Jacek Pyżalski
https://orcid.org/0000-0001-5817-276X
Adam Mickiewicz University in Poznań, Poland
pyzalski@amu.edu.pl

Natalia Walter
https://orcid.org/0000-0002-2347-9312
Adam Mickiewicz University in Poznań, Poland
natalia.walter@amu.edu.pl

Agnieszka Iwanicka
https://orcid.org/0000-0003-1176-6725
Adam Mickiewicz University in Poznań, Poland
iwanicka@amu.edu.pl

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Abstract

Research objectives: This study examines the role of digital skills in the personal and social development of young people. It aims to measure and understand these skills among the younger generation, while identifying ways to improve their development.

Research method: The data comes from the ySkills project under Horizon 2020, a longitudinal study conducted in six countries, including Estonia, Finland, Germany, Italy, Poland and Portugal. Specifically, we have analyzed data on Polish youth from 2021 and 2022. The sample includes 609 individuals aged 11 to 18, i.e. in the entire age range. Self-report scales assess

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digital skills, including technical abilities, information handling, interaction, communication and content creation. Results from the entire first wave in Poland (N=1161) are also included.

Context: In today's digital world, digital skills are essential for personal development and social engagement. This study focuses on Poland, where digital literacy is crucial for young people. It aims to shed light on the digital competences of Polish youth.

Findings: The study found that teenagers use the Internet mainly for social interaction and are comfortable using digital communication tools, such as email, instant messaging and social media. However, it stresses the need for further education in evaluating information available on the Internet and identifying reliable sources. Gender differences were observed, with boys demonstrating greater skills in navigating and processing information, which highlights the need for additional research to address gender disparities in digital skills.

Conclusions and recommendations: This study highlights the importance of digital skills for young people's development and integration into society. To bridge the digital literacy gap, we recommend targeted educational interventions that improve critical thinking and source evaluation skills. Further research and objective assessments are key to comprehensively eliminating the gender gap in digital skills. It is important to be aware of the limitations of the study, including the reliance on self-reporting and the potential impact of COVID-19 on the sample. Future efforts should aim for more robust and objective means of assessing digital skills among young people in Poland.

*Keywords***:** digital communication skills, digital information skills, age-related changes, Polish adolescents, longitudinal study

Introduction

This article is based on an analysis of data from the Horizon 2020 ySkills project, with two phases of longitudinal research in Poland in 2021 and 2022. The study focused on adolescents aged 12/13 to 18, thus covering

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both early (12–14/15) and late (15–18) adolescence. During early adolescence, significant changes occur in the parent-child relationship, resulting in a shift towards a more egalitarian and partnership-based relationship between the teenager and their parent/s. Adolescents spend less time with their parents and an increasing amount of time with their peers. The peer group plays a crucial role in the development of interpersonal competencies, by providing opportunities for interaction with individuals of similar status, fulfilling the need to belong and enhancing self-esteem (Piotrowski et al., 2014).

Throughout adolescence, social relationships become increasingly important, and positive relationships with family, peers and teachers are crucial for healthy development (Somerville, 2013; Crone & Dahl, 2012). Communication skills, both online and offline, become particularly sinificant at this stage. Adolescence also brings cognitive changes, including the development of formal thinking, specifically hypothetical and deductive reasoning (Piotrowski et al., 2014b). Adolescents actively develop their information skills and display eagerness to search and verify information. Information and communication technologies (ICTs) play a key role in adolescents' lives, as they support everyday communication and provide access to information and entertainment (Pyżalski et al., 2019).

With the development of technology, relationships have changed in contemporary society. Online platforms and mobile applications are widely used for initiating, maintaining, and transforming relationships, which makes communication one of the most prevalent online activities among youth (Smahel et al., 2020). Therefore, this article focuses primarily on the digital information and communication skills that teenagers acquire and improve at this stage of development.

The central notion of the ySkills project and this article revolves around digital competences, with a particular focus on digital skills. Competences encompass knowledge, skills and attitudes, while skills are measurable and necessary for applying knowledge to tasks and problem-solving situations (Walter & Pyżalski, 2021). Digital skills are defined based on objectives, audiences, and context, with the International

Telecommunication Union (ITU) defining them as the ability to use information and communication technologies (ICT) effectively to achieve beneficial outcomes while minimizing potential harm (ITU, 2018).

Digital competence, as recognized by the European Commission, involves the confident, critical, and responsible use of digital technologies to learn, work and participate in society (Council Recommendation on Key Competences for Life-long Learning, 2018). It includes skills and issues such as information and data literacy, communication and collaboration, media literacy, digital content creation, security, intellectual property, problem solving and critical thinking. The European Commission's Digital Competence Framework (DigComp 2.2) identifies five areas of digital competence: information and data literacy, communication and collaboration, digital content creation, security, and problem solving (Vourikari, Kluzer, Plunie, 2022). In addition, these areas overlap with the concept of 21st century skills, which places considerable emphasis on soft digital skills, which are considered crucial for the future labor market (van Laar et al., 2017).

The concept of digital competences is understood in a similar way in Polish studies. For example, Batorski et al. (2012) believe that the concept of digital competence covers a broad set of skills that determine the efficient and informed use of new technologies and active participation in the life of the information society. These include digital and information competences. Plebańska (2021) additionally notes that a digitally competent person is now expected to think independently, take initiative, solve problems creatively and use technology in a way that fits in with the current labor market situation or, more broadly, the current industrial revolution. She also pays attention to digital emotional intelligence.

According to Ester van Laar and co-authors (2018), digital skills include technical skills, information management, communication, collaboration, creativity, critical thinking and problem solving. In the ySkills project, we define them as the ability to use information and communication technologies in ways that help individuals achieve beneficial, high-quality outcomes in everyday life for themselves and others, and reduce potential harms associated with the more negative aspects of digital

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engagement (Donoso et al., 2020, p. 9). Based on previous research and literature analysis by van Deursen and Helsper (2018) and van Deursen, Helsper and Eynon (2016), a conceptual model has been created with indicators corresponding to four dimensions of digital literacy. These dimensions include functional and critical aspects and are as follows (Helsper et al., 2021):

1. Technical and operational skills, or proficiency in managing and operating ICT, including the technical skills of using devices, platforms and applications. It entails knowledge of using buttons, adjusting settings and programming.
2. Information navigation and processing skills, or the ability to critically search and select digital sources of information. It also includes the ability to critically evaluate information.
3. Communication and interaction skills, or the ability to use various digital media and technological features to interact with others, build networks and critically evaluate the impact of communication and interpersonal interactions.
4. Content creation and production skills, or the ability to create high-quality digital content, comprehend how it is produced and published, and how it impacts others.

As mentioned earlier, in view of the developmental characteristics of adolescents, communication skills, as well as information navigation and processing skills are the key themes in our analysis.

The Importance of Information and Communication Skills in Youth Development – Selected Results of a Study of European and Polish Adolescents

Young people use information and communication technologies extensively, and digital media can facilitate the development and maintenance of their social relationships. However, while these technologies can be a valuable source of information, they can also cause anxiety, provide

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misinformation and disrupt one's well-being. Additionally, the internet can be beneficial, as it provides young people with a vast source of information and tools to assess their credibility and biases, by using search engines and critical thinking methods. These skills can help them learn effectively, make informed decisions and succeed in various aspects of life.

Developing digital skills also enables young users to be independent and proactive in identifying and avoiding risks associated with their online activities. According to the EU Kids Online research concept, young people play both the role of recipients and actors in online interpersonal relationships and digital tasks (Pyżalski, 2019). Moreover, using technology requires a combination of various skills, such as translation, innovation, learning, communication and collaboration (Elphick, 2018).

Despite commonly held beliefs, research shows that young people's digital skills are not always as strong as they are given credit for. (European Commission, 2012).

ITU's 2018 *Measuring the Information Society* report presents information from the European Commission's 2016 data on the distribution of digital skills among children aged 4–14 in eight European countries, namely the UK, Poland, Spain, Germany, Sweden, France, Italy and the Netherlands. The data was collected by asking parents to assess their children's social, operational, information navigation, mobile and content creation digital skills. The findings reveal a diverse landscape, with Polish children scoring highest on information navigation skills, but lower on mobile skills and content creation skills. Moreover, parents from all countries surveyed reported lower levels of digital skills related to content creation compared to other digital skills investigated.

According to the Polish part of the EU Kids Online survey conducted by Pyżalski et al. (2019), only 37% of young people aged 11–17 rate their online information search skills as strong. However, 66% of young people know what information should and should not be shared on the internet. The survey also found that less than 16% of young people feel that they can be themselves online, while slightly less than 17% communicate differently online than in face-to-face meetings. Additionally, only 7% discuss personal matters online that they do not discuss offline.

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Common findings from all countries participating in the study are as follows: 1) a high percentage of children and adolescents use social media for a variety of communication activities, 2) children rate their online communication skills highly but lack critical evaluation of online interactions, 3) children rarely meet offline with people they meet online, and 4) families play an essential role in supporting children's digital information and communication skills (Smahel et al., 2020).

The *Teenagers 3.0* report by Lange (2021) confirms that the internet is a popular tool for accessing information and doing homework, with 64% of students using it for studying. Furthermore, 27.3% of students collaborate with their peers online when doing homework several times a week.

Developing information and communication competencies in children and young people is an important educational goal today. Communication skills are fundamental to learning, emotional development and establishing and maintaining social relationships, both at school and later in the workplace. Strong communication skills enable individuals to adapt to an increasingly diverse social environment while ensuring a good quality of life. Poor communication skills, on the other hand, can exacerbate personality problems, distrust of others, social isolation (which can affect mental health), and even risky behavior, especially at a young age (Martinek & Hellison, 2016; Teryushkova, 2016). The internet provides children and adolescents with an online space to interact with others, exchange views and ideas, and meet people who think like them. Research shows that individuals who are comfortable with online communication can also form deep offline relationships (Bargh et al., 2002). The psychological well-being of children and adolescents increasingly depends on their existence in digital spaces and on having a circle of friends and acquaintances online. The influence of online and offline peers is critical to the development of children's and adolescents' communication and information skills.

The literature uses the term "cyber-socialization" to describe learning how to function in the digital world, including communicating with others through new technologies. Cyber-socialization is gaining prominence

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as more and more people, especially young people, spend time online and use digital media to communicate, study, work or entertain themselves. Researchers suggest that, on the one hand, ICT can have a positive impact on communication, the development of information competencies, and the well-being of individuals (Verduyn et al., 2017; Timnea et al., 2018). On the other hand, this communication can effectively disrupt, distort and violate the mental well-being of internet users (Hudimova, 2020; Valtonen et al., 2021). One factor in such disruption may be the lack of non-verbal communication that is characteristic of text-based digital media (e.g., instant messaging), which can have a disruptive effect on the understanding of emotional signals conveyed in face-to-face communication, thereby limiting the mastery of critical social skills (Giedd, 2012; Knapp & Hall, 2010).

Methods

These results are partial outcomes of the larger ySkills project (ySkills.eu – European Union's Horizon 2020 Research and Innovation Programme under grant agreement no. 870612), which focuses on the digital skills of young people across the European Union.

A standardized online questionnaire prepared by the ySkills research consortium was distributed in 6 countries (Estonia, Finland, Germany, Italy, Poland and Portugal) between April and November 2021, and then repeated with the same sample after roughly a year (in 2022). Data was collected in cooperation with high schools. Convenience sampling was used. However, participating schools were selected based on their socioeconomic status to ensure a diverse sample. Students completed the questionnaires individually during school hours (either traditionally or online depending on the circumstances of the pandemic at the time and in the country). Informed consent was obtained from all respondents and their legal guardians in all participating countries, and the ethics committee issued a positive decision. The questionnaire was standardized across all countries and was presented in the language of each country.

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The questionnaire in each country was subjected to cognitive testing and piloting.

The article is limited to results on a sample of Polish adolescents. There were 609 participants in both waves of the survey. The sample consisted of 292 boys (47.9%), 301 girls (49.4%) and 16 participants who did not indicate their gender (2.6%).

In the first stage, the age of participants ranged from 11 to 16 years old. 4.1% of participants were 11 years old, 12.6% were 12 years old, 21% were 13 years old, 15.8% were 14 years old, 23.5% were 15 years old, and 23% were 16 years old). We report both results from the first wave (N=1161) (sample statistics are shown in the corresponding tables) and comparative results from the two waves. In the article, we present both the outcomes of the entire skill subscales (as described below in the methodology section) and the results for individual items. The t-test for independent variables was used to describe comparisons between subgroups in one wave, and the t-test for dependent variables when comparing results between two waves.

Digital Skills Scales

In the project, we measured four dimensions of digital skills, as described in the introduction (technical and operational skills, information navigation and processing, interaction and communication, content creation and production).

Data for the four dimensions of the digital skills scales were transformed as follows:

Those who answered "I don't understand what you mean by that" were assigned a score of 0. Thus, answers about individual skill received scores ranging from 0 to 6, with "I don't want to answer" options (DWTA) marked as missing (-99).

To calculate the high skill level, the number of items for which respondents reported the strongest skill (i.e., 5 "Very true for me") was counted for each dimension. This procedure was repeated for the overall

skill scale, including a separate programming skill score. High skill scores were divided by the number of a person's answers in a given category, excluding items with DWTA answers. This meant a score of 0 if the person had no strong skills, 0.5 if they had half of the strong skills, and 1 if they had all of the strong skills.

Cases were excluded if they had a missing score (including DWTA) in three or more items in separate skill categories. For the overall skill scale, anyone excluded on a separate category was also excluded from the overall skill scale.

Because some individuals gave fewer than six answers on separate skill scales, the proportional scores were irregular, resulting in multi-modal distributions with several peaks. To prepare the scales for analysis, a smoothing procedure was applied. Scores of .20 were divided into scores of .1666 (1/6), scores of .25 into .333 (2/6), .40 into .50 (3/6), .60 into .666, .75 into .666 and .80 into .8333.

All items were qualitatively validated through cognitive interviews, and the composite scales showed good statistical properties (acceptable levels of skewness and kurtosis), as well as high levels of reliability (alpha above 0.70 for all scales).

Additionally, the frequency of digital communication with peers and parents was measured using a scale with the following cafeteria: *Never, Several times, At least once a week, Daily or almost daily, Several times each day, Almost all the time.*

Results

In 2021, the first phase of the survey was carried out among teenagers from six European countries, including Poland. The Polish sample consisted of 1,161 (N=1161) participants between the ages of 11/12 (sixth grade of primary school) and 16/17 (second grade of secondary school). During the survey, young people were asked about two main ICT areas. Our analysis started from frequency of digital communication with people who are important in teenagers' lives. Firstly, we asked about their

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communication practices via the Internet with different audiences. Secondly, we sought to identify key aspects of communication skills and information search and processing skills. As shown in Table 1, the adolescents surveyed in this study mainly engage in online communication with their peers. Specifically, 75.9% of the respondents communicate online with their acquaintances/friends at least once a day. In contrast, 52.2% of the teens surveyed communicate online with their parents/guardians on a daily basis.

Table 1. Frequency of digital communication of Polish teenagers with peers and parents (guardians) (N=1161).

		I communicate with my friends (e.g., via Messenger)		I communicate with my parents or guardians (e.g., via Messenger)	
		n	%	n	%
Never		19	1.6	70	6.0
Several times		58	5.0	167	14.4
At least once a week		65	5.6	179	15.4
Every day or almost every day		252	21.7	268	23.1
Several times each day		286	24.6	189	16.3
Almost all the time		344	29.6	149	12.8
Missing	Missing value	84	7.2	82	7.1
	I do not know	26	2.2	35	3.0
	I prefer not to say	27	2.3	22	1.9

The digital communication skills of the surveyed youth are summarized in Table 2.

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Table 2. Self-assessment of communication skills among Polish teenagers (N=1161).

	Depending on the situation, I know what medium or tool to use to communicate with someone (e.g., make a call, send a WhatsApp message, send an email).		I know when I should mute or turn off video in online interactions.		I know which photos of me and information about me it is OK to share online.		I know when it is appropriate and when it is not appropriate to use emoticons (e.g. smileys, emojis), initialisms (e.g., LOL, OMG) and capital letters.		I know how to report negative content about me or the group I belong to.		I know how to recognize that someone is being bullied online.	
	n	%	n	%	n	%	n	%	n	%	n	%
I don't understand what you mean by this	24	2.1	24	2.1	32	2.8	14	1.2	43	3.7	29	2.5
Not at all true in my case	42	3.6	27	2.3	30	2.6	37	3.2	39	3.4	50	4.3
Not very true in my case	12	1.0	15	1.3	13	1.1	21	1.8	56	4.8	102	8.8
Neither true nor untrue in my case	23	2.0	52	4.5	59	5.1	63	5.4	146	12.6	363	31.3
Mostly true in my case	200	17.2	220	18.9	245	21.1	264	22.7	313	27	301	25.9
Very true in my case	817	70.4	778	67.0	728	62.7	713	61.4	503	43.3	254	21.9
Total	1118	96.3	1116	96.1	1107	95.3	1112	95.8	1100	94.7	1099	94.7
Missing · Missing value	18	1.6	21	1.8	24	2.1	20	1.7	20	1.7	19	1,6
Missing · I don't know	25	2.2	24	2.1	30	2.6	29	2.5	41	3.5	43	3.7
Missing · Total	43	3.7	45	3.9	54	4.7	49	4.2	61	5.3	62	5.3
Total N	1161	100	1161	100	1161	100	1161	100	1161	100	1161	100

Regarding digital skills in the area of information navigation and processing, in the first wave of the survey, participants answered questions about their individual skills, as shown in Table 3.

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Table 3. Self-assessment of information navigation and processing skills among Polish teenagers (N=1161).

		I know how to choose the best keywords for online searches		I know how to find the site I visited before		I know how to find information on a website, no matter how it is designed		I know how to use the advanced search functions of search engines		I know how to check if the information I find online is true		I know how to figure out if a website can be trusted	
		n	%	n	%	n	%	n	%	n	%	n	%
I don't understand what you mean by this		51	4.4	17	1.5	43	3.7	87	7.5	25	2.2	28	2.4
Not at all true in my case		33	2.8	37	3.2	42	3.6	58	5.0	48	4.1	47	4.0
Not very true in my case		43	3.7	20	1.7	83	7.1	178	15.3	111	9.6	91	7.8
Neither true nor untrue in my case		138	11.9	48	4.1	244	21.0	280	24.1	273	23.5	191	16.5
Mostly true in my case		431	37.1	325	28.0	396	34.1	289	24.9	400	34.5	376	32.4
Very true in my case		431	37.1	677	58.3	310	26.7	229	19.7	255	22	387	33.3
Total		1127	97	1124	96.8	1118	96.3	1121	96.6	1112	95.8	1120	96.5
Missing	Missing value	16	1.4	20	1.7	18	1.6	19	1.6	21	1.8	17	1.5
	I don't know	18	1.6	17	1.5	25	2.2	21	1.8	28	2.4	24	2,1
	Total	34	2	37	3.2	43	3.7	40	3.4	49	4.2	41	3.5
Total N		1161	100	1161	100	1161	100	1161	100	1161	100	1161	100

After conducting the second wave of the survey in 2022, we compiled the findings from the adolescents who took part in both phases. This is the percentage of strong skills in a specific category, calculated on the basis of at least 3 items. The process of calculating this indicator is described in the *Methods* section of the article. A statistically significant increase in the mean was observed in almost all categories, with the exception of programming

skills. Of particular note is the improvement in communication and inter-action skills, as well as information skills.

Table 4. Longitudinal comparisons of self-assessment of digital skills measured in two waves (*t-test* results*)

	I wave		Wave II		p (*t-test* for dependent groups)	Cohen d
	M	n	*M*	n		
Technical and operational skills	0.51	579	0.56	579	p<0.001	0.302
Programming skills	0.14	573	0.14	573	n.s.	
Information navigation and processing	**0.34**	**583**	**0.37**	**583**	**p<0.001**	**0.308**
Communication and interaction skills	**0.57**	**577**	**0.61**	**577**	**p<0.01**	**0.312**
Content creation and production skills	0.34	568	0.37	568	p<0.01	0.311
Digital skills (percentage of strong skills in all categories)	0.35	557	0.38	557	p<0.001	0.171

During the first wave of the survey (all teenagers), a statistically significant difference in mean scores was found between boys and girls. In particular, boys outperformed girls in the category of information navigation and processing skills (*M=0*.42 in boys, *M=0*.26 in girls; p<0.001), as well as in the category of communication and interaction skills (*M=0*.57 in boys, *M=0*.56 in girls, p<0.01). In the second wave, boys outperformed girls in the category of information navigation and processing skills (M=0.42 in boys, M=0.26 in girls; p<0.001). In the second wave of the survey, boys continued to score higher in information literacy (M=0.45 in boys, M=0.31 in girls; p<0.001), but there were no statistically significant differences in communication skills.

Discussion

The study revealed that Polish teenagers use the internet mainly to communicate with their peers, with 75.9% of them interacting with their friends on a daily basis, and only 52.2% communicating with their parents

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on a daily basis. This is in line with the developmental needs of adolescents, as positive peer relationships strengthen their social bonds, safety, self-esteem and social skills (Piotrowski et al., 2014). Technology has transformed relationships, with online platforms and mobile apps being common tools for initiating, maintaining and transforming relationships, particularly among young people (Smahel et al., 2020).

Polish adolescents exhibit strong digital communication skills, with over 87% of them declaring proficiency in using various digital tools. They are able to use emoticons, internet slang and acronyms appropriately, recognize online bullying, and report negative content. This is consistent with previous studies showing increased use of technology and better handling of digital media among young people (Batorski, 2015; Pyżalski, 2019). However, critical evaluation of online information and distinguishing between credible sources is an area where confidence is lower. Young people may lack critical thinking skills and resources to verify the accuracy of information (Swanson et al., 2017). OECD's PISA findings indicate that less than 10% of students can differentiate between fact and opinion (Schleicher, 2019).

Higher indicators of individual digital competences are associated with the age of the respondents. This suggests that children and teenagers are gradually becoming more proficient in using technology. This phenomenon can be attributed to their exposure to more advanced media technologies and more frequent ICT use, as well as the influence of their school education. It is worth highlighting that the overall results on the level of digital skills (percentage of strong skills across all categories) did not show significant improvement during the second wave of the survey. However, this does not mean that individual competencies were not rated higher by the respondents compared to previous assessments; rather, they did not consistently reach the highest level to a greater extent. Further analysis will be necessary after the next wave of surveys to delve deeper into this issue.

In terms of gender differences, boys outperformed girls in information navigation, processing and communication skills in the first wave of the study. In the second wave, boys maintained higher information

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literacy scores, while communication skills showed no significant differences. These findings underscore the need for further research on gender differences in digital skill development. Self-report questionnaires suggest greater confidence in digital skills among boys, but objective performance tests yield inconsistent results. Differing cultural norms and individual preferences may contribute to different strengths in digital skills between genders (Haddon et al., 2020).

Overall, Polish teenagers value their digital communication skills, particularly with their peers. While they navigate and search the internet effectively, additional education on how to critically evaluate information and identify credible sources would be beneficial.

Conclusion

The results presented here have important limitations. First of all, as discussed above, digital skills were measured using a self-assessment methodology that may be subject to some bias due to subjectivity and different benchmarks used by respondents. Such results should be triangulated with other methods, preferably a performance test, which was partially done in this project, although not reported. Additionally, the first wave of surveys was carried out during the educational crisis caused by the COVID-19 pandemic that resulted in high rates of absenteeism, as well as the inability to include some students in the sample due to problems reaching their parents/guardians. This may have caused sampling biases on some sociodemographic variables that were difficult to estimate. Nonetheless, the results obtained are valuable since they were collected within a large sample with high variance, as well as a longitudinal model that allowed the same respondents to be reached and identified in two stages (waves).

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