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Country-Specific Digital Inequalities in Older People's Online Health Information Seeking in Europe: Impact of Socio-Demographic and Socio-Economic Factors

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ABSTRACT

Since older people are traditionally considered disadvantaged when it comes to Internet use, it is useful to examine whether older individuals use the Internet for health information seeking (HIS). This study aims to investigate digital inequalities in terms of Internet use by older population for HIS in the European region. As methods, we applied secondary data analysis (of Eurostat data) to investigate the influence of age, educational level, sex, and countries' wealth. Cluster analysis combined with multidimensional scaling was used to find out those countries exhibiting similarities in older people's online HIS. The main results are: Older individuals do not equally use the Internet in general and for HIS in particular. Older Internet users with higher level of education and of the female sex are more likely to use the Internet for health information.

Keywords: health information seeking, digital inequality, digital divide, older people, Europe

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1. BACKGROUND

Information seeking, including online information seeking, has been a research area in information science for decades. Information seeking is an aspect of human information behavior (Bates, 2010; Fisher et al., 2005; Wilson, 2000). Health information and health information seeking (HIS) are receiving increasing attention in information science (Galarce et al., 2011; Ilhan, 2020; Johnson & Case, 2012). Health information is important for everyone (Cline & Haynes, 2001; Morahan-Martin, 2004). People engage in HIS behavior when they have to cope with a health-threatening situation, when they intend to adopt preventative behaviors, or when they want to actively participate in medical decision making concerning their health or that of their relatives (Lambert & Loiselle, 2007; Zimmerman & Shaw, 2020). Traditionally, health professionals were considered the main source of health information (Lambert & Loiselle, 2007). However, with the diffusion of information and communication technologies (ICT), public preferences have shifted to the Internet (Zimmerman & Shaw, 2020).

In 2018, 89% of households in the European Union (EU) had access to the Internet (Eurostat, 2019). The average share of Internet users in the population aged between 16 and 74 was also high, comprising 85% (Eurostat, 2019). Nevertheless, only 52% of Europeans were reported to use the Internet for HIS (Eurostat, 2020c). Furthermore, there are disparities between older and younger health information seekers both within and between countries (Eurostat, 2020a), although online HIS is especially important for older people (Bujnowska-Fedak & Mastalerz-Migas, 2015; Medlock et al., 2015; Sheng & Simpson, 2015) because they are more often confronted with chronic illness and acute diseases as well as preventative health care. At the same time, the proportion of older people in the European region increased significantly, putting additional pressure on public health care systems due to the high dependency of older population on health professionals (Quaglio et al., 2016; Vancea & Solé-Casals, 2016). Active HIS and, therefore, online HIS can be viewed as health-promotion behavior (Eriksson-Backa et al., 2018) leading to patients' empowerment and satisfaction (Longo, 2005). However, another well-known problem of the older population is digital inclusion (Matthews et al., 2019) as older people tend to use the Internet less actively and for a lesser number of activities than their younger counterparts (Heo et al., 2015; Hong & Cho, 2017; Hunsaker & Hargittai, 2018).

Digital inequality "tends to reinforce social inequality" (van Dijk, 2020). Digital inequalities in Internet access and the use of online health information by older adults form digital divides, which can be simply described as a gap between people who benefit from digital sources and those who do not (van Dijk, 2005). The first-level digital divide considers physical access to online information and includes aspects of material divides (van Deursen & van Dijk, 2019). The second-level digital divide concentrates on differences in the users' Internet skills and their levels of information literacy (van Deursen & van Dijk, 2011), i.e., the adequate usage of online information (Büchi et al., 2016; van Deursen & van Dijk, 2014). The final third-level digital divide concerns the outcomes of Internet use and the ways users really benefit from online information (van Dijk, 2020). All three levels of digital divides may be applied to the use of online health information (Brodie et al., 2000; Scherr et al., 2019; Wagner et al., 2005; Wyatt et al., 2005). Furthermore, digital divides are also present for older adults (the "grey divide") (Friemel, 2016; Quan-Haase et al., 2018). Are older persons "on the sidelines" (Johnson & Johnson, 2016)? The benefits of online health information use "are not shared by all members of older populations" (Yoon et al., 2020).

Concerning the use of online information, it should be added that although Internet access is a basic condition to profit from online information, equally important are the motivation of people to engage with online information and their level of general education, as well as their information literacy skills (Linde & Stock, 2011, p. 95). In order to adequately deal with online health information, individuals should possess "e-health skills" (Tavares, 2018; Vicente & Madden, 2017) or health information literacy, which is a combination of "health literacy" and "information literacy" (Eriksson-Backa et al., 2012; Ivanitskaya et al., 2006). The nuanced nature of ICT adoption is especially relevant for older adults who have to "reinvent themselves" and develop new routines to adopt new technology (Quan-Haase et al., 2016), and largely depends on the support from social and institutional systems to master digital skills and gain comfort experience with new technologies (Schreurs et al., 2017).

Previous studies demonstrated that digital divides are not accidental but determined by fundamental demographic and socio-economic factors (Friemel, 2016; van Deurson & van Dijk, 2014). In research on the differences in Internet use, the following factors have been most frequently discussed as Internet use predictors. They include socio-demographic variables of age and sex as well as socio-economic determinants such as educational level,

employment status, and income (van Deurson & van Dijk, 2014). On the country level, the wealth of a country positively correlates with the Internet use of older people (König et al., 2018). The examination of socio-demographic factors also became an important aspect of the research on HIS behavior (Zimmerman & Shaw, 2020); such factors as sex, ethnicity, socio-economic status, living area, and health literacy deserved special attention.

One can note that the factors influencing Internet use and HIS behavior replicate each other to a great extent. Not surprisingly, they are important also for the studies on online HIS and health information literacy. There are clear results highlighting sex-specific differences in searching and using health information from the Internet (Bidmon & Terlutter, 2015; Lim et al., 2011; Nölke et al., 2015). Similarly, higher levels of education relate strongly to higher levels of health information literacy (Eriksson-Backa et al., 2012; Estacio et al., 2019); on the macro-level, there are hints for relationships between health information literacy and socio-economic development, i.e., the wealth of the country (Liobikienė & Bernatonienė, 2018). The effects of education and sex as predictors of Internet use for HIS can be found also in relation to the older population (Eriksson-Backa et al., 2012; Bujnowska-Fedak & Mastalerz-Migas, 2015; Gazibara et al., 2016). However, the results are on the country or city level and are somewhat contradictory.

2. OBJECTIVES

As the Internet has the potential to fulfill health information needs and make people more informed partners of health professionals, it should be confirmed that older individuals can and will use online channels for HIS also in order to guarantee their "successful aging" (Holstein & Minkler, 2003). The main research question of this article, therefore, is: Are there country-specific digital inequalities in online HIS of older individuals? The data on 35 European countries, i.e., on the macro-level, concerning older adults and their use of the Internet for HIS in 2018, i.e., the period prior to the COVID-19 pandemic, are analyzed. First, the present study looks at the country-level, whether older people (and – for comparison – their younger counterparts) generally use the Internet. Medlock et al. (2015) found a positive association between Internet use and preference to use the Internet as a source of health information among older individuals, which needs to be checked on the macro-level. Second, the study investigates whether older Internet users engage in online HIS. Lastly, it is analyzed whether there are groups of older Internet users deprived of online HIS. This study examines the influence of socio-economic and socio-demographic factors such as countries' wealth, individuals' educational level, sex, and – first of all – age, whereby the focus lays on the older population. The proposed research model can be found in Fig. 1.

The concrete definition of "older person" in the literature is not clear, as different research teams work with different age ranges (starting points from 50+ to 65+). Eyeing on available data and in line with other studies (e.g., Hargittai & Dobransky, 2017), this study starts at age 55 and ends (due to data from the official statistics) with age 74. Also, the term "older people" (individuals, adults, etc.) is preferred over "seniors" and "elderlies" because it is the most neutral one and is the standard term in geriatrics (Avers et al., 2011).

There are manifold studies on people's health information behavior (e.g., Fry et al., 2015), especially HIS behavior (e.g., Cline & Haynes, 2001; Nölke et al., 2015; Zimmerman & Shaw, 2020), and there are reports on older individuals' use of the Internet (e.g., Friemel, 2016). However, there is a lack of research on the online HIS behavior of older persons on the macro-level, which is covered in the present article. In line with the aim of this study, the following research questions were formulated:

RQ1: Are there country-specific inequalities in Internet use of older people in Europe?
- RQ1a: How does Internet use vary among older individuals in the European region?
- RQ1b: How do the shares of younger and older individuals using the Internet differ within their respective countries?

RQ2: Are there country-specific inequalities in online HIS of older Internet users in Europe?
- RQ2a: How does Internet use for HIS vary among older Internet users in the European region?
- RQ2b: Do the shares of older Internet users correlate with the shares of older Internet users engaging in online HIS?
- RQ2c: Does a country's wealth correlate with the shares of older Internet users engaging in online HIS?
- RQ2d: How do the shares of older Internet users engaging in online HIS differ from the shares of their younger counterparts within the respective countries?
- RQ2e: How do the shares of older Internet users

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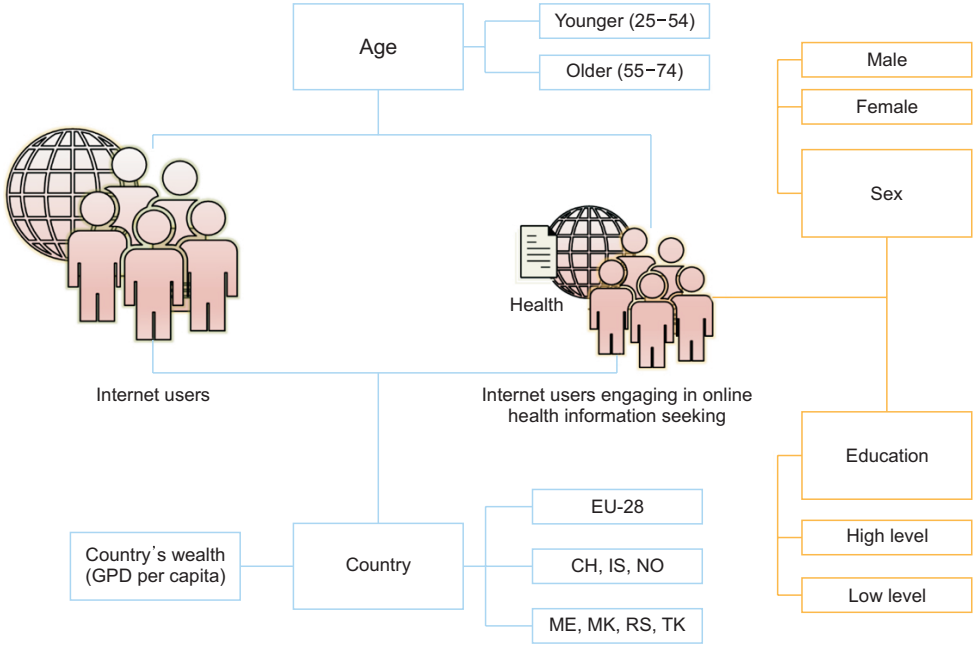

Fig. 1. Proposed research model: Older individuals' health information seeking behavior in context. GDP, gross domestic product; EU-28, 28 members of the European Union in 2018. Refer to Table 1 for the country codes.

engaging in online HIS differ depending on their educational level?

- RQ2f: How do the shares of older Internet users engaging in online HIS differ depending on their sex?
- RQ2g: Are there countries in Europe which exhibit similarities in Internet use for HIS of older Internet users?

3. DATA AND METHODS

To answer the research questions, secondary data analysis was conducted. The data used for this study were retrieved from the Eurostat database (Eurostat, 2020a, 2020b, 2020c, 2020d) and can be found in Table 1. In line with the research model, the following five datasets available in the Eurostat database were extracted: (1) percentage of individuals who used the Internet in the last three months prior to the survey (Internet users) by age (Eurostat, 2020b); and percentage of Internet users who sought health information on the Internet by (2) age, (3) formal education (high, low), (4) sex (male, female) (Eurostat, 2020c), and (5) purchasing power parity adjusted gross domestic product (GDP) per capita as a measure of countries' wealth (Eurostat, 2020d). The data from 2018 were used as a basis for the analysis because the datasets for this year were the most complete at the time of the study. The data from 2017 were taken in the case of Switzerland due to a data gap for 2018. The target group of the study was the older population aged 55 to 74. For comparison, the group of younger individuals aged from 25 to 54 was also used. The population aged 75 and above was not taken into analysis because of the insufficient data for this age group, namely the data were available for four countries only.

A total of 35 European countries were included in the analysis. These are the 28 members of the EU in 2018 (EU-28) followed by Iceland, Norway, and Switzerland, which are non-EU members but belong to the Schengen Area. Additionally, Montenegro, North Macedonia, Serbia, and Turkey were taken into the analysis as four out of five candidate countries to enter the EU. The data on Albania, the fifth candidate country, and Liechtenstein, one more Schengen Area country, were not provided in the Eurostat database for most of the chosen datasets and, hence, could not be included. In certain cases (i.e., in the descriptive analysis of Internet use for HIS by older population depending on the educational level and in the cluster analysis), Montenegro was excluded because of the partial data lack.

To analyze the relations between countries' wealth, Internet use, and Internet use for HIS, a non-parametric Spearman rank correlation was calculated because the variable of countries' wealth did not meet the assumption of normality (significance value of the Shapiro-Wilk test <0.05).

To identify those countries which may exhibit similarities in Internet use for HIS of older persons, cluster analy-

Table 1. Basic data on Internet use and Internet use for health information seeking (HIS) in 2018

Country name	Country code	GDP per capita	Percentage of Internet users[a], %		Percentage of Internet users[a] who used the Internet for HIS, %					
					Age group		Older individuals			
							Educational level		Sex	
			Y	O	Y	O	High	Low	Males	Females
I	II	III	IV	V	VI	VII	VIII	IX	X	XI
Austria	AT	39,400	95	68	62	56	53	56	54	60
Belgium	BE	36,300	94	74	54	50	59	40	44	56
Bulgaria	BG	15,700	79	34	40	50	60	32	39	59
Croatia	HR	19,400	89	46	68	70	72	63	64	75
Cyprus	CY	27,600	95	55	69	72	76	59	70	75
Czechia	CZ	28,000	97	64	65	68	71	75	53	82
Denmark	DK	39,700	99	95	71	62	73	55	57	68
Estonia	EE	25,300	97	72	68	60	60	65	49	67
Finland	FI	34,400	99	86	78	65	78	53	58	71
France	FR	32,100	94	74	52	52	62	43	48	56
Germany	DE	37,800	98	80	74	68	70	65	62	75
Greece	GR	21,100	86	40	65	73	85	53	70	75
Hungary	HU	21,900	90	45	74	81	84	67	76	84
Iceland	IS	40,400	100	97	67	54	66	39	49	59
Ireland	IE	58,600	94	55	61	49	54	40	45	53
Italy	IT	29,700	84	51	50	48	57	40	44	52
Latvia	LV	21,300	94	61	46	46	52	30	35	53
Lithuania	LT	24,800	90	54	71	72	76	76	68	74
Luxembourg	LU	80,900	99	89	57	55	68	41	49	63
Malta	MT	30,400	93	53	73	70	76	63	67	74
Montenegro	ME	14,800	88	33	62	62	-	-	65	56
Netherlands	NL	39,900	97	90	80	71	81	61	69	73
North Macedonia	MK	11,500	85	76	47	51	68	31	45	57
Norway	NO	46,900	99	93	73	57	62	61	51	63
Poland	PL	21,800	90	46	64	67	73	53	59	74
Portugal	PT	23,800	88	43	63	51	62	44	48	54
Romania	RO	20,100	82	39	46	56	71	47	50	62
Serbia	RS	12,200	89	40	57	52	62	32	47	58
Slovakia	SK	22,600	92	50	63	65	71	59	60	68
Slovenia	SI	26,900	91	53	63	60	68	55	52	68

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Table 1. Continued

Country name	Country code	GDP per capita	Percentage of Internet users[a], %		Percentage of Internet users[a] who used the Internet for HIS, %					
					Age group		Older individuals			
							Educational level		Sex	
			Y	O	Y	O	High	Low	Males	Females
Spain	ES	28,100	95	64	68	57	68	45	54	60
Sweden	SE	37,300	94	88	71	60	66	46	50	68
Switzerland	CH	48,100	97[a]	85[a]	70[a]	64[a]	69[a]	52[a]	76[a]	67[a]
Turkey	TK	19,700	79	31	71	54	77	41	55	54
United Kingdom	GB	32,500	98	86	66	50	61	38	45	55
EU-28 mean value		30,900	93	67	63	59	66	47	53	64

Internet users, individuals who used the Internet in the last 3 months prior to the survey conducted by Eurostat; GDP per capita: purchasing power parity adjusted gross domestic product per capita; O, older individuals (aged between 55-74); Y, younger individuals (aged between 25-54); EU-28, 28 members of the European Union in 2018.
[a]Values from 2017.

sis was applied. The chosen method is the agglomerative hierarchical single linkage method, which combines objects into clusters based on the minimum dissimilarity between them (Timm, 2002, p. 533). The Euclidian distance was defined as a proximity (dissimilarity) measure. The dissimilarity matrix was calculated based on five variables: percentage of older Internet users engaging in online HIS in general and depending on their educational level (higher or lower) and sex (male or female) (Table 1, columns VII-XI). As the results of cluster analysis need to undergo validation (Timm, 2002, p. 533) to ensure that data points are not randomly assigned to clusters, multidimensional scaling (MDS) was additionally employed. Therefore, the same proximity matrix was passed to the PROXSCAL module of the SPSS Software. In line with Borg et al. (2018, pp. 77-78), the initial configuration was changed to Torgerson's metric model with 1,000 iterations and a 0.0000001 stress value. Furthermore, visualization resulting from MDS can help to analyze and interpret the data in the proximity matrix (Borg et al., 2018, p. 11).

4. RESULTS

4.1. Country-Specific Inequalities in Internet Use of Older People in Europe (RQ1)

The analysis of data on Internet use in Europe (Table 1, columns IV-V) demonstrated that the second-level digital divides are present for older European population. First, the shares of older people who used the Internet varied greatly between countries, from 31% in Turkey and 33% in Montenegro to 95% in Denmark and 97% in Iceland (Fig. 2; *RQ1a*). Second, the shares of older Internet users differed from the shares of younger Internet users within the countries (*RQ1b*).

In the North and West European regions, older people were the most active in using the Internet. In Southeast countries, on the contrary, less than 50% of older people used the Internet. At the same time, the shares of younger Internet users were high in all countries (79% and above) and differed from country to country less significantly. Consequently, the in-country gaps between the two age groups were the greatest in the Southeast region (up to 55 percentage points [pp] in Montenegro and 49 pp in Serbia), whereas the differences in North countries were the lowest (e.g., three pp in Iceland and four pp in Denmark). This shows that digital inequalities between the two age groups in terms of Internet use can be tackled.

4.2. Country-Specific Inequalities in Online HIS behavior of Older Internet Users in Europe (RQ2)

The analysis of data on Internet use for HIS by older Internet users (Table 1, columns VI-XI) revealed great differences in the European region, with values below the EU-28 mean value of 59% in almost half of the analyzed countries (i.e., 17 out of 35). In Latvia, Italy, and Ireland, the Internet was used for HIS by less than 50% of older Internet users, whereas in the Netherlands, Lithuania, Cyprus, Greece, and Hungary it was used by more than 70%.

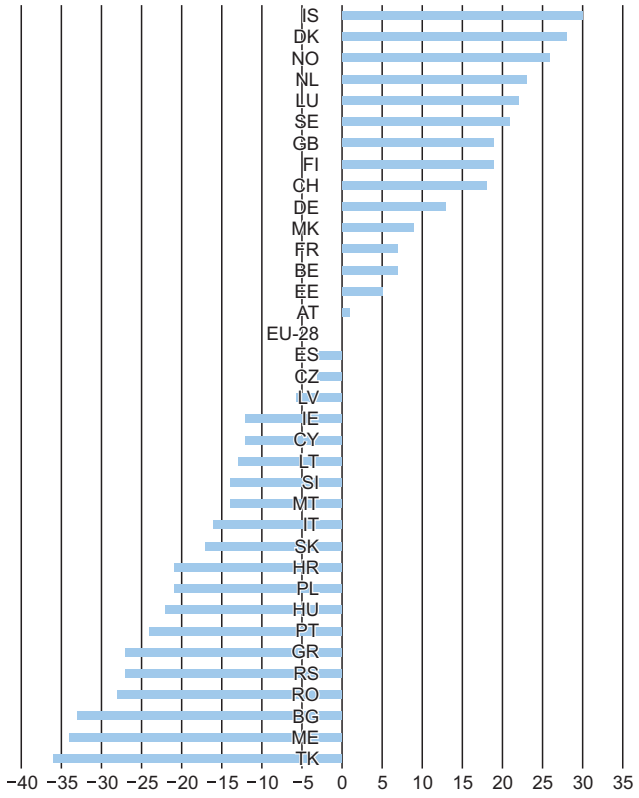

Fig. 2. Percentage of older Internet users in 2018. Deviation from the EU-28 mean value of 67%. EU-28, 28 members of the European Union in 2018. Refer to Table 1 for the country codes.

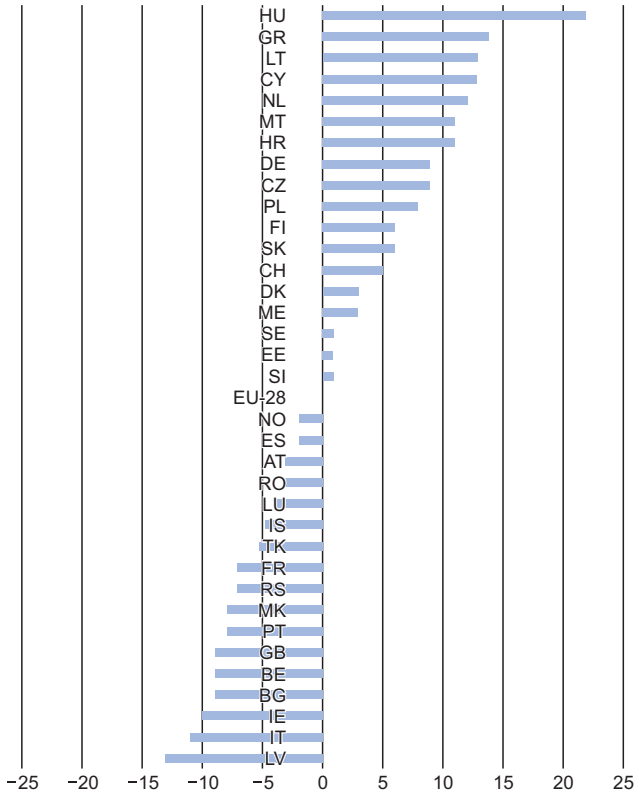

Fig. 3. Percentage of older Internet users engaging in online health information seeking in 2018. Deviation from the EU-28 mean value of 59%. EU-28, 28 members of the European Union in 2018. Refer to Table 1 for the country codes.

Further results on how Internet use for HIS varied among older Internet users (*RQ2a*) are presented in Fig. 3.

To answer *RQ2b*, a correlation of two variables was computed, i.e., between a) the shares of older people who generally used the Internet and b) the shares of older Internet users engaging in online HIS. The analysis resulted in no association ($r_s(33)$=-0.041; effect size according to Cohen (1992); Table 2), showing that the parameters do not affect or depend on each other. For instance, the shares of older Internet users were high in Iceland (97%) and the United Kingdom (86%), but those users engaged in online HIS rather inactively (54% and 50%, accordingly). Contrariwise, the shares of older Internet users can be low, but those users can actively use the Internet for HIS (e.g., older population in Hungary [45% and 81%], Greece [40% and 73%], and Croatia [46% and 70%]). At the same time, both shares can be high as in the Netherlands (90% and 71%), or low – as in Bulgaria (34% and 50%). Interestingly, the correlation between the named variables in relation to the younger generations resulted in a significant moderate (positive) correlation, showing that once younger people are online, they are likely to seek health information on the Internet.

Also, the correlation analysis between countries' wealth and the shares of older online health information seekers resulted in no linear relationship $r_s(33)$=-0.027 (effect size according to Cohen (1992); Table 2; *RQ2c*), meaning that there were both wealthy and rather poor countries where the Internet was actively or inactively used for HIS by older Internet users, e.g., Netherlands (GDP=39,900 and Internet use for HIS=71%), Ireland (GDP=58,600 and Internet use for HIS=49%), Croatia (GDP=19,400 and Internet use for HIS=70%), and Serbia (GDP=12,200 and Internet use for HIS=52%). It is noteworthy that the correlation between countries' wealth and the shares of younger health information seekers was positive and significant, although moderate $r_s(33)$=+0.349, p=0.05 (Table 2).

Focusing on the differences between younger and older Internet users engaging in online HIS (*RQ2d*), one can note that although older individuals seem to have more issues with their health, the shares of younger people using the Internet for HIS were higher than or

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Table 2. Correlations between Internet use, Internet use for health information seeking (HIS), and gross domestic product (GDP) in European countries (N=35; year: 2018)

Correlated variables	Spearman rank correlation	Effect size[a)]
Internet use (older users), % - Internet use for HIS (older users), %	-0.041	No association
Internet use (younger users), % - Internet use for HIS (younger users), %	+0.449*[b)]	Medium association
GDP per capita - Internet use for HIS (older users), %	-0.027	No association
GDP per capita - Internet use for HIS (younger users), %	+0.349**[c)]	Medium association
GDP per capita - Internet use (older users), %	+0.792*[b)]	High association
GDP per capita - Internet use (younger users), %	+0.803*[b)]	High association

[a)]According to Cohen (1992); *[b)]Correlation is significant at the level of 0.01; **[c)]Correlation is significant at the level of 0.05.

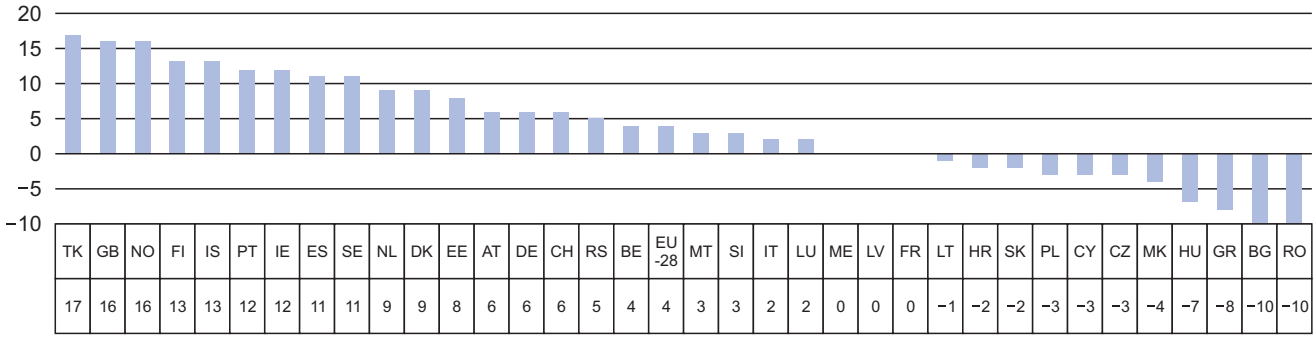

Fig. 4. Differences between younger and older Internet users engaging in online health information seeking within their respective countries (in percentage points). EU-28, 28 members of the European Union in 2018. Refer to Table 1 for the country codes.

equal to the shares of older Internet users engaging in HIS in almost two-thirds of the countries (Fig. 4). However, older individuals in eleven out of 35 analyzed countries sought health information on the Internet more actively than their younger counterparts, i.e., in Romania (-10 pp), Bulgaria (-10 pp), Greece (-8 pp), Hungary (-7 pp), North Macedonia (-4 pp), Czech Republic (-3 pp), Cyprus (-3 pp), Poland (-3 pp), Slovakia (-3 pp), Croatia (-2 pp), and Lithuania (-1 pp). Notably, most of these countries belong to the Central and Southeast regions.

Further analysis of the data on Internet use for HIS by older Internet users with high and low formal educational levels demonstrated in-country inequalities in most countries (Fig. 5; *RQ2e*). The Internet was used for HIS by more than 50% of older Internet users with high education in all the countries. At the same time, less than 50% of older Internet users with low education used the Internet for HIS in 16 out of 34 countries. Consequently, great differences, from nine to 37 pp, were observed between older individuals with low and high educational levels in more than two-thirds of the analyzed countries. However, there were countries where both groups of older individuals were equally or almost equally active, such as Norway (shares with high education=62% vs. low education=61%), Germany (70% vs. 65%), and Lithuania (76% vs. 76%). Moreover, the shares of older Internet users engaging in online HIS with high education were slightly lower than those with low education in Austria (53% vs. 56%), the Czech Republic (71% vs. 75%), and Estonia (60% vs. 65%).

Furthermore, relatively large differences were revealed among older online health information seekers depending on sex (Fig. 6; *RQ2f*). Overall, males were relatively inactive Internet users in the matter of HIS with values starting from 35%. However, that did not refer to the older men in Hungary (76%), Switzerland (76%), Cyprus (70%), and Greece (70%). At the same time, the shares of older women exceeded 50% in all the countries and were higher than those of older men in all but three countries, including Switzerland (shares of older women=67% and men=76%), Montenegro (56% and 65%), and Turkey (54% and 55%).

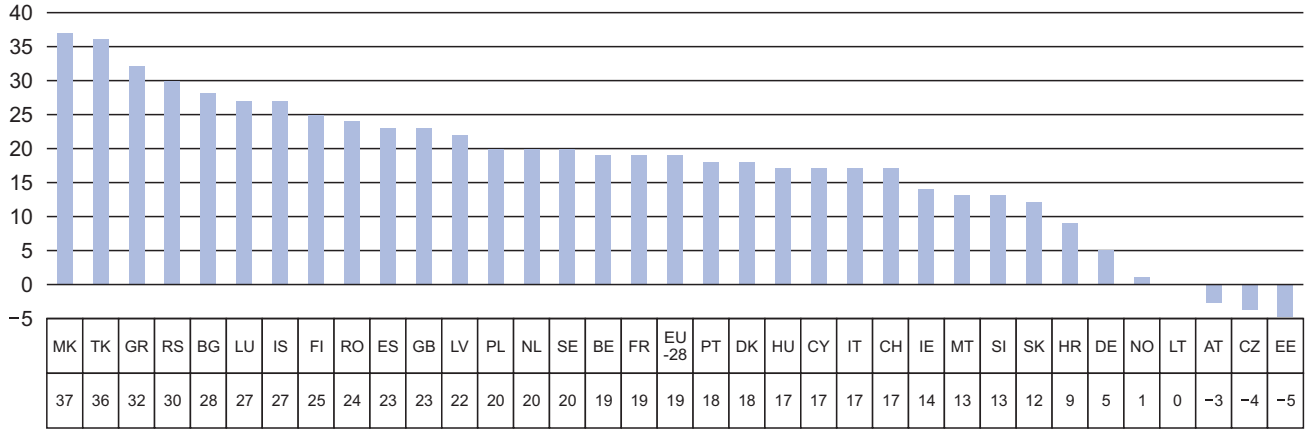

Fig. 5. Differences between older Internet users engaging in online health information seeking with high and low educational levels within their respective countries (in percentage points). EU-28, 28 members of the European Union in 2018. Refer to Table 1 for the country codes.

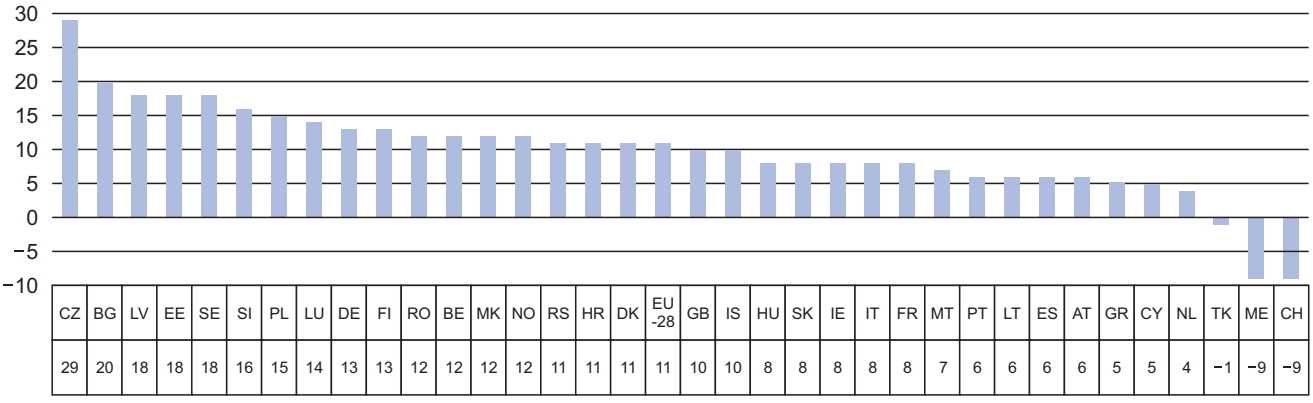

Fig. 6. Differences between older female and male Internet users engaging in online health information seeking within their respective countries (in percentage points). EU-28, 28 members of the European Union in 2018. Refer to Table 1 for the country codes.

To find out whether there are countries that exhibit similarities in Internet use for HIS by older Internet users (*RQ2g*), cluster analysis in combination with the MDS was conducted, revealing four main clusters of countries (Table 3, Fig. 7). The least active older individuals with shares starting from 31% can be found in Cluster A, the largest one. Older Internet users in countries of Clusters B and C can be characterized as moderately active in online HIS, with shares varying from 49% to 67% in Cluster B and 52-78% in Cluster C. Notably, the role of education is hardly evident in Cluster B in comparison to Cluster C. Older Internet users in countries of Cluster D engaged in online HIS most actively. In this cluster, the shares ranged from 53% for older people with low education to 85% for older individuals with high education. The dissimilarity values of the seven countries differed from their nearest neighbors to a great extent, and therefore those countries were not directly assigned to any cluster. Older Internet users in Latvia were found to be the least active in online HIS, whereas in Hungary they were the most active. The older population in Turkey can also be described as rather inactive in HIS and has its nearest neighbor in Cluster A; however, the shares of older individuals with high education (77%) and older men (55%) are higher than in other countries of Cluster A. Older individuals in Austria can be characterized as moderately active, standing between Cluster A and B. Similarly to Hungary, Lithuania had active older Internet users engaging in online HIS and stood out in that older Internet users with high and low education were equally moderately highly active (76% for both groups). Czechia could also be assigned to the most active countries, but older males there were among the least active in Europe (53%).

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Table 3. Clusters of countries exhibiting similarities in Internet use for health information seeking (HIS) of older Internet users identified by cluster analysis combined with multidimensional scaling

Cluster	Countries (country codes)	Shares of older Internet users engaging in online HIS, %				
		Generally	With high education	With low education	Males	Females
A	SE, RO, ES, LU, IS, PT, FR, GB, BE, IT, IE, RS, MK, BG	48-60	54-71	31-47	39-54	52-68
B	EE, NO	57-60	60-62	61-65	49-51	63-67
C	PL, SK, FI, DK, SI	60-67	68-78	53-59	52-60	68-74
D	DE, HR, MT, CY, NL, GR	68-73	70-85	(53) 59-65[a)]	62-70	73-75
Outliers						
Nearest cluster	Outlier	Nearest neighbor	Generally	With high education	With low education	Males	Females
A	LV	BG	46	52	30	35	53
A	TK	ES	54	77	41	55	54
B	AT	NO	56	53	56	54	60
D	CH	CY	64	69	52	76	67
D	CZ	DE	68	71	75	53	82
D	LT	MT	72	76	76	68	74
D	HU	NL	81	84	67	76	84

Refer to Table 1 for the country codes.
[a)]For one country (i.e., Greece) the value compises 53%; the values for the rest of the countries range between 59% and 65%.

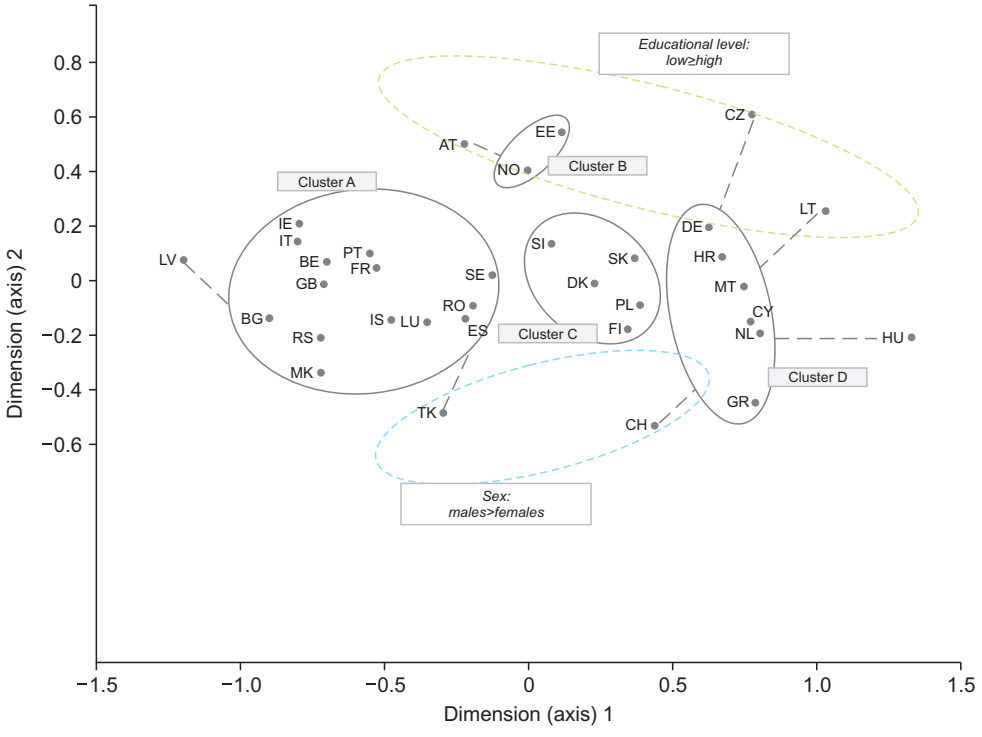

Fig. 7. Results of cluster analysis combined with multidimensional scaling. 34 countries classified into four clusters including seven outliers. Countries with the least active older Internet users engaging in online health information seeking are on the left side, and the most active are on the right side. Refer to Table 1 for the country codes.

5. DISCUSSION

In this study, Internet use by older individuals in 35 European countries was analyzed to determine whether digital inequalities (i.e., the second-level digital divides) are present in the older population. The findings show that although the average percentage of the European population using the Internet is high, digital inequalities between countries persist. This becomes especially the fact when comparing the shares of older Internet users in North and Southeast European countries. König et al. (2018) also reported such division of countries, which can be explained by countries' wealth, because the richer a country, the higher the level of Internet use. This is applicable to both older and younger generations.

The existence of country-specific digital inequalities was further confirmed by the analysis of online HIS behavior of older Internet users. The findings demonstrated that generally gaps exist between European countries, but, unlike the findings on general Internet use, it turned out that countries' wealth does not correlate with online HIS as there are both wealthy and rather poor countries where older Internet users actively or rather inactively engage in online HIS. Previous results on the positive influence of countries' wealth on online HIS reported by Liobikienė and Bernatonienė (2018) are thus extended. On the macro-level, it was also only partially confirmed that previous Internet use by older population contributes to the active engagement in online HIS (Medlock et al., 2015), as countries were found where the shares of older Internet users were high, but those users did not tend to actively use the Internet for HIS (e.g., Iceland, United Kingdom).

A comparison of older and younger Internet users engaging in online HIS additionally confirmed the presence of digital inequalities, not only between countries but also within them. Whereas younger adults are traditionally considered to be more active Internet users and this conforms to most countries also in matters of online HIS, in this study a group of countries (viz., Bulgaria, Romania, Greece, Hungary) can be observed where older Internet users engage in online HIS more actively than younger people. Remarkably, all those countries have a relatively low percentage of older Internet users (45% or less), which could serve as an explanation for the high rates of online HIS. As people with higher education generally tend to be online (van Deurson & van Dijk, 2014), this category of people probably forms the majority of older Internet users in those countries. With that, higher education is treated as a positive predictor of higher levels of health information literacy (Eriksson-Backa et al., 2012), which results in higher rates of online HIS, as people with better health knowledge are more interested in using the Internet as a source of health information (Estacio et al., 2019).

Directed by the aims of this study, the role of education and sex in online HIS behavior of older Internet users was examined. Along with the age factor, the results on the role of education and sex were also slightly mixed. Generally, higher education positively influences online HIS, which was previously confirmed by Eriksson-Backa et al. (2012) and by Bujnowska-Fedak and Mastalerz-Migas (2015). The overall importance of high education can be explained by its parallel association with better Internet skills (van Deursen & van Dijk, 2010) and with higher levels of information literacy (Eriksson-Backa et al., 2012; Estacio et al., 2019). Thus, older adults who already use the Internet efficiently will be probably more capable of using it for HIS. In addition to this, older individuals who have better knowledge and understanding of health issues perceive the Internet and online information as more useful and are generally more likely to start using the Internet for HIS (Eriksson-Backa et al., 2012; Estacio et al., 2019). However, the role of education was not proved in Austria, the Czech Republic, Estonia, and Lithuania, where older Internet users with low and high educational levels are equally interested in online HIS.

Concerning the sex differences among older Internet users, although older men are generally more active in using the Internet (Friemel, 2016), this study showed that older women are more active in online HIS. This can be interpreted by previous findings that older women are less critical of health information on the Internet (Erikson-Backa et al., 2012). In addition to this, generally, women consider the Internet to be a more efficient method for HIS and evaluate online information as more useful. Also, the Internet is viewed by women as an "efficient method of searching (easy, quick, always available, capable of enhancing search success)" (Bidmon & Terlutter, 2015). Furthermore, women may seek health information not only for themselves but also for other family members due to their well-established social role as family caregivers (Bidmon & Terlutter, 2015; Nölke et al., 2015). Not less important is the fact that women are generally more health-conscious, which may also lead to higher use of online information (Erikson-Backa et al., 2012; Nölke et al., 2015). However, sex differences in online HIS among older adults were not observed in Montenegro, Switzerland, and Turkey.

The cluster analysis and MDS reaffirmed the existence of inequalities in online HIS in Europe, revealing four

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main clusters of countries exhibiting similar online HIS behavior: from least active through moderately active to the most active. Seven countries demonstrated unique online HIS behavior. Most countries were assigned to the least active group, showing that the Internet as a source of health information should be better promoted among the older European population. With regard to the older Internet users most active in online HIS, which were found to reside in Hungary, one should take into account that although older Internet users in Hungary are active in online HIS, the majority of the population is still excluded from the benefits of online HIS, as the percentage of older Internet users there is low.

Several limitations should be considered when interpreting the results of this study. Although previous research emphasizes the role of socio-demographic factors as determinants of digital divides, HIS behavior, and online HIS behavior, the phenomenon is more nuanced. Psychological factors (such as character traits, personal trust in online information, self-efficacy, and internal locus of control), as well as previous life experience, family context, and access to social and institutional support systems (e.g., availability of health care services and their costs), should be considered for a deeper understanding of older people's online HIS behavior (Eriksson-Backa et al., 2018; Longo, 2005; Quan-Haase et al., 2016; Schreurs et al., 2017). This further relates to another particularity of the research on online HIS by older adults – the heterogeneity of the group. Older population should not be viewed as a homogenous group of "laggards," but rather one should distinguish between different types of Internet and online health information users (Quan-Haase et al., 2018). The importance of an individual or group-specific approach is additionally supported by studies criticizing techno-optimism (Cid et al., 2020) and should not be ignored by health service providers, health organizations, governments, libraries, and other institutional bodies promoting and implementing online HIS behavior and health information literacy. Another factor which appears to naturally influence online HIS behavior, but was not analyzed in this study, is individuals' health status. Previous studies reported mixed results (Bujnowska-Fedak & Mastalerz-Migas, 2015; Eriksson-Backa et al., 2012; Liobikienė & Bernatonienė, 2018), but they referred to a small number of countries and only partially to older individuals. Therefore, an additional study on the macro-level could give a better overview of how online HIS behavior depends on health status.

6. CONCLUSIONS AND FUTURE RESEARCH

This study provides an overview on the problem of digital inequalities in the European region, focusing on Internet use for HIS and older population. The analysis of data on 35 countries proved that the older population persists in being partially excluded from Internet use in most of the analyzed countries. Moreover, once older individuals start using the Internet, it does not guarantee that they will use it to fulfill their health information needs. Older Internet users are principally in a disadvantaged position in terms of online HIS in comparison to their younger counterparts. Also within the older population itself, unequal use of the Internet for HIS can be observed depending on the educational level and sex. The study suggests that more efforts are required to make Internet use for HIS more attractive for older adults and especially for older adults with low educational levels, as well as for older men. There is a practical implication of the results for health and social care knowledge services, libraries, and national health institutions: Older people's awareness of online health information and their health information literacy should be strengthened to optimize their health behavior and to minimize digital divides. Furthermore, this study indicates that attention should be paid to regional differences, as the shares of older Internet users in the South and Southeast European countries remain low and, consequently, the older population in this region is automatically excluded from the benefits of the Internet, including access to online health information. Additionally, the global COVID-19 pandemic declared in 2020 (Cucinotta & Vanelli, 2020) can only reinforce the importance of online HIS among older populations. The use of the Internet for HIS during and after the pandemic should be further investigated.

Although this study shows results on general trends in Internet use and for HIS in particular, some exceptions were found, some of which contradict previous research. The role of education was not proved in Lithuania, Austria, the Czech Republic, and Estonia, and the role of sex was not demonstrated in Montenegro, Switzerland, and Turkey. Therefore, studies on countries' levels are needed to explain exceptional cases. Furthermore, countries with a high level of Internet diffusion among the older population but low rates of Internet use for HIS (viz., Iceland, Luxembourg, United Kingdom, Belgium, France, and Sweden) represent an additional point of interest. In times of medical personal deficiency, it should be understood why older people, who are already online, do not actively

use the Internet for HIS when it can provide useful information about preventative health care as well as particular illnesses and diseases. At the same time, as the health information found on the Internet can affect individuals' decisions not only positively but also negatively, future research could control how the older population uses obtained information. This becomes important in countries with high shares of older Internet users engaging in online HIS (i.e., Hungary, Greece, Lithuania, Netherlands, Germany) but even more important in countries where older people with low educational levels are active in online HIS (viz., Lithuania, Czech Republic, Hungary, Germany) as lower educational levels are associated with lower levels of health information literacy.

What are the main findings of our study? There are inequalities in online HIS depending on age: Older Internet users are less active in seeking online information, although they experience more health-related problems. Once an older person is online, it does not guarantee that the person will use the Internet for HIS. Older Internet users in almost half of the analyzed countries are rather inactive in online HIS; however, there are country-specific differences concerning sex and education. Since the shares of older Internet users in Southeast European countries remain low, the older population in these countries is almost excluded from online HIS. Health and social care knowledge services, libraries, and national health institutions are called upon to strengthen older people's health information literacy. Due to the low levels of Internet use for HIS among older individuals in Southeast European countries, these countries should be given special attention in future research. Further research is also needed on those countries with high shares of older Internet users but low proportions of online health information seekers, as well as on the countries in which older people with lower education levels are actively involved in online HIS.

CONFLICTS OF INTEREST

No potential conflict of interest relevant to this article was reported.

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