

Análise do fenómeno de Hikikomori: um estudo internacional infodemiológico de dados do Twitter na língua portuguesa

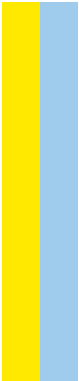
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Dissertação de Candidatura ao grau de Mestre em Medicina Legal submetida ao Instituto de Ciências Biomédicas de Abel Salazar da Universidade do Porto

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RESUMO

Contexto: Hikikomori é um conceito que se refere ao isolamento extremo de indivíduos nas suas próprias casas, com uma duração mínima de seis meses. Nos últimos anos, o isolamento social tornou-se um importante problema clínico, social e de saúde pública, com uma maior consciencialização sobre hikikomori em todo o mundo. A língua portuguesa é uma das seis línguas mais faladas no mundo, mas nenhum estudo analisou os conteúdos relativos a este fenómeno expressos em português. A infodemiologia é o estudo e a análise da divulgação de informações sobre saúde na internet e noutras fontes digitais. O Twitter é, portanto, uma excelente ferramenta para estudar este fenómeno, uma vez que nos permite chegar a jovens socialmente distantes e dar-lhes apoio.

Objetivo: Explorar o conteúdo dos tweets relacionados com hikikomori em português e medir o interesse dos utilizadores por este fenómeno.

Métodos: Realizámos uma análise de métodos mistos de todos os tweets disponíveis publicamente na língua portuguesa utilizando a palavras-chave selecionada entre 1 de janeiro de 2008 e 19 de outubro de 2022. A inteligência artificial foi utilizada para classificar todos os tweets da base de dados, e estes foram classificados de acordo com o seu conteúdo (positivo/negativo, informação concetual, histórias pessoais, curiosidades) e o tipo de utilizador (indivíduos com hikikomori, familiares e amigos, e outros). Também realizámos uma análise de emoções e determinámos o número de retweets e likes gerados por cada tweet como indicador do interesse do utilizador num determinado tópico.

Resultados: Do total de 13915 tweets, 10731 foram classificados como negativos e 3184 como positivos. Relativamente ao conteúdo, as curiosidades foram o tópico mais publicado, mais retweetado e mais apreciado. A nível mundial, a maioria dos tweets relacionados com hikikomori em português foram publicados na Europa; e, dentro do tipo de utilizadores, os indivíduos hikikomori foram os que mais publicaram tweets. No que respeita à análise das emoções, a maioria dos tweets eram neutros.

Conclusões: A maioria dos tweets portugueses sobre hikikomori descreve-os de forma negativa. Investigação futura deve centrar-se na forma como ajudar e apoiar os hikikomoris encontrados no Twitter.

Palavras-chaves: Hikikomori; solidão; isolamento social; saúde mental; internet; redes sociais; retração social; dependência da internet.

ABSTRACT

Background: Hikikomori is a concept that refers to the extreme isolation of individuals in their own homes, lasting at least six months. In recent years social isolation has become an important clinical, social, and public health problem, with increased awareness of hikikomori around the globe. Portuguese is one of the six most spoken languages in the world, but no studies have analysed the contents towards this phenomenon expressed in Portuguese. Infodemiology is the study and analysis of the dissemination of health information on the internet and other digital sources. Twitter is therefore an excellent tool to study this phenomenon, as it allows us to reach out to socially distant young people and give them support.

Objective: To explore the content of tweets related to hikikomori in Portuguese and measure the interest of users in this phenomenon.

Methods: We conducted a mixed methods analysis of all publicly available tweets in the Portuguese language using the selected keyword between 1st January 2008, and 19th October 2022. Artificial intelligence was used to classify all tweets in the database, and they were classified, according to their content (positive/negative, concept information, personal stories, curiosities) and the type of user (individuals with hikikomori, family and friends, and others). We also conducted an emotion analysis and determined the number of retweets and likes generated by each tweet as an indicator of user interest in a given topic.

Results: Among the total of 13915 tweets generated, 10731 were classified as negative, and 3184 as positive. Regarding content, curiosities were the most posted topic, and were more retweeted and liked. Worldwide, most of the hikikomori related tweets in Portuguese were posted in Europe; and within the type of users, individuals with hikikomori were those that posted the most such tweets. With respect to emotion analysis, the majority of tweets were neutral.

Conclusions: Most Portuguese tweets about hikikomori describe it negatively. Future research should focus on how to help and support the hikikomori people found on Twitter.

Keywords: Hikikomori; loneliness; social isolation; mental health; internet; social media; social withdrawal; internet addiction.

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BACKGROUND

Hikikomori is a Japanese concept that emerged in the last decades of the 20th century and refers to extreme withdrawal by some people at their own homes, lasting at least six months [\[1\]](#). This isolation usually begins in adolescence or early adulthood and affects a higher proportion of males [\[2\]](#). It is characterized by a lack of participation in education, work, and other daily life activities, resulting in profound suffering or functional impairment [\[3-5\]](#). The families of individuals with hikikomori too are deeply affected by the condition, because they live in despair for seeing them acting this way daily, as they withdraw from the family and as much as family members try to work around the situation, they do not allow it [\[6, 7\]](#).

Whilst the internet is increasingly present in our lives, and therefore, people are more digitally connected, this can sometimes lead to isolation and increased loneliness [\[8\]](#). There may be different reasons why people isolate themselves on the internet, from online gaming to social networking, as well as family problems and difficulties of inclusion in school of young people. Bullying, a serious social problem, is characterized by aggressive behavior and systematic abuse of power [\[9-11\]](#). It often causes young people to take refuge at home, leading to severe and sometimes prolonged social withdrawal. Bullying may encourage hikikomori behaviors, such as isolation and loss of contact with family and friends, to emerge as a kind of defense or as a means of escaping the hostile social environment [\[12, 13\]](#).

The Covid-19 pandemic led to an increased awareness on social isolation. Studies in different countries, such as Brazil, Portugal, England, China, Iran, Malaysia, Pakistan, Philippines, Thailand, and Vietnam, showed that the pandemic affected mental health, leading to anxiety, depression, and stress, which culminated in social isolation [\[14-17\]](#). The pandemic brought many changes, from mandatory physical distancing to quarantines, which may have reinforced hikikomori prone behavior in people with mental health conditions [\[18, 19\]](#).

On one hand, the internet is essential for sharing opinions, knowledge, and problems. On the other hand, online social networks allow new forms of (online) communication and information sharing [\[20\]](#). Twitter is considered one of the most popular social networks, due to the ease with which its users can read and send short messages

with a limit of 280 characters, with the possibility of anonymity [20-23]. Users can also retweet, which makes them reach a larger population, sometimes marking their tweets with hashtags to identify a theme and allow other users to see related tweets [24, 25].

The analysis of tweets, especially concerning health, has been one of the strategies adopted by researchers recently, to explore, identify and reach individuals with particular characteristics of interest to seek their perspectives, which otherwise would be marginalized or excluded. Infodemiology is the science that includes the collection, analysis and interpretation of health-related information in electronic media (internet and other digital sources) with the aim of informing public health and public policy [26, 27]. Twitter has a relevant contribution to the dissemination of health information and is a helpful tool to investigate the hikikomori phenomenon since those affected often use social media as a refuge [1, 28]. Previous studies of hikikomori using infodemiology explored perceptions of hikikomori outside Japan and identified the types of content on Twitter related to hikikomori in the Japanese language, and showed the presence of hikikomori in Western languages and that personal stories were the most posted content [7, 8].

Although hikikomori was considered a typical phenomenon related to Japanese culture [2, 29, 30], over the years different studies have been conducted investigate this phenomenon in other countries [1, 7, 31, 32]. Although Portuguese being the sixth most spoken language in the world, to this day, no studies have analysed this phenomenon in this language.

The main aim of this study has been to explore the perceptions reported about hikikomori phenomenon in the Portuguese language by Twitter users. In particular, this study addressed the following research questions: (1) How do Twitter users express their views on hikikomori and what emotions do they associate with it? (2) Has the frequency of tweets about the hikikomori phenomenon changed over time, including during the Covid-19 pandemic? (3) What type of content related to hikikomori generates more interest on Twitter, and are there any geographical differences in Portuguese-speaking countries regarding the hikikomori phenomenon tweets?

METHODS

Research Strategy

The research strategy focused on the collection and content analysis of Portuguese-language tweets about hikikomori. We included tweets that met the following criteria: (1) public (not private/protected) tweets; (2) use the keyword *hikikomori*; (3) tweets posted between 1st January 2008, and 19th October 2022; and (4) text in Portuguese language. Our exclusion criteria were: (1) the majority of the text in the tweet in a language other than Portuguese; (2) tweets with only a link or image without any text. The tool used for collecting tweets was Tweet Binder, which has been widely used in previous research and provides access to 100% of public tweets [33, 34]. This tool provides the tweet text, count of retweets and likes for each tweet, as well as the date of publication, a link to the tweet in its context, user description, and geolocation data. Regarding geolocation, we have gathered data at the country level. To enable comparison of the number of tweets posted in each country, we have grouped them into continents. The number of retweets and likes generated by each tweet were analysed as an indicator of user interest in a given topic.

Content Analysis Process

All tweets in our database were analysed using a content analysis procedure that consists of creating codes and categories. We created a codebook to characterize each tweet, where each tweet was analysed according to the categories including: i) whether content was from a positive or negative perspective; ii) whether it was about information relating to the hikikomori phenomenon; iii) whether it was an account of personal stories, or whether it was about curiosities of the phenomenon. The Twitter users were classified into three users types: “individuals with hikikomori” (people who describe themselves as hikikomori), “family and friends” (including family members and close friends or acquaintances), and “others” (unspecified as not fitting the previous types). Table 1 provides a detailed characterization of the categories and examples of tweets that fall into these categories.

Table 1. Detailed characterization of the categories and examples of tweets that fall into these categories.		
CODE	DEFINITION	EXAMPLES OF TWEETS
Concept information	Tweets that attempt to inform about what the hikikomori phenomenon is	“Você sabe o que é #hikikomori ? Hikikomori é um fenômeno social recente na história do Japão. As autoridades do país definiram que pessoas em reclusão social a mais de seis meses são portadores da doença.”
Online Support	Tweets offering online support to people with hikikomori	“Participe do grupo Hikikomori Brasil no Facebook. #Hikikomori #Otaku”
Personal stories	Tweets about your day to day life as a hikikomori	“Por hoje é só a cadelinha aqui precisa dormir por que acorda cedo, vou tentar atualizar amanhã mas não prometo nada se não é só sábado mesmo. Obrigado por lerem meus dengo e Views em #HIKIKOMORI#”
Curiosities	Tweets reporting curiosities about the phenomenon	“Yongguk lançou a música “#HIKIKOMORI”! O nome da música é um termo japonês que retrata pessoas que se isolam da sociedade evitando contato com as pessoas #BANGYONGGUK_HIKIKOMORI # BANGYONGGUK #Yongguk” #BANGYONGGUK_HIKIKOMORI #yonggukfanart #kpopfanart” “#HIKIKOMORI: pessoa reclusa, isolada de todos e tudo. o JAPÃO sabia que tinha 541 mil deles entre 15 e 39 anos. uma pesquisa acaba de revelar que há 613 mil entre 40 e 64 anos. um caso especial são as “casas 8050”, pais de 80+ cuidando de reclusos de 50+.”

Application of Artificial Intelligence to Evaluate Tweets

Recent technological advancements have led to the development of artificial intelligence (AI), including machine learning (ML) [35] and deep learning (DL) [36]. Neural networks, inspired by human brain neurons, are extensively used in various applications, such as natural language processing (NLP) [37], weather prediction [38], coronavirus detection [39], and image object detection [40]. In this study, a pretrained neural network called BERTWEET [41], trained on 850 million English tweets, was employed to classify hikikomori-related tweets into different categories.

Before applying the BERTWEET network, the tweet database underwent preprocessing steps. Non-English tweets were translated into English using Google Translator since the network is trained only on English tweets. The tweets were then normalized by removing special characters, separating negative tenses, and eliminating repeated characters. As BERTWEET was not originally trained to classify the desired categories, a process called fine-tuning was conducted. The manually classified tweets were randomly split into training and testing subsets, with 75% used for fine-tuning the network and 25% for validation. This methodology, previously employed with positive outcomes [42], was employed to ensure the fine-tuned BERTWEET model performed well

on the database. The fine-tuned BERTWEET model was then used to categorize the remaining tweets that had not been manually classified.

Additionally, the emotions expressed in the tweets were analyzed using a pretrained neural network called emotion-english-distilroberta-base [43]. This network, capable of detecting Ekman's six basic emotions plus neutral, was applied to the translated and normalized dataset of 13,915 tweets [44]. The emotion-english-distilroberta-base model, previously used in other research studies, does not require additional fine-tuning as it serves the same purpose for which it was originally trained [45, 46]. The number of likes and retweets each tweet generated, the date and time of each tweet, a permanent link to the tweet, and a description of each user's profile were collected. The nature of users who posted tweets was determined according to the available information (tweet content, description of the user's profile, or Twitter identifier).

Statistical Analysis

Descriptive statistics were used to summarize tweets, likes, and retweets of users related to the content topics, tone, user type, emotions, and location. Correlation coefficients were determined to measure the strength and direction of their association. Additionally, we conducted an emotional analysis to graphically represent Twitter users' emotions by type of user; time trends to describe the number of all tweets posted by continents between 2008-2022 as well as to illustrate the number of tweets posted before and after the Covid-19 pandemic; and the proportion of tweets posted by type of users across the different continents.

Ethical Considerations

This study used publicly available tweets. This study received approval from the Ethics Committee of the Biomedical Sciences Institute Abel Salazar at the University of Porto (Ref 2023/CE/P03/(P401/CETI/ICBAS)).

RESULTS

Overall Tweets, Likes, and Retweets

Among a total of 13,915 tweets posted in Portuguese about hikikomori, 3,184 (22.9%) were classified as positive, and 10,731 (77.1%) as negative. The content of the tweets was classified as "curiosities" (n=9,818, 70.6%), "personal stories" (n=3,675, 26.4%) or "concept information" (n=422, 3.0%) (Table 2).

Within the user type, these tweets were classified as "individuals with hikikomori" (n=5,571, 10.0%), "family and friends" (n=4,653, 33.4%) or "others" (n=3,691, 26.5%).

With respect to emotion analysis, the majority of tweets were "neutral" (n=4,991, 35.9%). The emotion "joy" was present in 2,453 (17.6%) tweets, "surprise" in 1,943 (14.0%) tweets, "sadness" in 1,822 (13.1%) tweets, "fear" in 1,319 (9.5%) tweets, "anger" in 1,114 (8.0%) tweets, and "disgust" in 273 (2.0%) tweets.

From the world regions, the majority of tweets were posted in "Europe" (n=553, 4.0%). From the rest of tweets, 487 (3.5%) tweets were posted in "America", 377 (2.7%) tweets were posted in "Asia", 91 (0.7%) tweets were posted in "Africa" and 7 (0.1%) tweets were posted in "Oceania". As much as 12,400 (89.11%) did not report their location ("Missing").

There was a total of 21,307 likes and 5,359 retweets of hikikomori related phenomenon in Portuguese. Regarding content, "curiosities" showed the highest number of likes and retweets. Tweets posted in a positive way have more likes and retweets than tweets posted in a negative way. The "others" type of user shows a higher number of likes and retweets and, "disgust" feelings, are the sentiment with the most likes and retweets. "Europe" was the continent with the highest number of likes and retweets of hikikomori related tweets in Portuguese-language.

The full details of the frequency of these tweets are reported in Table 2.

Table 2. Number of tweets, retweets, and likes related to the content topics, tone, user type, emotions, and location.						
	Tweets		Likes		Retweets	
	n	%	n	Number Likes/Number Tweets	n	Number Retweets/Number Tweets
Overall	13,915	100	21,307	--	5,359	--
User type						
Individuals with hikikomori	5,571	40.0	3,953	0.71	404	0.07
Family and friends	4,653	33.4	5,013	1.08	346	0.07
Others	3,691	26.5	12,341	3.34	4,609	1.25
Content						
Concept Information	422	3.0	1,694	4.01	322	0.76
Personal Stories	3,675	26.4	2,862	0.78	459	0.12
Curiosities	9,818	70.6	16,751	1.71	4,578	0.47
Tone						
Positive	3,184	22.9	3,735	1.17	1,662	0.53
Negative	10,731	77.1	17,572	1.64	3,697	0.34
Emotions						
Anger	1,114	8.0	1,302	1.17	222	0.2
Disgust	273	2.0	2,695	9.87	1,012	3.71
Fear	1,319	9.5	2,734	2.07	941	0.71
Joy	2,453	17.6	3,039	1.24	1,413	0.58
Neutral	4,991	35.9	6,706	1.34	770	0.15
Sadness	1,822	13.1	2,498	1.37	751	0.41
Surprise	1,943	14.0	2,333	1.20	250	0.13
Continents						
America	487	3.5	226	0.46	140	0.29
Europe	553	4.0	2,892	5.23	1,098	1.99
Africa	91	0.7	55	0.6	13	0.14
Asia	377	2.7	426	1.13	141	0.37
Oceania	7	0.1	20	2.86	2	0.29
Missing	12,400	89.1	17,688	1.4	3,965	0.32

Content Topics

Table 3 describes how the content topics are related to tweets classified according to user type, emotions, continents, and tone.

Concept information: 397 (94.1%) tweets were classified as negative, and 25 (5.9%) as positive. Within the user type, these were made by "others" in 398 (94.3%), "family and friends" in 15 (3.6%) tweets and "individuals with hikikomori" in 9 (2.1%) tweets. With respect to emotion analysis, the majority of tweets were "neutral" (n=204, 48.3%). The emotion "fear" was present in 75 (17.8%) tweets, "sadness" in 53 (12.6%) tweets, "surprise" in 37 (8.8%) tweets, "joy" in 27 (6.4%) tweets, "anger" in 22 (5.2%) tweets and "disgust" in 4 (1.0%) tweets. Across the world, a total of 330 (78.2%) tweets did not report their location ("Missing"), 47 (11.1%) tweets were posted in "America", 21 (5.0%) tweets were posted in "Asia", 17 (4.0%) tweets were posted in "Europe", 7 (1.7%) tweets were posted in "Africa", and 0 (0%) tweets were posted in "Oceania".

Personal stories: 2665 (72.5%) tweets were classified as negative, and 1,010 (27.5%) tweets as positive. Within the user type, these were made by a "individuals with hikikomori" in 3,536 (96.2%) tweets, "family and friends" in 112 (3.1%), and "others" in 27 (0.7%) tweets. With respect to emotion analysis, most tweets were "neutral" (n=1,058, 28.8%). The emotion "sadness" was present in 876 (23.8%) tweets, "joy" in 519 (14.1%) tweets, "surprise" in 479 (13.0%) tweets, "fear" in 391 (10.6%) tweets, "anger" in 258 (7.0%) tweets and "disgust" in 94 (2.6%) tweets. Worldwide, of 3,299 (89.8%) tweets we have no report of their location ("Missing"), 137 (3.7%) tweets were posted in "Europe", 107 (2.9%) tweets were posted in "Asia", 106 (2.9%) tweets were posted in "America", 22 (0.6%) tweets were posted in "Africa" and 4 (0.1%) tweets were posted in "Oceania".

Curiosities: 7,669 (78.1%) tweets were classified as negative, and 2,149 (21.9%) as positive. Within the user type, these were made by a "family and friends" in 4,526 (46.1%), "individuals with hikikomori" in 2,026 (20.6%) tweets, and "others" in 3,266 (33.3%) tweets. With respect to emotion analysis, the majority of tweets were "neutral" (n=3,729, 38.0%). The emotion "joy" was present in 1,907 (19.4%) tweets, "surprise" in 1,427 (14.5%) tweets, "sadness" in 893 (9.1%) tweets, "fear" in 853 (8.7%) tweets, "anger" in 834 (8.5%) tweets and "disgust" in 175 (1.8%) tweets. Worldwide, of 8,771 (89.3%) tweets we have no report of their location ("Missing"), 399 (4.1%) tweets were posted in "Europe", 334 (3.4%) tweets were posted in "America", 249 (2.5%) tweets were posted in "Asia", 62 (0.6%) tweets were posted in "Africa" and 3 (0%) tweets were posted in "Oceania".

Table 3. Content topics related to tweets classified according to the type of user, emotions, continents, and tone.

	Tweets related to Content					
	Concept information		Personal stories		Curiosities	
	n	%	n	%	n	%
Overall	422	3.0	3,675	26.4	9,818	70.6
User type						
Individuals with hikikomori	9	2.1	3,536	96.2	2,026	20.6
Family and friends	15	3.6	112	3.1	4,526	46.1
Others	398	94.3	27	0.7	3,266	33.3
Tone						
Positive	25	5.9	1,010	27.5	2,149	21.9
Negative	397	94.1	2,665	72.5	7,669	78.1
Emotions						
Anger	22	5.2	258	7.0	834	8.5
Disgust	4	1.0	94	2.6	175	1.8
Fear	75	17.8	391	10.6	853	8.7
Joy	27	6.4	519	14.1	1,907	19.4
Neutral	204	48.3	1,058	28.8	3,729	38.0
Sadness	53	12.6	876	23.8	893	9.1
Surprise	37	8.8	479	13.0	1,427	14.5
Continents						
America	47	11.1	106	2.9	334	3.4
Europe	17	4.0	137	3.7	399	4.1
Africa	7	1.7	22	0.6	62	0.6
Asia	21	5.0	107	2.9	249	2.5
Oceania	0	0	4	0.1	3	0
Missing	330	78.2	3,299	89.8	8,771	89.3

Emotion Analysis

Figure 1 displays the Twitter users emotions by type of user and reports that in all user types, the majority of tweets were “neutral”, whereas “disgust” emotion was the least frequent. Among the “individuals with hikikomori” users, the second most frequent emotion was “sadness”, whilst in the “family and friends” the second most frequent emotion was “surprise”, and in “others” types of users the second most prevalent emotion was “joy”.

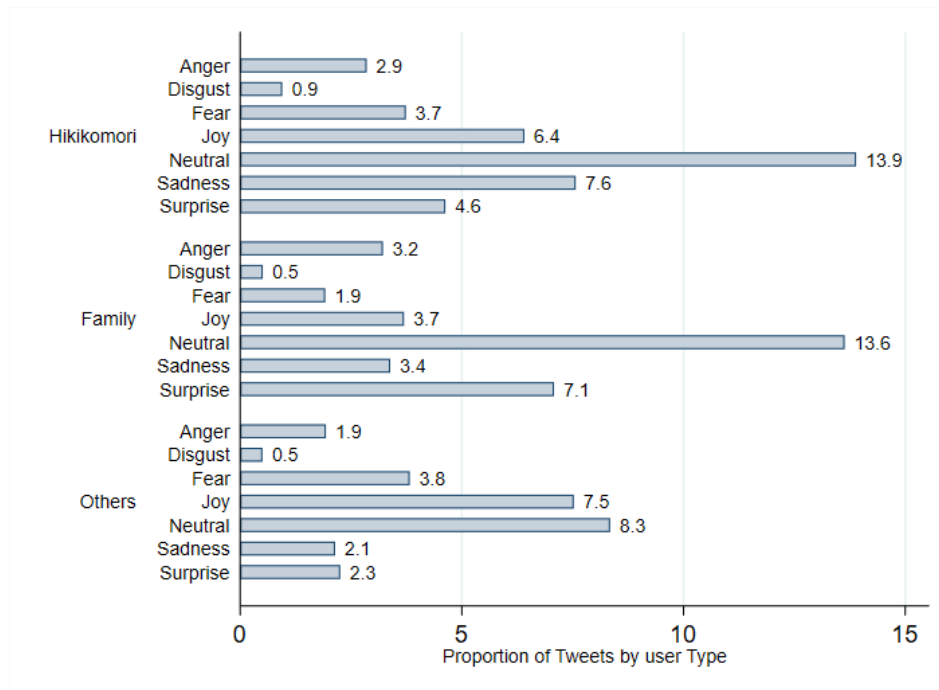


Figure 1 – Proportion of type of user by considered emotions of tweets.

Number of Tweets Over Time (2008-2022)

Over the years (Figure 2), there was a progressive increase in the number of tweets about hikikomori in Portuguese on all continents except in Oceania where tweets were only retrieved since 2018 and where there are less tweets. Particularly in America, Europe, and Asia there was a higher increase in the number of tweets as the years passed.

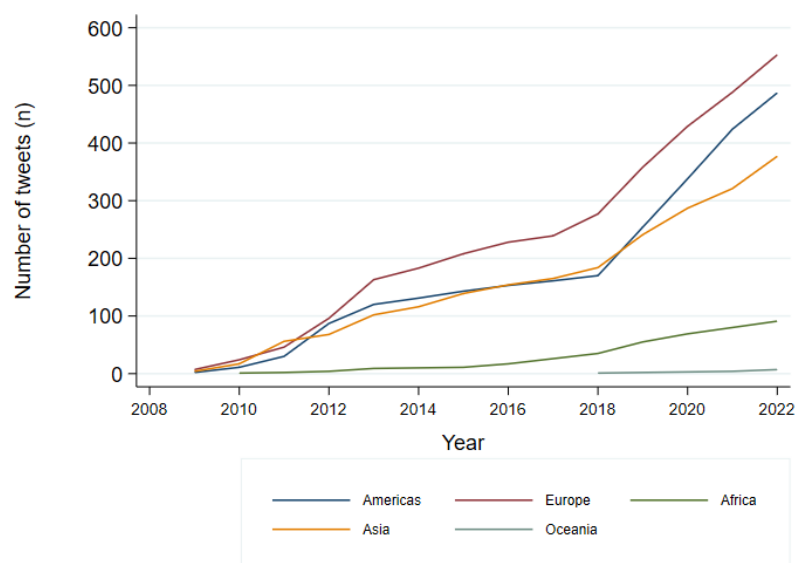


Figure 2 – Time trend of all tweets posted by continents between 2008-2022.

Regarding the Covid-19 pandemic period, a difference in the number of tweets posted before and after the pandemic can graphically be observed. During and after the pandemic the number of tweets was higher (Figure 3).

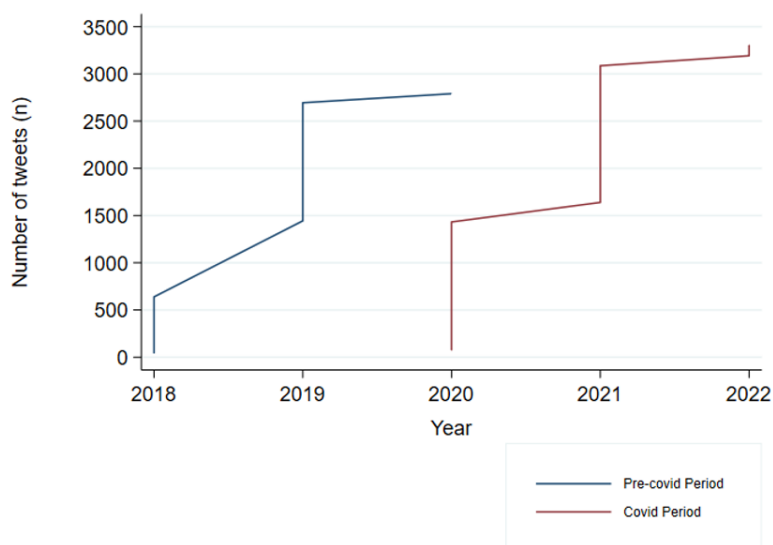


Figure 3 – Time trend of all tweets posted 2 years before and 2 years after the beginning of the Covid-19 pandemic (March 1st). In this figure, the line represents the frequency of tweets posted by users.

Continents

Regarding the user type (individuals with hikikomori, family and friends, others) that post the most tweets in Portuguese in the different parts of the world, it was in Africa, Asia, and Oceania that more tweets were posted by “individuals with hikikomori”. In America, more tweets were posted by a “individuals with hikikomori ” and "others", equally. In Europe, there are more tweets posted by “family and friends”.

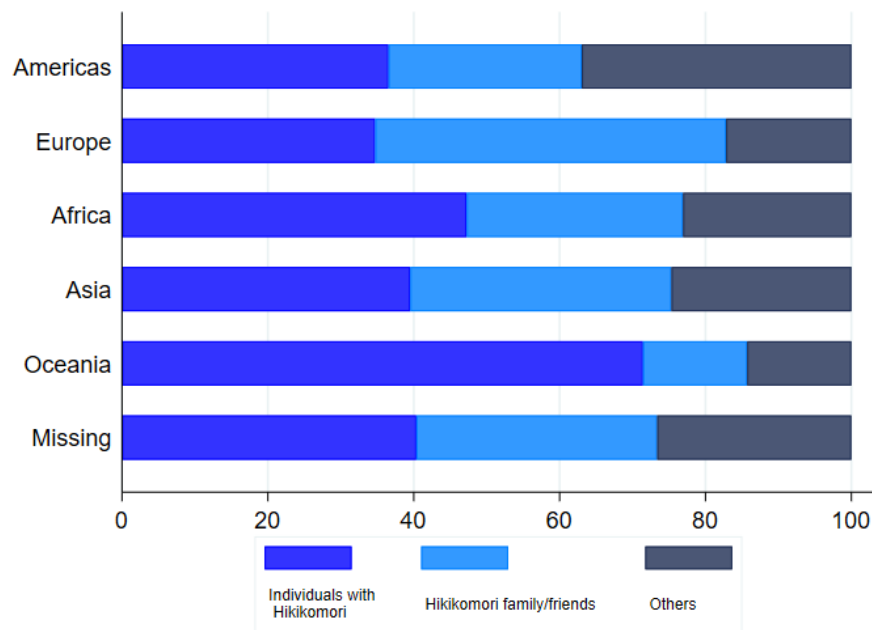


Figure 4 - User type ratio (Y-axis) by continents (X-axis)

DISCUSSION

Key Findings

The number of likes and retweets retrieved reflect an interest in the hikikomori phenomenon. Within the content (concept information, personal stories, curiosities) tweets about curiosities were the most frequent and most of the tweets posted report hikikomori as something negative. Concerning the user type, “individuals with hikikomori” post more tweets about the story of their day (personal stories) while “family and friends” of people with hikikomori, curiosities are the topic that gets more attention, “others” types of users post more tweets about the concept of hikikomori itself, and of all the types of users, the “individuals with hikikomori” were the more frequent. Regarding emotions, most tweets were neutral, and the least emotion was disgust.

The knowledge of the hikikomori phenomenon is globally spreaded, with users in Europe posting the most tweets and users in Oceania the least. The distribution of the different user types was relatively homogeneous, with most continents having more tweets posted by “individuals with hikikomori”. Many people seem to join social networks to occupy their time during the Covid period [18], increasing the number of tweets posted during the pandemic compared to before.

Comparison With the Other Literature

A study conducted with psychiatrists in Australia, Bangladesh, Iran, India, Japan, South Korea, Taiwan, Thailand, and the USA, demonstrated that hikikomori exists in many countries, leading to a globalization of this phenomenon [30, 47]. Another study [7] was able to identify Twitter contents suggesting the existence of hikikomori in Western and other countries based on the languages analysed (Catalan, English, French, Italian and Spanish), just as in our study we were able to demonstrate the presence of hikikomori contents in the Portuguese language. The number of tweets posted on different continents has increased significantly over the years, on the one hand, because people are using Twitter more to express their thoughts and feelings, and on the other hand because the hikikomori phenomenon is becoming more and more known and talked about. A study in Portugal that explored the general population's attitudes toward prison volunteering, demonstrated that users posted more tweets about volunteering in prisons in America [48], whereas our study it was users from Europe who posted the most. This may be related to the fact that people from Europe are more familiar with the term hikikomori than people from other continents.

While a study [8] of tweets about hikikomori in Japanese showed that personal stories were the most posted content, in our study, curiosities about hikikomori were predominant, which suggests that the hikikomori phenomenon has generated more interest among people since the users who posted the tweets know some curiosities about this phenomenon.

The interest of users in a particular topic can be assessed through the analysis of the number of retweets and likes generated by each tweet [49]. A study [8] that also investigated this phenomenon by analyzing tweets, had more likes than retweets, just like in our study, perhaps due to the fact that people are more comfortable to show their interest in the subject, but less comfortable to contribute to the dissemination of the tweets.

Two previous studies [7, 8] have already shown that the majority of tweets report hikikomori as a problem, which corroborates with what we showed in our study, which suggests spread awareness of the seriousness of the phenomenon.

Implication of the Findings for Future Policies and Research

Twitter is a good tool to study the hikikomori phenomenon since the people affected often use social networks as a refuge. Internet platforms allow us to reach socially withdrawn youth, and in this way, warn of risks and provide support.

This study showed, similarly to other studies, that the hikikomori phenomenon is not only restricted to Japan [7, 8, 30, 47]; it is also known and spoken in Portuguese all over the world.

Our findings help to raise awareness to people with hikikomori so that they are identified more quickly and easily and help, and support is given to improve the quality of life of those affected by hikikomori in Portuguese speaking countries and beyond. Future research could focus on how to help and support hikikomori people identified through Twitter. Helping a hikikomori person is a complex and challenging task, although there are several ways to accomplish this, such as providing support by establishing a good support network, not only for hikikomori people but also for their family and friends, encouraging professional help as well. It is also essential to promote education on the subject, alerting the public to its risks and consequences, and raising awareness of ways to prevent its development.

Future research studies using Twitter data can be done on the hikikomori phenomenon in other countries and in other languages.

Strengths and Limitations

This is the first study to investigate tweets related to hikikomori in the Portuguese language and to investigate its geographical differences. However, this study has some limitations. First, the fact that we used the listed set of keywords may have limited our collection of tweets, since users may have used another term to refer to the hikikomori phenomenon, and thus tweets that refer to it in a different way may not have been collected.

Second, the information contained in some tweets was sparse and since some of the information was not sufficient it could not be used.

Third, the extent of missing data regarding the geographical location has limited our capacity to investigate geographical differences regarding the hikikomori phenomenon in Portuguese-speaking countries.

Finally, whilst we analysed the number of retweets and likes generated by each tweet as an indicator of user interest in a given topic, these engagement metrics can be influenced by other factors and thus may not truly match user interest.

CONCLUSIONS

Our findings show that the hikikomori phenomenon also occurs in tweets in Portuguese language, and in all continents of the world, which demonstrates the globalization of this phenomenon. The majority of tweets report hikikomori negatively, and therefore, for most people this phenomenon is perceived as a problem that should be addressed. “Individuals with hikikomori” were the type of user who posted the most tweets, and curiosities were the most posted content.

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ANNEX

Annex I – Study's approval by CHUP/ICBAS Ethics Committee

Exma. Senhora
Dr^a Francisca Correia Lopes

ICBAS-UP

v.referência	v.comunicação	n.referência	data
		GS/HCC/2	24.02.2023

Assunto
2023/CE/P03(P401/CETI/ICBAS)

Exma. Senhora Dr^a Francisca Correia Lopes,

Informa-se que o projeto de Investigação com o título "Analysis of the Hikikomori phenomenon – an infodemiology study of Twitter data in portuguese", com a referência 2023/CE/P03/(P401/CETI/ICBAS), submetido à Comissão de Ética conjunta CHUP/ICBAS, foi apreciado em reunião plenária de 15 de fevereiro de 2023, tendo obtido parecer favorável.

Com os nossos cumprimentos,

O Diretor,



(Prof. Doutor Henrique Cyrne Carvalho)

FR



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APPENDIX

Appendix I – Presentations and publications linked with this study

1. Oral communication of this study's project to the students of the second year of the MSc in Legal Medicine on November 26, 2022.
2. Oral presentation at IJUP (Investigação Jovem da Universidade do Porto), Congress on May 10, 2023. Title of the presentation 'Analysis of the Hikikomori Phenomenon – An International Infodemiology Study of Twitter Data in Portuguese'
3. Article published in 2024 in the BMC Public Health Journal, with the title 'Analysis of the hikikomori phenomenon – an international infodemiology study of Twitter data in Portuguese' by Francisca Correia Lopes, Mariana Pinto da Costa, César I. Fernández-Lázaro, Francisco J. Lara-Abelenda, Alan R. Teo, Victor Pereira-Sanchez and Miguel Angel Álvarez-Mon (<https://doi.org/10.1186/s12889-023-17617-0>).