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CHANGES IN HEALTH LITERACY ASSESSMENT OF VIDZEME STATISTICAL REGION IN LATVIA

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Abstract
The ability to find, understand, evaluate and use information about an individual's health during the Covid-19 pandemic has become crucial. Therefore, health literacy (HL) skills development in Latvia, also in other OECD countries, is a priority area. Insufficient HL information base in Latvia is a fundamental basis for the research goal: to determine factors influencing HL and their changes among the population of Vidzeme statistical region (LV008) in Latvia. The study compares the authors' 2020 study based on the European Health Literacy Questionnaire (HLS-EU-Q47). The study includes survey of respondents (n = 383) using pen-and-paper interviewing (PAPI) and telephone interview approach. Various methods and tests were used: Principal axis factor analysis (PFA) with varimax rotation, Confirmatory factor analysis (CFA), Compare means Independent-sample T-test, Anova, Kaiser-Mayer-Olkin (KMO), Bartlett's test and Chi-squared test, Cronbach's and Spearman-Brown methods, correlations (Pearson and Spearman's) and Multiple linear regression (MLR) with Assumption Testing analysis, and Cronbach's test. The study identified four factors influencing health literacy: access, understanding, evaluation, and use. Compared to the study conducted by the authors in 2020, which determined that education has a positive impact on factor – access, the HL has increased more strongly in the age groups 18-19, 20-29 and 30-39. However, among women the HL level has decreased compared to the previous study by authors and HLS-EU, the proportion of people with sufficient and excellent HL in the European Union has increased overall by 13.5%, while the proportion of people with limited HL decreased by 24.4%.
Key words: health literacy, socioeconomics factors; demographic factors.

Introduction

Health literacy (HL) is an important factor determining the health of individuals and society in large (Nutbeam, 2008). Limited HL can impact health of society during health crisis such as COVID-19 pandemic (Abdel-Latif, 2020). A European HL survey found that, on average, 47% of respondents have problems with health management (Sorensen *et al*., 2015). HL problems are mainly related to people's lack of knowledge and competences, which hinders proper understanding and decision-making about their health, care, disease prevention and health promotion (Sorensen, 2012; Altin, 2014; Connor, Mantwill, & Schulz, 2014; Guzys, Kenny, & Dickson-Swift, 2015). For instance, there is a connection between low HL and insufficient knowledge about ones health and increased expenditures on health services (Rowlands *et al*., 2014; Wallace *et al*., 2016). However, there are also different HL impacting factors, such as, gender, education, occupation, income, etc. (Protheroe *et al*., 2017; Cho *et al*., 2020; Chiu *et al*., 2020). The International Health Literacy Association (IHLA) pointed to the need to promote HL and its importance (IHLA, 2021). The HL skills in Latvia, as well as in other OECD countries, has been identified as one of the priority fields of skills to be increased. The HL research in Latvia has been aimed at research on patients' health satisfaction, health care, HL skills development (Rasnaca, Vibane, & Nikisins, 2017; Onose *et al*., 2017; Silkane, Davidsone, & Veliverronena, 2018). Authors agree that research in this area has been limited compared to other EU member states (Heijmans *et al*., 2015). Previously the lack of information on HL in Latvia has been indicated in European Commission research (Heijmans *et al*., 2015). Based on topicality of HL, authors continued the research conducted in 2020-2021 (Kodrica & Grizane, 2021) and chose the **aim of the research**: determination of changes in HL influencing factors in Vidzeme statistical region of Latvia (LV008). **Tasks of the research**: (1) to carry out a review of the scientific literature on the health literacy survey (HLS-Q) on the methods used to determine the factors; (2) to determine the sample size for Vidzeme statistical region, to conduct a survey, to determine and evaluate the factors influencing HL; (3) to compare changes in HL sample in Vidzeme statistical region; (4) to determine the HL index; (5) to compare the HL of Vidzeme statistical region with the data of other EU countries.

Materials and Methods

The research was compared with a similar study by the authors in 2020 (Research_1), based on the European Health Literacy Survey (HLS-EU-Q47) (Sorensen *et al*., 2013; Kodrica & Grizane, 2021). Research_2 47 questions were rated on a 4-point Likert scale (1 = very difficult, 2 = difficult, 3 = easy and 4 = very easy), which identified 4 competencies related to health information management *access*, *understand*, *evaluate* and *apply* information. The rating allows the calculation of both the overall HL index and the

HL index for each of these four competencies. The formula used allowed the standardization of HL indices to uniform values from 0 to 50 (HLS-EU Consortium, 2012):

$$index = (M-1)\times(50/n), \quad (1)$$

where

index – was the specific index calculated;

M – the mean of all participating items for each person;

1 – was the minimal possible value of the mean (leading to a minimum value of the index of 0);

n – was the range of the mean;

50 – was the chosen maximum value of the new metric.

The obtained HL index was grouped, similarly to Resarch_1, according to the value in 3 groups from inappropriate and problematic (0-33), to sufficient (> 33-42) and excellent HL (> 42-50), to assess the HL of respondents by gender, age, education and GIM (EUR) and comparisons with other countries (Kodrica & Grizane, 2021). The frequency and percentage of HL was calculated, based on the gender, age, education (educational level), GIM (EUR) of respondents.

Research place: Vidzeme statistical region (LV 008) in Latvia. *Research period:* from January till December 2021. The calculated sample size, 383 respondents was based on the number of active working age population (Official statistic portal, 2021), proportionally to each gender. Due to the limitations caused by Covid-19 a mixed survey approach was conducted: pen-and-paper interviewing (PAPI) and telephone interviews. *Research method:* PFA with varimax rotation, CFA, KMO, while determining the HL impacting factors and values. An Independent-sample T-test was used to compare the means of the two gender groups. Multiple linear regression (MLR) with assumption testing analysis was used to predict the role of gender, education, age and GIM (EUR) in HL.

Results and Discussion

An analysis of 11 studies in Europe and Asia from 2015 to 2021 revealed that HL is relevant in many countries. The studies differentiate in sheer number of respondents from 383 to 10,024; number of survey questions 12 to 86 and their content, geographical or administrative location – from a given country to a block of countries, such as the EU. In these surveys, different methods and tests have been utilised: Anova, Kaiser-Mayer-Olkin (KMO), Bartlett's test and Chi-squared test, Cronbach's and Spearman-Brown methods, Confirmatory factor analysis (CFA), Factor analysis, Principle component analysis (PCA), correlations (Pearson and Spearman's) and regressions (Multiple linear) (Solar & Irwin, 2010; Sorensen *et al*., 2012, 2013, 2015; Wallace *et al*., 2016; Bodur, Filiz, & Kalkan, 2017; Macleod *et al*., 2017). Taking into concern the previous research concept, similar methods and tests were conducted (Kodrica & Grizane, 2021).

The second research collected the demographical and socioeconomic data of respondents as follows: (Table 1).

The internal consistency test showed that the alpha factor for 47 units is 0.983, α> 09, indicating that the units have a high internal consistency.

PFA with varimax rotation identified 4 factors: *access*, *understand*, *evaluate*, and *apply*, associated with health information management. The value of Kaiser Meyer Olkin (KMO) is α> 0.8, which according to Kaiser (1974) is a positive trend.

For construct validity, CFA was conducted with Extracted method: Principal Axis and Rotation Method: Varimax Factoring with Kaiser Normalization. Rotation convergence in 9 iterations. After the rotation factor *access* accounted for 27.48% of the variance, factor *understand* for 23.2%, factor *estimation* for 13.5%, and the factor *apply* for 9.4% of the variance. Table 2. displays the items and factor loadings for the rotated factors, with loadings less than 0.4 omitted to improve clarity. The factor that indexes *access*, the factor that *understands* the index,

Table 1

The profile of the respondents (n = 383)

Category	Profile
Gender	female – 50.1 %; male – 49.9 %
Age	18-19 – 33.2%; 20-29 – 29%; 30 -39 – 31.9%; 40-49 – 2.6%; 50-59 – 2.3%; 60> – 1.0%
Education (Educatiol level)	higher – 12%; vocational or vocational secondary – 45.4%; general secondary – 35.8; primary or lower than primary – 6.8%
Gross income per month (EUR)	<400 – 4.4%; 400-700 – 19.6%; 700-1000 – 49.1; 1000-1500 – 21.9%; 1500> – 5%

Source: author's calculations.

put a heavy load on 21 items. The factor *appraise* was a heavy load of 14 units, but factor *apply* to 13 units.

Thereby four factors were determined: *access*, *understand*, *appraise* and *apply*. The eigenvalues 34.92 of the First factor *access* explains the largest quantity of observed variables common dispersion, for 64-85% of the variance. However, factors *understand* and *appraise* explain half the variables, while the fourth factors' *apply* eigenvalues are just 8.10, i.e., the factor explains the smallest quantity common variance of the observed variables.

MLR in SPSS with Assumption Testing analysis was performed to determine the role of gender**,** education**,** age and GIM (EUR) in HL predicting by ***access***, ***understand***, ***appraise*** and ***apply*.**

Access. Compare means Independent-sample T-test tool indicates that there was not a statistically significant difference between male and female on *access*: Levene's test is not statistically significant, because its p = 0.13: we do not reject its null hypothesis of equal gender for men and women variances, t (381) = - 0.853, p = 0.39, males (M = 2.41, SD = 0.54, but females (M = 2.46, SD = 0.59). The confidence interval for the difference between the means was 2.37±2.54 for women and 2.33±2.49 for men indicating that the difference could be as small as one point, which is probably not a practically import difference.

MLR correlation matrix of HL factor *access* scores predictors gender, education, age and GIM (EUR) indicated, that among predictors age un education r = 0.398, age and GIM (EUR) r = -139, gender and GIM (EUR) r = -0.373, which is a weak and insignificant relationship between gender and GIM (EUR). The relationship is functional and diminishing. Therefore, a moderate correlation exists; however, it is not significant enough, so that trend correcting steps would be justified. The tolerance level is above 0.2, i.e. 0.8, but the VIF scores are well below 10, i.e., 1.17 predictor gender to 1.24 education. Therefore, the assumption to be met was fulfilled. The assumption of homoscedasticity is fulfilled. Durbin-Watson = 1.74.

MLR was carried out to investigate the relationship between HL factors *access* scores and predictors gender, education, age and GIM (EUR). Obtained results: gender (β = -0.008, p = 0.899), age (β = 0.04, p = 0.880), education (β = 0.131, p = 0.01), GIM (EUR) (β = -0.061, p <0.084), F (4, 38) = 4.82, p < 0.001, with all four variables significantly contributing to the prediction. Taken into account that **F-test value is less than 0.05, then the null hypothesis has to be rejected: regression equation statistically significantly explain the change of resulting indications.** The adjusted R squared value was 0.38. This indicates that 38% of the variance can be explained with the MLR model, in which factor interaction effect is included and that gender, education, age and gross income per month (EUR) can impact the factor *access*. The beta weights, suggest that education has a positive impact on factor *access*, negatively associated with predictor GIM (EUR). In the meantime, in Research_1, the data were evident of the contrary.

Understand. Compare means Independent- sample T-test tool indicates that, there was not a statistically significant difference between **gender group** male and female on *undestand*: Levene's test is not statistically significant, because its p = 0.63, t (381) = -0.308, p = 0.76, males (M = 2.50, SD = 0.59, but females (M = 2.48, SD = 0.57). Levene's test is not statistically significant, because its p = 0.63 for men and women variances, t (381) = -0.31. The confidence interval for the difference between the means was analogic to -0.14±0.10 for women and for men indicating that there is no significant difference.

MLR correlation matrix of HL factor *understand* scores predictors gender, education, age and GIM (EUR) indicated, that among predictors age and education r = 0.398, education and GIM (EUR) r = -139, gender and GIM (EUR) r = -0.373, that is a weak and insignificant correlation, while between gender and GIM (EUR) relation is functional and diminishing. Therefore, a moderate correlation exists; however, it is not significant enough, so that trend correcting steps would be justified. Tolerance level is significantly above 0.2, i.e. 0.8, but VIF scores are significantly below 10, i.e. 1.17 predictor gender until 1.24 education. Therefore, the assumption to be met was fulfilled. The Durbin-Watson statistic showed that the assumption about homoscedasticity is met (Durbin-Watson = 1.55).

MLR was carried out to investigate the relationship between HL factor *understand* scores predictors gender, education, age and GIM (EUR) and factor access. Acquired results: gender (β = 0.043, p = 0.502), age (β = -0.86, p = 0.005), education (β = 0.057, p = 0.172), GIM (EUR) (β = 0.031, p = 0.399), F (4,378) = 2.05, p = 0.09, with all four variables is not significantly contributing to the prediction. **Since the value of F-test is >0.05, then H0 hypothesis was confirmed: regression equation cannot statistically significantly explain change of resultative indicators.** The adjusted R squared value was 0.02. This indicates that only 2% of the variance can be explained by a MLR model, in which factor interaction effect and the gender, education, age and GIM (EUR) impact factor *understand.* Meanwhile the Research_1 indicated 31%.

Appraise. Compare means Independent- sample T-test tool indicates, that there was not a statistically significant difference between **gender group** male and female on *appraise*: Levene's test is not statistically significant, because its p = 0.12, t (381) = -0.23, males (M = 2.43, SD = 0.53), but females (M = 2.42,

SD = 0.53). The confidence interval for the difference between the means was anologic -0.13±0.01 for women and for men indicating that there is no difference.

MLR correlation matrix indicated that among factor *appraise* scores predictors age and education r = 0.398, age and GIM (EUR) r = -139, gender and GIM (EUR) r = -0.373, that is weak and insignificant, in addition the relation between the gender and GIM (EUR) is functional and diminishing. Therefore, a moderate correlation exists. Tolerance is above 0.2, i.e. 0.8, but VIF scores are below 10, i.e. 1.17 predictor gender till 1.24 for *education.* Therefore, the assumption to be met is fulfilled. An assumption of homoscedasticity has been met (Durbin-Watson = 1.60).

MLR was carried out to investigate the relationship between predictors gender, education, age and GIM (EUR) and HL factor *appraise*. The acquired results: gender (β = 0.015, p = 0.811), age (β = -0.006, p = 0.834), education (β = -0.024, p = 0.548), GIM (EUR) (β = 0.002, p = 0.949), F (4,378) = 0.17, p = 0.95. Since the F-test value is p > 0.05, the **H0 hypothesis is confirmed: regression equation does not explain statistically significantly the change of resulting indications.** The adjusted R squared value was 0.02. This indicates that 2% of the variance can be explained with MLR model, in which factor interaction effect and the impact of gender, education, age and GIM (EUR) on factor *appraise* is indicated. Compared to the Research_1 it indicates that 30% of the variance in *appraise* was by model.

Apply. Compare means Independent - sample T-test tool indicates that there not a statistically significant difference between gender group, male and female, on *appraise*: Levene's test is not statistically significant, because its p = 0.39, t (381) = -0.39, males (M = 2.46, SD = 0.60), but females (M = 2.43, SD = 060). The confidence interval for the difference between the means was similar -0.14±0.09 for women and for men indicating that there was practically no difference.

MLR correlation matrix indicates that among predictors age and education r = 0.398, age and GIM (EUR) r = -139, gender and gross income per month (EUR) r = -0.373, which is a weak and insignificant relationship. In addition the relationship between gender and GIM (EUR) is functional and diminishing. Therefore, a moderate correlation exists. Tolerance is high above 0.2, to 0.8, but the VIF score is under 10, i.e. 1.17 predictor gender until 1.24 for education. Therefore, the assumption to be met was met. The assumption of homoscedasticity is fulfilled (Durbin-Watson = 1.54).

MLR was carried out to investigate the relationship between HL factor *apply* scores predictors gender, education, age and GIM (EUR) and factor *access.* The acquired results: gender (β = 0.023, p = 0.727), age (β = -0.019, p = 0.533), education (β = -0.004, p = 0.931), GIM (EUR) (β = 0.003 p = 0.810), F (4,378) = 0.15, p = 0.963. Since the F-test value was larger than 0.05, H0 **hypothesis was affirmed: regression equation did not explain statistically significant resulting indications.** The adjusted R squared value was 0.02. This indicates that 2% of the variance can be explained with MLR model, in which factor interaction effect has been applied and that gender, education, age and GIM (EUR) impact factor *apply,* but Research_1 indicate that 30% of the variance in appraise was by model.

HL index division according to gender indicates that out of 192 respondents 63.5% for women and out from 191 respondents for 61.3% for men is a limited HL (*inadequate* + *problematic*). HL *excellent* evaluation is relatively similar in percentage 36.5% for women and 37.7% for man. HL excellent has been indicated by 49% respondents, who receive salary in the range of 700-1000 gross income per month (EUR), 52.5% respondents with higher and vocational or vocational secondary education. Contrary to Research_1 the evaluation dominant *excellent* HL value was in an age group 18-19, 20-29 and 30-39. Although 59.8% of these age groups were respondents with limited

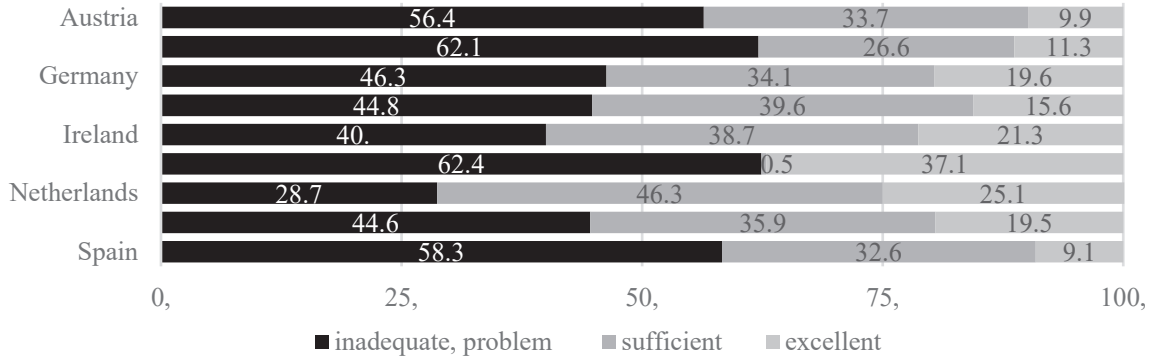

Figure 1. Levels of health literacy index by country and LV008.

Source: author's calculations based on Sorensen *et al*., 2015.

HL, the 40.2% with excellent HL are the reason for further research. Authors have made assumption that the achievements are based on computer literacy, more pronounced among men. Thereby the positive impact of predictor education on factor *access* can be explained. Overall 73.1% respondents of age groups 50-59 and 60> with primary or lower than primary education indicated limited HL. Thereby previous research on HL of elderly people groups can be confirmed (Macleod *et al*., 2017). However, the actual HL skills, according to (DeWalt & Pignone, 2005), can vary. In this study, for instance, in the age group 60> it was determined that 50% have HL at *excellent* level. Similarly to previous Research_1 differences in the HL level were observed between people of different education level, indicating increased HL among senior age group of women. Authors put forward assumption that men with higher computer literacy tend to have higher HL, which should be further studied. Further research on improvements to HL in age groups 50-59 and 60> with primary or lower than primary education is required, because 73.1% respondents of this group had limited HL.

Levels of HL index by country and LV008 in Latvia in Research_2 are showed in Figure 1, where Bulgaria and Spain have the largest HL index.

The number of respondents with HL *excellent* has increased by 24.4%, compared to research of period 2020-2021. It is by 20.7% greater than that of other countries (Figure 1); however, lack of comparable data should be taken into account.

Conclusions

1. Four factors influencing HL were identified in the study: access, understanding, evaluation and application in the Vidzeme statistical region of Latvia (LV008)
2. Compared to 2021 HL research (Research_2) of inhabitants of Vidzeme statistical region in Latvia, the following changes were observed: education is positively impacted by factor *access*, and is negatively associated with predictor GIM (EUR).
3. Compared to the study of 2021 (Researh_2) with the study of 2021 (Research_1), the factor *access* (Study_2) has a positive effect on education and negatively affects GIM (EUR), while (Study_1) the factor *access* is negatively related to the education of forecasters, but positively forecaster GIM (EUR).
4. The research (Research_2) indicated, that 38% of the variance can be explained with MLR model with predictors gender, education, age and GIM (EUR), that impacts factor *access*, only 2% of the variance, that impacts factors *understand*, *appraise* and *apply*. However, (Research_1) indicated factors *access* 30%, *understand* 31%, *appraise* and *apply* 30% of the variance can be explained with MLR model with these predictors.
5. 63.5% for women and for 61.3% for men is a limited HL, but HL excellent evaluation is 36.5% for women and 37.7% for men. Contrary to (Research_1) the evaluation dominant excellent HL value was in the age groups 18-19, 20-29 and 30-39. However, 73.1% respondents of age groups 50-59 and 60> with primary or lower than primary education indicated limited HL.
6. Comparing to the limited HL index of the respondents of Vidzeme statistical region (LV008) in research (Research_1) and the results of HLS-EU research concerning the EU member states, the proportion of people with limited HL has decreased by 24.4% and the proportion of those with sufficient and excellent HL skills have increased by 13.5%.

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