5.105**	**−2.818**
High intensity	**−7.743**	**−9.030**	**−6.455**	**−7.031**	**−8.500**	**−5.562**
Moderately limiting	**−10.007**	**−11.825**	**−8.189**	**−7.864**	**−9.949**	**−5.778**
Severely limiting	**−17.311**	**−18.960**	**−15.663**	**−16.275**	**−18.186**	**−14.364**
Long-standing illness						
II neoplasms and benign growths	**−3.465**	**−5.836**	**−1.094**	**−10.451**	**−13.196**	**−7.706**
III endocrine and metabolic				**−3.257**	**−4.700**	**−1.815**
V mental disorders	**−4.140**	**−6.133**	**−2.147**	**−3.604**	**−5.871**	**−1.337**
IV nervous system				**−5.102**	**−7.191**	**−3.013**
VII heart and circulatory system	**−1.722**	**−2.877**	**−0.567**	**−3.777**	**−5.171**	**−2.383**
VIII respiratory system				**−1.991**	**−3.776**	**−0.206**
IX digestive system				**−3.727**	**−5.464**	**−1.990**

(*Continued*)

TABLE 3 Continued

2017	EQ VAS			SRH		
	Beta coefficient	95% confidence interval		Beta coefficient	95% confidence interval	
X genitourinary system				**−4.355**	**−6.737**	**−1.974**
Medication use						
NA	**−1.272**	**−2.213**	**−0.331**	**−3.204**	**−4.285**	**−2.122**
Yes	−0.192	−1.303	0.920	−0.980	−2.333	0.373
Medication type						
Cardiovascular				**−2.296**	**−3.747**	**−0.845**
Gastrointestinal	**−2.705**	**−3.926**	**−1.484**	**−2.367**	**−3.794**	**−0.941**
Respiratory medicine	**−1.838**	**−3.262**	**−0.413**	**−2.994**	**−4.779**	**−1.208**
CNS medicine	**−2.669**	**−3.904**	**−1.434**			
Cytotoxic or immunosuppressive				**−10.554**	**−14.687**	**−6.421**
Nutrition/blood				**−2.924**	**−4.635**	**−1.214**
Constant term	**86.254**	**83.870**	**88.637**	**87.956**	**85.095**	**90.818**

Bold values indicate statistical significance.

35% and 41% of the variance in each cohort, respectively. Similarly, studies that investigated the EQ VAS using American [33–35] and European [36, 37] samples all found that health status, such as the number or presence of health conditions, had some of the strongest relationships with the EQ VAS.

Furthermore, the largest effects in the current study were found between pain symptoms and the SRH/EQ VAS. The literature has shown that pain is strongly associated with the SRH and EQ VAS [5, 38–40]. Specifically, the study by Rubin and Zimmer [36] indicated that the association between pain and the SRH remains strong even after adjusting for demographic, socioeconomic, and social support variables. This was also observed in this study: in the final model, the coefficient size of the pain item remained relatively large after controlling for all other covariates.

However, in these data, we found socioeconomic/demographic factors to be less important in the full model when the presence of illness, functional limitations, and symptoms were also included. This could also be explained by Jylhä's model: as illustrated in Figure 1, socioeconomic/demographic factors are considered context factors, shaping how individuals view their health rather than having a direct impact. Nevertheless, the current findings align with previous studies showing that socioeconomic/demographic factors are statistically significantly associated with the SRH, including gender, age, education, employment, income, and living area/condition [41]. This largely aligns with our findings. Studies that included employment also found strong associations with the EQ VAS [35, 37], whereas employment (defined by occupation) was not retained in our final model.

None of the physiological variables were retained in the final models. One of the reasons may be that many values were missing in the dataset. Physiological variables in the HSE were collected during nurse visits following the initial interview, and not all participants agreed to participate. The literature has indicated that many biomarkers, including cholesterol and hemoglobin, are strongly and logically associated with the SRH, even after adjusting for chronic disease and functional status, and has concluded that the SRH has a solid biological basis [42].

It is interesting to note that among studies examining the variance of the SRH and the EQ VAS, the proportion of variance explained by various models in the literature is usually no more than 50% [30, 31]. A relatively large amount of variance, up to 70%, remains unexplained. Indeed, we found full SRH and EQ VAS models to explain approximately 40% of the variance. Besides measurement error (which has been investigated for the EQ VAS [3]), there could be other reasons for the unexplained variance. We acknowledge that our secondary data source did not contain variables belonging to some components of Jylhä's model, and a larger amount of variance may be explained if these elements were included in the models. However, due to the similarity between the variance explained in this study and in the published literature, we believe the impact of the excluded variables to be modest. Another possible source of variation is response heterogeneity: individuals with similar underlyinghealth may respond differently to health questions either due to differences in item/response interpretation and/or reporting style [43–48]. Response heterogeneity can be adjusted for using vignettes; however, this information is not included in the HSE data. Finally, other theoretical frameworks for SRH suggest that these single-item measures may capture an emergent rating of health that cannot be disaggregated into parts [49, 50]. In the emergent model of SRH, it would not be possible to parse out the remaining variation in the measure.

Limitations

Due to the variables included/excluded in the HSE data, we could not investigate all aspects of Jylhä's model. For instance, culture, environmental context, health history, and reference group, all of

TABLE 4 Final regression model results from the health survey for England 2018 dataset (What health-related information does the EQ VAS capture? building on a self-rated health (SRH) model, England, 2026).

	EQ VAS			SRH		
	Beta coefficient	95% confidence interval		Beta coefficient	95% confidence interval	
Age: reference 18–24						
25–34	−1.188	−2.828	0.453	−1.690	−3.668	0.288
35–44	−1.037	−2.658	0.584	**−3.384**	**−5.341**	**−1.427**
45–54	−0.032	−1.655	1.591	**−4.061**	**−6.013**	**−2.109**
55–64	0.820	−0.830	2.470	**−4.248**	**−6.241**	**−2.254**
65–74	**3.660**	**1.950**	**5.369**	**−2.788**	**−4.877**	**−0.699**
75+	**3.383**	**1.512**	**5.254**	−1.504	−3.819	0.811
Gender- female	0.268	−0.453	0.990	**1.510**	**0.668**	**2.351**
QIMD: reference least deprived						
2nd lowest quintile	**−1.049**	**−1.937**	**−0.160**	**−1.111**	**−2.147**	**−0.074**
Lowest quintile	**−1.305**	**−2.294**	**−0.317**	**−1.415**	**−2.580**	**−0.250**
Education: reference NVQ4/NVQ5/Degree or equivalent						
Below degree				−0.230	−1.271	0.811
No qualification				**−2.670**	**−4.165**	**−1.174**
Employment: Managerial/professional						
Intermediate				**−1.365**	**−2.477**	**−0.253**
Routine/manual				**−2.534**	**−3.661**	**−1.406**
Other				**−3.601**	**−6.459**	**−0.742**
Income: reference lowest quintile						
NA	0.476	−0.761	1.712	**1.491**	**0.037**	**2.944**
2nd lowest quintile	**1.663**	**0.439**	**2.887**	**2.187**	**0.751**	**3.623**
Middle or higher	**2.961**	**1.911**	**4.010**	**3.027**	**1.756**	**4.298**
Drinking: 1–13 units per week						
No drinks in the previous year	**−1.351**	**−2.355**	**−0.346**	**−4.114**	**−5.303**	**−2.925**
14–21 units pw	0.086	−1.221	1.392	−0.007	−1.523	1.509
>21	**−1.033**	**−2.042**	**−0.025**	−0.151	−1.323	1.021
Smoking status: Current smoker						
Former smoker	**1.568**	**0.440**	**2.696**	**3.497**	**2.177**	**4.817**
Never	**2.451**	**1.414**	**3.488**	**5.083**	**3.856**	**6.310**
Vegetable/fruit consumption: 0 to 1 per week						
2 to <3 pw	**1.432**	**0.339**	**2.524**	0.240	−1.034	1.514
3+ pw	**2.019**	**1.164**	**2.875**	**1.812**	**0.804**	**2.819**
Exercise: reference active						
Inactive below 30 min	**−5.481**	**−6.337**	**−4.625**	**−5.027**	**−6.025**	**−4.030**
Refused	−1.037	−2.438	0.364	−1.455	−3.086	0.176

(*Continued*)

TABLE 4 Continued

	EQ VAS			SRH		
	Beta coefficient	95% confidence interval		Beta coefficient	95% confidence interval	
BMI: reference normal weight						
NA	**−4.145**	**−5.315**	**−2.975**	**−4.260**	**−5.624**	**−2.896**
Overweight	**−1.539**	**−2.441**	**−0.638**	**−1.453**	**−2.501**	**−0.405**
Obese	**−4.218**	**−5.176**	**−3.260**	**−5.587**	**−6.703**	**−4.471**
Functional limitations						
Mobility	**−10.185**	**−11.570**	**−8.800**	**−12.214**	**−13.826**	**−10.602**
Dexterity	**−4.971**	**−6.428**	**−3.514**	**−3.690**	**−5.390**	**−1.991**
Memory	**−4.494**	**−6.192**	**−2.796**	**−5.972**	**−7.958**	**−3.986**
Mental health	**−5.491**	**−7.543**	**−3.439**	**−10.563**	**−12.204**	**−8.922**
Stamina	**−5.761**	**−6.932**	**−4.590**	**−10.422**	**−11.825**	**−9.019**
Socially	**−4.224**	**−6.746**	**−1.701**			
Other				**−4.568**	**−8.228**	**−0.909**
Long-standing illness: reference no illness						
II neoplasms and benign growths	**−6.339**	**−8.673**	**−4.005**	**−11.703**	**−14.321**	**−9.085**
III endocrine and metabolic				**−2.484**	**−4.111**	**−0.857**
V mental disorders	**−2.150**	**−4.123**	**−0.178**			
IV nervous system	**−5.298**	**−7.070**	**−3.526**	**−7.615**	**−9.693**	**−5.536**
VII heart and circulatory system	**−1.306**	**−2.450**	**−0.162**	**−5.248**	**−6.597**	**−3.898**
IX digestive system				**−2.719**	**−4.552**	**−0.887**
X genitourinary system	**−2.843**	**−4.851**	**−0.835**	**−4.841**	**−7.188**	**−2.494**
XIII musculoskeletal system	**−1.967**	**−3.092**	**−0.843**	**−3.659**	**−4.969**	**−2.349**
I infectious disease	**−7.444**	**−14.241**	**−0.648**			
IV blood and related organs				**−5.508**	**−9.088**	**−1.928**
Medication use						
NA	**−1.179**	**−2.084**	**−0.273**	**−3.120**	**−4.175**	**−2.065**
Yes	0.753	−0.392	1.898	**−2.071**	**−3.454**	**−0.688**
Medication type						
Gastrointestinal	**−2.606**	**−3.889**	**−1.323**	**−2.488**	**−3.998**	**−0.977**
Respiratory medicine				**−2.139**	**−3.800**	**−0.477**
CNS medicine	**−1.754**	**−3.028**	**−0.480**	**−1.646**	**−3.121**	**−0.171**
Endocrine	**−1.940**	**−3.236**	**−0.645**	**−2.270**	**−3.937**	**−0.604**
Cytotoxic or immunosuppressive	**−5.558**	**−9.548**	**−1.567**			
Constant term	**82.301**	**80.284**	**84.319**	**86.304**	**83.657**	**88.952**

p-values<0.05 are indicated in **Bold**.

which were outlined by Jylhä (2009), were not available in the HSE data. It has been shown, in both qualitative and quantitative research, that individual and cultural differences are important in reporting one's own overall health [28, 51]. Similarly, Jylhä included optimism/pessimism and depression as important modifiers of evaluation frameworks, but these measures were not readily available in the data. Although items associated with mental health were included in the functional limitation, presence of illness, and medication use blocks, components such as

detailed measures of positive/negative affect and mental health were not included. Future examination of the EQ VAS should include robust measures of affect and mental health. Additionally, a very important aspect of both models is experienced symptoms. Unfortunately, clear measures of experienced symptoms were only collected for pain, and therefore lack representation in our models.

Missing data in the HSE present another limitation. Sensitive data, such as income, had up to 20% "not applicable" responses from adults aged 18+ in the sample. Data collected during the nurse visit, such as blood pressure and cholesterol levels, also had a high rate of missing data, as not all interview participants consented to/participated in the follow-up nurse visit. We did include missing/NA data as a category to minimize loss of information in the regression models, but this makes the results difficult to interpret.

We employed a simple OLS regression approach with a stepwise inclusion procedure at the block level. Other more advanced techniques, such as censored or generalized linear models, were tested, but no difference in the overall results was found. We used p-value and F-test-based model building, which may have led to overfitting. Thus, the difference between the 2017 and 2018 datasets could be due to the model's sensitivity to small differences as variable blocks are added. To facilitate comparison between the SRH and the EQ VAS, the same OLS regression technique was used on the rescaled SRH data (on a 0–100 scale). Treating ordinal data as interval data could lead to problems such as changeable estimates depending on arbitrary scale choices and physically impossible predictions. Due to this mismatch between the regression techniques and data properties, caution should be applied when interpreting SRH results. Nevertheless, some studies have suggested that the use of linear regression is justifiable [52–54]. We also examined the regression models using linearized SRH data [17], reflecting different weights for each response level and therefore uneven intervals. Despite the resulting coefficients and adjusted R^2 values differing slightly, the comparisons with the EQ VAS remained unchanged.

Furthermore, the pathway of Jylhä's model, from selecting health elements to evaluating them, cannot be fully expressed or captured by the current regression analysis. For example, age and gender variables were considered context factors that shape how individuals view their health, and differ from factors such as functional limitations and symptom variables, which have a direct impact. The findings may indicate a causal pathway in which some predictors (contextual) are more distal than other predictors (functional and illness-related). Future studies with advanced methods, such as structural equation modeling, which can incorporate different pathways, are encouraged. Finally, possible interaction terms between variables within a block and/or between blocks might improve the model's fit, which was not explored in the current study. Future studies might further investigate this area.

Final conclusions

This study provides a first empirical assessment to understand the EQ VAS using Jylhä's model. The study also contributes to the accumulated evidence of how Jylhä's model applies to self-ratings of health, regardless of response scales. Future studies that use a full set of relevant data and/or advanced methods, such as structural equation modeling, are needed to fully understand the information captured by the EQ VAS.

Author contributions

LHC: Conceptualization, Methodology, Formal analysis, Writing, Original Draft. PK: Conceptualization, Writing, Review and Editing. TK: Conceptualization, Writing, Review and Editing. YSF: Conceptualization, Methodology, Formal analysis, Writing, Original Draft.

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Conflict of interest

All authors are the members of the EuroQol Group. Author LHC is employed by the company LHC Healthcare Consultancy.

The remaining authors declare that this work was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

The Supplementary Material for this article can be found online at: https://www.ssph-journal.org/articles/10.3389/ijph.2026.1610037/full#supplementary-material

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