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ORIGINAL PAPER

Telemedicine and social media: A contemporary analysis of the most shared content by internet users

Vincenzo Mirone [1], Francesco Di Bello [1], Simone Morra [1], Gianluigi Califano [1], Luigi Cirillo [1], Marco Abate [1], Giovanni Maria Fusco [1], Stefano Luzzago [2], Claudia Mirone [3], Luigi Napolitano [1], Roberto La Rocca [1], Massimiliano Creta [1], Giuseppe Celentano [1], Marco Capece [1], Gennaro Musi [2], Francesco Mangiapia [1], Nicola Longo [1], Claudia Collà Ruvolo [1]

[1] Department of Neurosciences, Reproductive Sciences and Odontostomatology, University of Naples "Federico II", Naples, Italy;
[2] Urology Department, Istituto Europeo di Oncologia (I.E.O.), Milan, Italy;
[3] Multidisciplinary Department of Medical, Surgical and Dental Sciences, University of Campania "Luigi Vanvitelli", Naples, Italy.

Summary ***Objective: To evaluate the telemedicine information published on the most popular social media platforms, during the second year of the COVID-19 pandemic.***

Methods: We queried the BuzzSumo tool to identify related-telemedicine article links that were shared most on social media, from February 2021 to February 2022. The PEMAT-P was used for the quality assessment of the most shared links.

Results: 125 links were eligible for the analysis. Facebook was the most used social media platform for sharing articles (median engagement: 1000). Most of the articles were published by magazines (n = 82, 65.6%) and the main topic addressed was general information (n = 49, 39.2%). In the subgroup analyses of the 34 most shared articles, Facebook was the most used social media platform (median engagement:1950), most of the articles were published by magazines (n = 24, 70.6%), whereas the main topic addressed was the prescription of the abortion pill (n = 9, 26.5%). According to the PEMAT-P tool, the median understandability and actionability score was 63.8 and 20%, respectively.

Conclusions: The interest in telemedicine has increased all over the world, as evidenced by the high engagement in social media articles, recorded during the last year. However, the access to digital health services is still limited, the information provided is often not verified by an official entity and unable to fill the digital divide exacerbated by COVID 19 pandemic crisis. Hence, health policy should be developed or modified to ensure a more egalitarian Internet access for all citizens. Official medical institutions should standardize telemedicine regulation and online content to reduce the widespread of misleading information.

KEY WORDS: *Telehealth; Virtual healthcare; Healthcare technology; COVID-19.*

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INTRODUCTION

Telehealth represents a fast-developing area of contemporary medicine during the last decades. The word "*telehealth*" is defined by "*the use of information technology and telecommunications to provide access to health assessment, consultation, diagnosis, intervention, supervision, and information across distance*" (1). Telemedicine specifically refers to remote clinical services and was first adopted in the 1950's when a closed-circuit television connected to a prison was employed by an American psychiatrist to provide mental health services (2-4).

Due to the COVID-19 pandemic outbreak, the request for information on telemedicine activity increased exponentially (5). This phenomenon emerged in an attempt to reduce the chance of infection without compromising patients' care (6, 7). Additionally, the COVID-19 pandemic has stressed the digital divide, especially in remote and rural areas (8). Hence, the advantages of remote care include both a reduction of the overcrowding in health centers and solving the inequalities in health care access due to sociodemographic and economic characteristics. Recently new telemedicine platforms and schedules, such as Amazon care or Telehealth apps, were created and more and more used by the public (7, 9-11). Despite this scenario, health policymakers had to work smarter, promoting more realistic planning and interventions to standardize the *information and communication technology* (ICT).

Nowadays, *social media* (SoMe), are important tools for professional networking, medical education, research recruitment, and patient information (12-19). Among internet sources, YouTube is the second most used website and over 2.6 billion people worldwide use it once a month (17). Facebook is the third most used website and counts around 2.9 billion monthly active users in the world (*https://www.semrush.com/website/top/*). Finally, Twitter is at eleventh place in the top 500 sites on the web and counts 206 million daily active users worldwide (*https://www.semrush.com/website/top/*). However, the material available on these platforms differs from studies published within the scientific literature community, which underwent a peer review process, whereas information on the Internet is not always checked and verified. Consequently, low quality information may be available on the Internet and the users may acquire misleading information.

The current study aims to evaluate the content type and quality of information on telemedicine available on the most clicked SoMe platforms during the second year following the COVID-19 pandemic outbreak.

Materials and methods

Search strategy and links selection criteria

On February 28th, 2022, from 9:00 a.m. To 6:00 p.m. UTC-4, the *BuzzSumo* online analytic tool (*http://buzzsumo.com*) was used in order to gather the most shared internet links regarding telemedicine. Specifically, *BuzzSumo* is an online analytic tool working as a data controller application that searches for articles based on keywords and provides data about the number of shares on the most popular social media platforms, such as *Facebook*, *Twitter*, *Reddit*, and *Pinterest* reporting the article's engagement. Engagement is defined as the total number of interactions (meaning likes, comments, or sharing) that users have with a particular article link. This tool has already been used in previous research papers, in order to collect links regarding a specific topic, also in the medical and public health field (18-21). Conversely, other studies evaluated the medical content uploaded in only one of social media platforms (22, 23). For example, *Loeb et al.* evaluated the quality of bladder cancer information on *YouTube*™, without considering other important sharing websites (22). Moreover, *Alex J Xu et al.* examined the quality of prostate cancer content only on the Instagram social media platform (23). Thus, in the current study, thanks to the *BuzzSumo* tool, it was possible to explore internet content simultaneously on several and independent social media platforms. According to the *BuzzSumo* 30-day free trial rules, only links published during the year preceding the search date (from the 28th February 2021 to the 28th February 2022) were available for consultation. Only "*English language*" and "*all country*" settings were applied before searching.

The *BuzzSumo* systematic research was performed using the following four keywords: "*Telemedicine*", "*Telehealth*", "*Healthcare technology*" and "*Virtual healthcare*", selected among ten keywords obtained by *BuzzSumo* suggestions (Supplementary Table 1). Only the keyword which provides at least 1000 results and with at least 50% of links related to the telemedicine topic were included. Thus, four different searches were performed. For each keyword, the first 50 links were collected, obtaining a total of 200 links. The threshold of 50 links was since *BuzzSumo* allowed to open only the first 100 links and that approximately over the 50th link most of those were with low engagement value and were almost off-topic.

The following exclusion criteria were applied (Figure 1): i) off-topic (n = 43, 21.5%), ii) duplicates (n = 14, 7.0%), iii) expired links (n = 14, 7.0%) and links with a subscription needed (n = 4, 2.0%). Thus, 29, 37, 38 and 21 links (for a total of 125) were included using "*Telemedicine*", "*Telehealth*", "*Healthcare technology*" and "*Virtual healthcare*" keywords, respectively. For each link, the following characteristics were collected: *Facebook*, *Twitter*, *Pinterest*, and *Reddit* engagement, evergreen score (measuring the number of social engagements and back-

Supplementary Table 1.
Search keywords obtained by BuzzSumo analytic tool suggestions. Only the keyword which provides at least 1000 results and with at least 50% of links related to the telemedicine topic were included.

	Number of links	Percentage of on-topic links
Included keywords		
Telemedicine	12709	80%
Telehealth	22908	76%
Virtual healthcare	5915	64%
Healthcare Technology	1679	76%
Included keywords		
Videoconsultation	9147	34%
Telemedicine and Healthcare	920	-
Teleconsultation	469	-
Telemonitoring	269	-
Healthcare on demand	205	-
Televisit	18	-

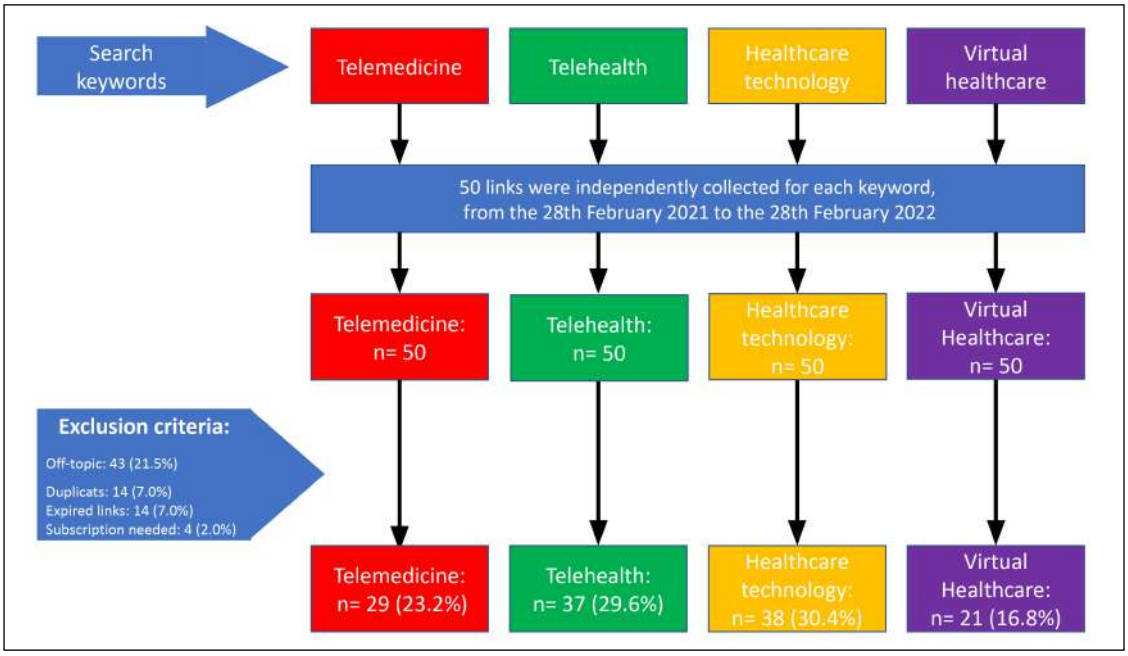

Figure 1. *BuzzSumo links identification and selection, from the 28th February 2021 to the 28th February 2022.*

links an article receives 30 days after beginning publication, if an article is considered "*Evergreen*" it has maintained it is relevance to an audience for longer) and total engagement. Additionally, links' source (defined as non-medical informative site [such as magazines], communication channel, alternative media [such as blogs]), medical centers, hospitals or universities, *YouTube* or official national website), topic (defined as information on the role of telemedicine through the years, obstetrics and gynecology [defined as prescription of abortion pill, contraception or pregnancy), telehealth platform, new technologies, health policy, telehealth human relationship, mental health) and country (defined as *United States, Asia, Australia, Canada*, and *Europe*) data was also collected.

In the links' quality assessment, the following tools, in their language, were used: the Jama benchmark score and the *Patient Education Materials Assessment Tool for Printable Materials* (PEMAT-P). The JAMA benchmark tool scores website quality based on four criteria: disclosure of authorship, attribution of sources, disclosure of commercial interest and website ownership, and currency (date of update) (24). The PEMAT-P is a systematic method to evaluate and compare the understandability (17 items) and actionability (7 items) of patient education materials. Higher the score and more understandable or actionable is the material (25-28).

The links' content was independently assessed by two investigators (a junior and a senior resident doctor). A third investigator (an Associate Professor) adjudicated any differences, and a consensus was achieved among all reviewers.

Statistical analyses

Descriptive statistics were presented as means with the *standard deviation* (SD) and medians with the *interquartile ranges* (IQR) for continuously coded variables or counts and percentages for categorically coded variables. All data were collected for each link included in the analyses. Subsequently, subgroup analysis was performed on the most shared links defined as links characterized by *Facebook*, *Twitter* engagement and evergreens score values above the respective overall median score. In all statistical analyses, the R software (*www.rproject.org*) environment for statistical computing and graphics (R version 4.0.0) was used.

Results

Link's engagement

Of all 200 links examined, 125 were selected for the analyses (Table 1). Facebook was the most used SoMe platform to share articles on telemedicine (mean: 3195.5 [SD:967.5], median: 1000 [IQR:130-220]), followed by Twitter (mean: 114.8 [SD:20.5], median: 48 [IQR:6-124]), Reddit (mean: 41.3 [SD: 29.3], median: 0 [IQR:0-1]) and Pinterest (mean:0.4 [SD:0.1], median: 0 [IQR:0]). The mean and median evergreen score was 2.2 (SD:0.3) and 1 (IQR:0-4), respectively. Finally, the mean and median total score was 3353.9 (SD:971.4) and 1200 (IQR:211-2500), respectively.

Link's characteristics

According to the source of the link, most of the articles were published by Magazines (n = 82, 65.6%), followed by news organizations (n = 20, 16%), alternative media (n = 10, 8%), *YouTube* (n = 6, 4.8%), medical centers, hospitals or universities (n = 4, 3.2%) and official national website (n = 3, 2.4%). The main topic addressed was information on the role of telemedicine through the years (n = 49, 39.2%), followed by obstetrics and gynecological field (n = 22, 17.6%; specifically the prescription of abortion pill [n = 20, 90.9%]), platform proposal (n = 20, 16%), new technology (n = 15, 12%), health policy (n = 9, 7.2%), mental health (n = 5, 4.0%) and human relationship (n = 4, 3.2%). Finally, most of the links were published in the United States (n = 106, 84.8%) (Table 2).

Table 1.

Social media engagements of 125 links on telemedicine collected with BuzzSumo analytic tool, from the 28th February 2021 to the 28th February 2022.

Engagement is defined as the total number of interactions (meaning likes, comments, or sharing) that users have with a particular article link.

		Overall
Facebook	Mean (SD)	3195.5 (967.5)
	Median (IQR)	1000 (130-2200)
Twitter	Mean (SD)	114.8 (20.5)
	Median (IQR)	48 (6-124)
Pinterest	Mean (SD)	0.4 (0.1)
	Median (IQR)	0 (0-0)
Reddit	Mean (SD)	41.3 (29.1)
	Median (IQR)	0 (0-1)
Evergreen score	Mean (SD)	2.2 (0.3)
	Median (IQR)	1(0-4)
Total	Mean (SD)	3353.9 (971.4)
	Median (IQR)	1200 (211-2500)

IQR: Interquartile range; SD: Standard Deviation.

Table 2.

Content characteristics of 125 links on telemedicine collected with BuzzSumo analytic tool from the 28th February 2021 to the 28th February 2022.

		Overall (n = 125)
Source		
Number of articles (%)	Non-medical informative sites	82 (65.6)
	Communication channel	20 (16.0)
	Alternative media	10 (8.0)
	Medical center, Hospital or University	4 (3.2)
	YouTube	6 (4.8)
	Official national website	3 (2.4)
Topic		
Number of articles (%)	Obstetric and gynecology	22 (17.6)
	Prescription of abortion pill	20 (90.9)
	Contraception	2 (9.0)
	Pregnancy	1 (4.5)
	Information on the role of Telemedicine through the years	49 (39.2)
	Telehealth platform	20 (16.0)
	New technologies	15 (12.0)
	Health policy	9 (7.2)
	Telehealth human relationship	4 (3.2)
	Mental health	5 (4.0)
Country		
Number of articles (%)	United States	106 (84.8)
	Asia	11 (8.8)
	Australia	4 (3.2)
	Canada	3 (2.4)
	Europe	1 (0.8)

Table 3.
Social media engagements, content charavteristics quality assessment of 34 most shared links on telemedicine collected with BuzzSumo analytic tool from the 28th February 2021 to the 28th February 2022.Those links were characterized by a Facebook and Twitter engagements and evergreens score values above the respectively median score recorded in the overall analysis.

			Overall (n = 34)
Facebook	Mean (SD)		6385.3 (2970.6)
	Median (IQR)		1950 (1425-3950)
Twitter	Mean (SD)		194.9 (22.225)
	Median (IQR)		145.5 (103.2-258.2)
Pinterest	Mean (SD)		1.1 (0.222)
	Median (IQR)		1 (0-2)
Reddit	Mean (SD)		137.3 (106.052)
	Median (IQR)		1.5 (0-5.8)
Evergreen score	Mean (SD)		5.4 (0.593)
	Median (IQR)		4 (3-6.8)
Total	Mean (SD)		6705.9 (2981.643)
	Median (IQR)		2400 (1550-4400)
Source, n (%)	Non-informative channel		24 (70.6)
	Communication channel		6 (17.6)
	Alternative media		2 (5.9)
	Medical center, Hospital or University		2 (5.9)
	YouTube		0 (0)
	Official national website		0 (0)
Topic, n (%)	Obstetrics and Gynecology		10 (29.4)
	Prescription of abortion pill		9 (90.0)
	Contraception		1 (10.0)
	Pregnancy		0 (0)
	Information on the role of Telemedicine through the years		9 (26.5)
	Health policy		5 (14.7)
	Telehealth human relationship		4 (11.8)
	Mental health		3 (8.8)
	Telehealth platform		3 (8.8)
	New technologies		0 (0)
Country, n (%)	United States		31 (91.2)
	Asia		1 (2.9)
	Australia		2 (5.9)
	Canada		0 (0)
	Europe		0 (0)
PEMAT-P			
Understandability	Median (IQR)		63.4 (50.7-81.2)
Actionability	Median (IQR)		20 (0-50.0)
JAMA Benchmark scoring (1 point for each criteria, max= 4 points)		**Number of links**	**Percentage of links adhering to criteria**
Authorship	Authors and contributors, affiliations, and relevant credentials	34	100
Attribution	References and sources used for the content and relevant copyright information	34	100
Disclosures	Ownership, sponsorship, advertising, underwriting, commercial funding, and potential conflicts of interests	34	100
Currency	Dates of posted and updated information	34	100

Subgroup analysis

We performed a subgroup quality assessment analysis on the link characterized by the highest engagement, defined as links with a Facebook and Twitter engagement and evergreens score values above the respective median score recorded in the overall analyses. Of all 125 links examined, 34 were selected for the analyses. As well as in the overall analyses, *Facebook* was the most used *SoMe* platform for sharing articles on telemedicine (mean:6385.3 [SD:2970.6], median:1950 [IQR:1425-3950]), most of the articles were published by Magazines (n = 24, 70.6%) and were published in the United States (n = 31, 91.2%). Differently from the overall analyses, the main topic addressed was the obstetrics and gynecological field (n = 10, 29.4%), specifically the prescription of abortion pill [n = 9, 90%]) (Table 3).

According to the JAMA benchmark score, all links respected the four criteria defined as disclosure of authorship, attribution of sources, disclosure of commercial interest and website ownership, and currency (date of update). According to the PEMAT-P tool, the median understandability score was 63.8% (IQR:50.7-81.2), and the median actionability score was 20% (IQR:0-50.0).

Discussion

After the COVID-19 pandemic outbreak in March 2020, the need and interest for telemedicine development increased all over the world (4, 6, 7). The current study aims to evaluate the articles and videos' content type and quality on telemedicine uploaded on the most clicked *SoMe* platforms. Our analyses identified several noteworthy observations.

First, from the overall analyses, it emerged that the social media platform used most to share information on telemedicine was *Facebook*, followed by *Twitter*. While *Facebook* has the greatest number of active user accounts worldwide, *Twitter* appears to be a good platform for the dissemination of scientific information and knowledge transfer. These observations may be explained by a *Facebook* audience of a wide age group. Moreover, Facebook's users are allowed to share videos and articles and fix them to posts over a long period (21). Conversely, social media platforms such as *Pinterest* or *Reddit* have poorly used for this aim. Similar observations were recorded in other studies (13, 19, 21). For example, Alsyouf et al. used the *BuzzSumo* analytic tool to gather the most shared articles on genitourinary malignancies and *Facebook* resulted in the most used SoMe platform (13). Altogether, *SoMe* had revolutionized the health information spread, communication and monitoring in health care (29). For instance, *Petruzzi et al.* measured telemedicine impressions via *WhatsApp* and clinical assessments that were consistent in 82% of the cases examined (30). Additionally, this new form of knowledge could solve the digital divide of our society, enlightened by the COVID-19 pandemic (8). Indeed, it should be noted that for people who live in remote and rural areas or COVID-19 infected, the access to digital technologies for diagnosis, follow-up and treatment has been a significant resource (8). Moreover, telehealth and digital health had decreased the COVID-19 exposure, reducing the likelihood of contamination and infection during the pandemic (31). A great contribution was also given by the physicians that started to use the Internet to book an appointment, to send and receive examinations and laboratory results through a web-based portal (29). For

instance, the *Georgia Health Sciences University* has enabled the communication between patients and their physicians through a web-based platform for asking questions or requesting prescription refills (32). As a result, both physicians and patients were willing to embrace digital tools to maintain and continue the high-quality care delivery (33). In conclusion, the *SoMe* should be considered as an unprecedented tool that could make evidence-based information accessible to the public and promote positive health behaviors (29). In this regard, the governments must consider telemedicine as an opportunity to facilitate access to the Internet and ICT for their citizens (33). Thus, health policymakers and health care managers must learn about the digital divide and must plan and promote more realistic interventions to improve the access to telehealth (33).

Second, we recorded that most of the links (65.5%) were published on non-official websites, such as *Magazines*. Conversely, only 5% of articles were published by the official national website or medical entities, which should be considered a reliable source. In consequence, the quality content of telemedicine information on the Internet is not guaranteed by medical organizations and misleading information may be widespread. In addition, more than 80% of the articles were uploaded in the *United States*, highlighting a higher interest in them, with respect to the rest of the world. Finally, most of the articles wrote about Information on the role of telemedicine through the years. For example, *Alena Kharlamenko* wrote an article on the platejoy blog describing in detail telemedicine's definition and the different approaches providing several televisits examples. From our results, it emerged that a non-negligible part of the viewed links focused on telehealth human relationships and mental health. One of the main concerns regarding telemedicine use is the absence of physical contact between patients and physicians, which may impair the clinical evaluation and the correct patient management. The in-person visit is particularly crucial for some kind of specialty, such as psychiatry, where a simple check of laboratory blood exams or a pill prescription is not possible. However, in specific conditions, such as during a COVID-19 pandemic, the application of the telemedicine is noteworthy. Thus, the category of psychologists and psychiatrists could benefit from telemedicine implementation. For instance, in Ireland, 92% of the psychiatrists surveyed reported a reduction in diagnostic confidence due to the absence of a visual comparison with the patients (34). The transitioning from telephone consultations to video consultations would improve to allow a better acceptance of the service and a better receptivity from the specialist physicians (34). In addition to these aspects, several other links focused the attention on the development of new technologies. Specifically, *mobile health applications* (MHAs) represent a potential educational instrument of telemedicine. The use of MHAs is constantly increasing year to year, but the main concern was the lack of scientific validation (1, 9-11). This lack is highly restricted. Indeed, the MHAs could be used both to educate patients about their conditions and to promote high-quality health information. Moreover, apps could become a library service accessible to everyone, from health care workers to patients. Scientific Society should create and validate their own MHAs and then promote their use through the general population and to the patients affected by specific diseases. Moreover, policymakers should have learnt from COVID-19 pandemic crisis that more equal Internet access should be guaranteed for the public also in normal times (8). Hence, health policy should be developed or modified to ensure a more egalitarian Internet access for all citizens. In addition to increasing and widening access to the Internet and the health knowledge services, ICTs should be employed to lead towards digitization of health care (1, 8). In conclusion, several relevant topics were addressed by the link shared on the *SoMe*. However, few articles better explained the traps hidden with telemedicine, such as an increased level of distrust with doctors and a higher risk of defrauding patients resulting from an absence of appropriate regulation (3).

Third, in the subgroup analysis, we quantified internet users' engagement across a variety of social media platforms on the 34 most shared links on telemedicine. Subsequently, we evaluated the quality of information shared on these platforms. We recorded that as well for the overall analyses, Facebook resulted in the most used platform, whereas the main topic addressed was the prescription of the abortion pill through telemedicine. In December 2021, the *Food and Drug Administration* permanently removed the in-person requirement for picking up abortion medication (*https://www.fda.gov/drugs/postmarket-drug-safety-information-patients-and-providers/mifeprex-mifepristone-information*) and in 2022 the *World Health Organization* recommend the use of telemedicine for abortion pill prescriptions in its abortion care guidelines (*World Health Organization 2022*). However, multiple governments place limits on telehealth access to abortion care as evidenced by several articles available on the web. This topic has aroused great interest in the United States, as revealed by our analyses. It may represent a starting point to interpret telemedicine as a powerful instrument to use in several circumstances, from chronic disease management for medical advice. Finally, according to the PEMAT-P results, we recorded a higher understandability than actionability score (median 63.8 *vs* 20.0%). The understandability score reflects how viewers could process and assimilate articles' key messages, despite their cultural and medical backgrounds. The actionability score reflects how viewers could apply the information achieved. These observations confirmed what we expected since most of the articles were informative rather than instructive.

Taken together, telemedicine has become a hot topic during the last years, especially after the need emerged from the COVID-19 outbreak, which did not allow patients to get in person visits and healthcare in general. These interests resulted in higher investments from governments all over the world (7). From our analyses emerged that the telemedicine advantages (such as lower costs, access to health care from rural areas, or fastest interaction between patients and physicians or between physicians of different specialties) and the disadvantages (such as lower control of privacy and security, lower patient engagement and the evolving patient-physician relationship, limited and fragmented insurance coverage of telemedicine) were not

well discussed on the internet (35). In the future, a standard regulation should be promoted to increase telemedicine knowledge allowing people to properly use this essential service today. Moreover, the use of MHAs should be promoted both for their educational role as a telemedicine instrument and for spreading high-quality health information.

Our study is not devoid of limitations. **First**, *BuzzSumo* tool only collected data from *Facebook*, *Twitter*, *Pinterest*, *Reddit*, and *YouTube*. In consequence, information available on other social media platforms such as Instagram and *TikTok* may be missed. **Second**, *Facebook* was the most used platform to share articles. However, we were not able to discriminate if a person sharing an article actually promoted it or warned against it. **Third**, some reliable or unreliable articles may be missed, due to our search terms choose and to the number of links included for each term. However, we used four different keywords with the highest number and on-topic links. Fourth, quality assessment videos were subjectively evaluated. However, to reduce this confounder, three investigators were involved to independently analyze video contents. Finally, according to the 30-day free trial *BuzzSumo* version, we were only able to collect the links uploaded during the last year. In consequence, our study observations represent a frame on what was mostly shared during the second year following the COVID-19 outbreak. Future studies should update our observations in order to confirm or reject them. Regardless of these limitations, the present study can be considered as a snapshot of the latest and most shared information on telemedicine available on the Internet.

Conclusions

The interest in telemedicine has increased all over the world, as evidenced by the high engagement in social media articles, recorded during the last year. However, the access to digital health services is still limited, the information provided is often not verified by an official entity and unable to fill the digital divide exacerbated by COVID 19 pandemic crisis. Hence, health policy should be developed or modified to ensure a more egalitarian Internet access for all citizens. In addition to increasing and widening access to the Internet and the health knowledge services, ICTs should be employed to lead towards digitization of health care. In the future, official medical institutions should standardize telemedicine regulation, creating their own MHAs and online content to reduce the widespread of misleading information.

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Correspondence

Vincenzo Mirone, MD
mirone@unina.it

Francesco Di Bello, MD
fran.dibello12@gmail.com

Simone Morra, MD
simonemorra93@gmail.com

Luigi Cirillo, MD
cirilloluigi22@gmail.com

Marco Abate, MD
marcoabate5@gmail.com

Giovanni M. Fusco, MD
giom.fusco@gmail.com

Luigi Napolitano, MD
luiginap89@gmail.com

Roberto La Rocca, MD
robertolarocca87@gmail.com

Massimiliano Creta, MD
max.creta@gmail.com

Giuseppe Celentano, MD
dr.giuseppecelentano@gmail.com

Marco Capece, MD
drmarcocapece@gmail.com

Francesco Mangiapia, MD
mangiapiaf@gmail.com

Nicola Longo, MD
nicola.longo@unina.it

Claudia Collà Ruvolo, MD
c.collaruvolo@gmail.com

Gianluigi Califano, MD (Corresponding Author)
gianl.califano2@gmail.com
Department of Neurosciences, Reproductive Sciences and Odontostomatology, University of Naples "Federico II"
Via Sergio Pansini n°5, 80138 Naples

Gennaro Musi, MD

Stefano Luzzago, MD

Urology Department, Istituto Europeo di Oncologia (I.E.O.), Milan, Italy

Claudia Mirone, MD
claudia.mirone@unina.it
Multidisciplinary Department of Medical, Surgical and Dental Sciences, University of Campania "Luigi Vanvitelli", Naples, Italy

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