



Branding cancer research institutions through social media platforms

Pablo Medina-Aguerrebera ^{1*}

 0000-0002-4463-4721

Eva Medina ²

 0000-0001-6276-4127

Toni Gonzalez-Pacanowski ²

 0000-0003-3005-2218

¹ Faculty of Communications, Arts and Sciences, Canadian University Dubai, Dubai, UAE

² School of Communication and Psychology, University of Alicante, Alicante, SPAIN

* Corresponding author: pablo.medina@tud.ac.ae

Citation: Medina-Aguerrebera, P., Medina, E., & Gonzalez-Pacanowski, T. (2023). Branding cancer research institutions through social media platforms. *Online Journal of Communication and Media Technologies*, 13(2), e202313. <https://doi.org/10.30935/ojcm/12955>

ARTICLE INFO

Received: 23 Sep 2022

Accepted: 29 Dec 2022

ABSTRACT

Cancer research institutions resort to social media platforms to reinforce their relations with stakeholders and promote their brand. Nevertheless, they face several challenges: strict legal frameworks, patients' new demands, and the development health technology. This paper aims to analyze how cancer research institutions manage social media platforms, as well as their corporate websites, for branding purposes. To do that, we conducted a literature review about cancer hospitals' corporate communication strategies on these platforms; and then, we resorted to 48 indicators to evaluate how the top 100 cancer research institutions in the world managed their corporate websites, as well as their corporate profiles on *Facebook*, *Twitter*, and *YouTube*, for promoting their brand. We concluded that these organizations should use social media platforms to explain their brand architecture, develop a corporate website based on a public health approach, and describe their social engagements in a clearer way. Finally, we recommended three managerial initiatives for these organizations: creating an in-house communication department employing experts in communication and public health, conducting an intellectual reflection about the company's brand genealogy, and integrating oncologists and nurses in the company's corporate communication initiatives carried out on social media platforms.

Keywords: cancer hospitals, research centers, corporate communication, brand, social media

INTRODUCTION

The professional management of corporate communication is already considered as a strategic area in many industries. Thanks to corporate communication, companies can promote their brands, accelerate their internal processes and achieve different business goals. Healthcare organizations, such as hospitals, public health authorities, or patients associations, also resort to these initiatives to become more credible brands and this way influence their stakeholders' perceptions about different issues (treatments, services, quality, etc.). To do that, these organizations launch corporate events, collaborate with media companies, develop their own websites and corporate profiles on social media platforms, and even propose mobile apps to improve patients' engagement with the brand. In this framework, cancer research institutions (hospitals, research centers, etc.) have recently increased their investment in corporate communication to enhance their relations with stakeholders and this way promote their brand. Nevertheless, they face different challenges such as legal frameworks, patients' requirements or the development of new technological tools (big data,

artificial intelligence, deep learning, etc.). To efficiently face these challenges, cancer research institutions recruit experts in corporate communication who are in charge of implementing different initiatives focused on the brand. And many of these initiatives are based on a professional use of social media. This paper aims to analyze how cancer research institutions manage social media platforms, as well as their own corporate websites, to promote their corporate brand. To do that, we conducted a literature review about cancer hospitals' corporate communication strategies, their branding initiatives as well as their branding strategies on social media platforms. Then, we carried out a quantitative analysis about how the top 100 cancer research institutions in the world managed their corporate websites, as well as their corporate profiles on *Facebook*, *Twitter*, and *YouTube*, for promoting their brand. To do that, we considered 48 key performance indicators aiming to evaluate how each organization disseminate brand-related content. Finally, we proposed three conclusions as well as three managerial recommendations to help health organizations on cancer research use social media platforms in a more professional way.

BRANDING CANCER RESEARCH INSTITUTIONS

Cancer Hospitals' Corporate Communication Strategies

The professional management of corporate communication is a relatively recent profession in the health industry (Maier, 2016): most schools of medicine do not propose courses on corporate communication (Gilligan et al., 2016) and many hospitals have not implemented yet a corporate communication department to manage these initiatives in a professional way (Blackstone & Pressman, 2016). Even if recently some private hospitals have developed their corporate communication departments (Apenteng et al., 2020), these organizations need to reinforce their engagements with this corporate communication in order to improve their relations with patients. This situation is especially important for hospitals dealing with cancer patients because these last ones need access to complex information systems about diseases and treatments (Yeob et al., 2017). Besides, cancer patients build an image of their clinicians centered in the communication relations that they establish with them (Beesley et al., 2016). To efficiently manage this area, cancer hospitals should develop three main communication initiatives: interpersonal, internal and external communication (Gonzalez-Pacanowski et al., 2018).

Cancer patients face a high prevalence of psychological stress that could be minimized by health professionals' skills in interpersonal communication (Moore et al., 2018). These skills influence patients' medical outcomes (Epstein et al., 2017), their engagement with doctors' recommendations (Brand et al., 2017) and their behavior outside the hospital (Peterson et al., 2016). Schools of medicine and cancer organizations should provide physicians with training allowing them to reinforce their skills in interpersonal communication (Epstein et al., 2017). These courses should include content about how to control emotions and integrate social issues related to medicine, such as culture or religion (Salmon & Bridget, 2017). When oncologists reinforce their skills in interpersonal communication, they can efficiently address the six core functions of cancer patient-centered communication: managing uncertainty, responding to emotions, making collective decisions, fostering healing relationships, enabling self-management and exchanging information (Blanch-Hartigan et al., 2016).

According to Welch and Jackson (2007), employees are the key players of every internal communication initiative: they should be engaged with the company, its brands and its objectives. In hospitals, employees are the most powerful communication "channel", that is why they should understand the company's mission and vision and disseminate these corporate values through their daily behaviors (Naveen et al., 2014). When cancer hospitals manage internal communication, they respect three main criteria:

- (1) protecting patients' rights such as privacy, information quality or autonomy (Pelitti, 2016),
- (2) sharing accurate information allowing employees to improve their performance (Rodrigues et al., 2016), and
- (3) quantifying the impact of every internal communication initiative on the hospital's brand (Zerfass & Viertmann, 2017).

Besides interpersonal and internal communication, cancer hospitals implement external communication initiatives to manage their relations with stakeholders, such as media companies, suppliers or public authorities (Gonzalez-Pacanowski et al., 2018). One of the most important stakeholders they interact with are patients, who are considered as true public opinion leaders (BecerraMunoz et al., 2015). Before implementing any external communication initiative, cancer hospitals analyze their stakeholders' attitudes and expectations (Moser & Greeman, 2014) as well as their competitors' external communication strategies (Kemp et al., 2014). Based on these insights, they launch unique external communication initiatives that besides respect three principles:

- (1) promoting public health-related content useful for every stakeholder (Fischer, 2014),
- (2) reinforcing the organization's brand (Naveen et al., 2014), and
- (3) measuring how external communication initiatives impact on the company's brand, identity, and leadership (Moreno et al., 2016).

Cancer Hospitals' Branding Initiatives

The brand refers to tangible and intangible assets that create an added value influencing stakeholders' perceptions about the organization (Gombeski et al., 2014). This corporate element determines the company's communication strategies: in other words, all interpersonal, internal and external communication initiatives should be consistent with the company's brand (Maier, 2016). In the health industry, hospitals implement branding initiatives to reinforce their scientific credibility (Esposito, 2017) and become meaningful organizations able to positively influence society (Zerfass & Viertmann, 2017).

Before implementing any branding initiatives, cancer hospitals define their brand architecture: identity, values, mission, vision and culture (Gonzalez-Pacanowski et al., 2018). The corporate *identity* can be defined as the main reasons why the company's founders decided to create the organization (Veltri & Nardo, 2013). *Values* refers to tangible ideas allowing employee to integrate the company's identity in their daily activities (Sheehan & Isaac, 2014). Concerning the *mission*, it describes the midterm objectives pursued by the company and specifies different tangible paths to achieve them (Cady et al., 2011). The *vision* establishes the different organizational changes that should be implemented to help the company achieve its long-term objectives (Singal & Jain, 2013). Finally, the *culture* refers to the unique way in which every employee works in order to create a unique professional environment (Nelson et al., 2014).

Cancer hospitals can implement five main branding strategies. *First*, focusing on emotional aspects to reinforce patients' engagement with the company's brand (Kemp et al., 2014). *Second*, developing personal branding campaigns highlighting employees' added value as well as their positive impact on the organization's internal functioning (Trepanier & Gooch, 2014). *Third*, cobranding campaigns allowing the cancer organization to interact with other institutions, such as research centers, media companies or public authorities (Gombeski et al., 2014). *Fourth*, collaborating with external agencies specialized in publishing national and international rankings about health organizations (Cua et al., 2017). And *fifth*, resorting to social media platforms to disseminate brand related-content and this way influence stakeholders' perceptions about the cancer organization (Triemstra et al., 2018).

Managing interpersonal, internal, and external communication initiatives in a professional way allows health organizations to protect their brand and reinforce their corporate reputation (Kotsenas et al., 2018). This last concept refers to the health organization's legitimacy to conduct their research and clinical activities (Blomgren et al., 2016), and determines stakeholders' perceptions about the company's employees and services (Mira-Lorenzo & Navarro, 2014). Thanks to reputation, health organizations can establish more efficient communication campaigns because stakeholders associate them with scientific credibility and professional performance (Kemp et al., 2014).

Cancer Hospitals' Branding Strategies on Social Media

Managing social media in a professional way positively contributes to improve cancer hospitals' brand (Medina-Aguerrebera et al., 2020). These organizations resort to social media to engage entire populations at low cost, connect patients and doctors, encourage adherence with cancer care and collect data for advancing

cancer research (Prochaska et al., 2017). Besides, these platforms allow them to promote individual and public health (Yang et al., 2018), enrich corporate relations with external media companies (Kotsenas et al., 2018), and reduce social inequality because patients can access scientific information in an easy way and without any cost (De Las Heras-Pedrosa et al., 2020).

Despite all these advantages, defining efficient online branding strategies constitutes an intellectual challenge, that is why cancer hospitals should respect five main principles:

- (1) conducting research about patients' attitudes and perceptions (Mazor et al., 2016),
- (2) integrating oncologists in online initiatives to reinforce patients' self-confidence (Yeob et al., 2017),
- (3) implementing evidence-based practices to protect patients against misinformation (Sedrak et al., 2017),
- (4) providing patients with a social, emotional support network allowing them to share experiences with other patients (Namkoong et al., 2017), and
- (5) implementing online communities to help patients reinforce their empowerment (Falisi et al., 2017).

Cancer hospitals use different social media platforms for their branding campaigns, such as *Facebook*, *Twitter*, or *YouTube*. More and more cancer patients and oncologists resort to *Facebook* for interacting with each other (Attai et al., 2016), share medical information and experiences (Kotsenas et al., 2018) and documenting the cancer journey (Gage-Bouchard et al., 2017). Concerning *Twitter*, most cancer patients use this platform for establishing an emotional support network (Sedrak et al., 2016), integrating online communities specialized on some cancer diseases (Sedrak et al., 2017) and disseminating information about cancer prevention and healthy habits (Sutton et al., 2018). Finally, cancer hospitals integrate *YouTube* into their branding strategies for facilitating decision-making processes between patients and doctors (Basch et al., 2015), sharing visual medical information about cancer treatments (Míguez-González et al., 2019) and helping patients to learn how to control their negative emotions such as fear, anger, or sadness (Balasooriya-Smeekens et al., 2015). On the other hand, some cancer hospitals have recently resorted to other social media platforms, such as *TikTok* or *Instagram*. Thanks to *Instagram*, cancer hospitals can better understand patient's perceptions about the disease and the treatments (Cho et al., 2018). As to *TikTok*, it allows these institutions to better interact with patients, engage with them and implement health education initiatives (Zhu et al., 2020).

Using social media for branding initiatives represents a risk in terms of reputation: criticism, fake news, insults, etc. (Lagu et al., 2016). Nevertheless, health organizations' social presence positively influences their corporate reputation (Triemstra et al., 2018), that is why most of them assume the risk and resort to these platforms for branding purposes (Costa-Sánchez & Míguez-González, 2018). In order to control risks and optimize their social presence, cancer hospitals utilize key performance indicators to constantly evaluate their reputation (Garga et al., 2020); moreover, these organizations also measure how branding initiatives on social media contribute to improve medical services and, therefore, patients' perceptions about the brand (Ivanov & Sharman, 2018).

METHODOLOGY

Cancer research institutions resort to social media platforms to disseminate brand-related content and reinforce their relations with stakeholders. In order to evaluate how these organizations carry out these branding initiatives, we have considered the *top-100 healthcare institutions on cancer research*, a ranking published by *Nature* in 2020. To do this ranking, *Nature's* researchers considered three main criteria:

- (1) number of articles in cancer research from January 2015 to August 2019,
- (2) number of cancer articles over the period, and
- (3) percentage of internationally collaborative articles in cancer research over the period¹.

¹ More information about this ranking available on: <https://www.natureindex.com/supplements/nature-index-2020-cancer/tables/healthcare> (Accessed: 25 January 2022).

Nature's ranking identified the top-100 healthcare institutions on cancer research in the world (**Appendix A**). In order to better understand how these organizations managed online platforms for branding purposes, we focused our quantitative analysis on their corporate websites, as well as their corporate profiles on *Facebook*, *Twitter*, and *YouTube*². According to Namkoong et al. (2017), most healthcare organizations consider their corporate websites as a strategic tool for their corporate communication initiatives. Nevertheless, these organizations also resort to *Facebook*, for sharing medical information and support patients from an emotional point of view (Attai et al., 2016); *Twitter*, for disseminating corporate information about events, treatments and scientific discoveries (Park et al., 2016); and *YouTube*, for health education initiatives based on visual tools (Míguez-González et al., 2019).

From 2nd March to 5th April 2022, we carried out a quantitative analysis to analyze how the 100 best cancer research institutions managed their corporate websites, as well as their corporate profile on *Facebook*, *Twitter*, and *YouTube* for branding purposes. We built a database, that we reviewed twice to make sure there was not any mistake.

When identifying every cancer center's profile on the four platforms, we followed three main principles:

- (1) focusing on the cancer center's corporate profile and not on other profiles managed by some departments or other companies related to the cancer center,
- (2) concerning corporate websites, we only analyzed websites in English, given that these organizations try to become global brands and
- (3) with respect to *Facebook*, *Twitter*, and *YouTube*, we considered profiles in English, but also in other languages (Chinese, French, German, etc.), given that patients and other stakeholders are free to speak English, or their local language.

Once identified these institutions' corporate profiles on the four platforms, we resorted to 48 key performance indicators to evaluate how they managed their branding initiatives. These indicators were grouped in three categories:

- (1) identity,
- (2) communication activities, and
- (3) users' engagement (**Table 1**).

Table 1. Indicators

Corporate website	<i>Facebook</i>	<i>Twitter</i>	<i>YouTube</i>
Identity*			
1. Corporate logo	1. Corporate logo	1. Corporate logo	1. Corporate logo
2. Multilingual website	2. Links to corporate websites	2. Links to corporate websites	2. Links to corporate websites
3. Links to medical departments	3. Organization's description	3. Organization's description	3. Organization's description
4. Find a doctor or a researcher	4. Milestones	4. Joined date	4. Milestones
5. Find diseases	5. Awards	5. Foundation date	5. Awards
6. Links to research & education departments	6. Brand values	6. Hashtags on the description	6. Brand values
7. Link to press department	7. Mission	7. Health professionals or researchers on main image	7. Mission
8. Links to social media platforms	8. Vision	8. Links to other social media platforms	8. Vision
Communication activities**			
9. Videos on homepage	9. Videos integrated	9. Number of followings	9. Playlists
10. Press releases on homepage	10. Events	10. Media section with videos	10. Channels

² We carried out this analysis from 2nd March to 5th April 2022.

Table 1 (continued). Indicators

Corporate website	Facebook	Twitter	YouTube
Users' engagement***			
11. Patients' platform	11. Number of likes	11. Number of likes	11. Number of subscribers
12. Mobile apps	12. Number of followers	12. Number of followers	12. Number of views

Concerning these indicators, we tried to harmonize all of them, but we also respected the different metrics proposed by each platform (*Facebook*, *Twitter*, and *YouTube*). When analyzing each indicator, we only considered the information that we could immediately retrieve by doing only one click on the different sections (homepage, information, and about us). We used a binary system to analyze all indicators, except for seven indicators: *Facebook* (11 and 12), *Twitter* (9,11, and 12), and *YouTube* (11 and 12). These last ones were evaluated as absolute numbers. Once the database was completed, we reviewed twice all the results to make sure there was not any mistake.

RESULTS

Our quantitative analysis proved that most cancer research institutions followed a professional logic when managing their corporate websites and their profiles on *Facebook*, *Twitter*, and *YouTube*: they publish some brand-related content, they respect corporate logos, they integrate platforms, etc. Nevertheless, many of them must improve their practices. In order to how, we present our results grouped in four sections: *corporate website*, *Facebook*, *Twitter*, and *YouTube*.

Corporate Website

According to our results, 93% of organizations had a corporate website, and most of them fulfill key performance indicators, especially those related to *identity*: corporate logo in the homepage (100%), links to medical departments (100%), links to research and education sections (98%), links to their corporate social media platforms (92%), link to the communication department (88%), search engine for finding doctors (70%), multilingual website (56%), and search engine for finding diseases (34%). Concerning *communication activities* criteria, 89% of organizations published press releases on their homepage, and 56% also displayed videos. With respect to *users' engagement*, 52% of organizations proposed a patients' platform, and 10% a mobile app for helping patients interact with the organization in a more personal way. On the other hand, 55,91% of organizations respected between eight and 10 indicators (**Table 2**), and the only ones to fulfill all indicators were *Michigan Medicine* (USA), *Mayo Clinic* (USA), *NYU Langone Medical Center* (USA), *Roswell Park Cancer Institute*, *Cedars-Sinai Medical Center* (USA), and *Singapore Health Services* (Singapore).

Table 2. Indicators distribution

Number of indicators	Number of organizations	Number of indicators	Number of organizations
12	6	6	7
11	7	5	4
10	14	4	2
9	22	3	1
8	16	2	0
7	14	1	0

Facebook

Many cancer research institutions considered this platform³ as a corporate communication tool: in fact, 84% of organizations analyzed had a corporate profile on *Facebook*. Nevertheless, many of these institutions did not respect most criteria related to *identity*: corporate logo on the main profile image (100%), links to corporate websites related to the organization (100%), corporate description about the organization (96%), milestones (18%), awards (12%), mission (4%), vision (4%), and brand values (1%). As to *communication activities*, all organizations showcased videos and 96% had an events section to describe different initiatives

³ Some cancer organizations displayed a *Facebook* link on their corporate website published in their local language, but not on their corporate website published in English. On the other hand, some organizations displaying a *Facebook* link on their corporate website published in their local language did not even have a corporate website in English.

launched by the company. Concerning *users' engagement*, the best hospitals by number of likes and followers were *St. Jude Children's Research Hospital*, *Cleveland Clinic*, and *Mayo Clinic* (Table 3).

Table 3. Organizations by number of likes & followers

No	Organization	Number of likes	Number of followers
1	St. Jude Children's Research Hospital (USA)	2,473,393	2,411,681
2	Cleveland Clinic (USA)	2,024,737	1,952,187
3	Mayo Clinic (USA)	1,204,604	1,228,152
4	Boston Children's Hospital (USA)	753,056	697,053
5	Johns Hopkins Medicine (USA)	651,976	660,658
6	Dana-Farber Cancer Institute (USA)	435,353	430,253
7	The University of Texas MD Anderson Cancer Center (USA)	368,717	374,694
8	UCLA Health (USA)	309,149	309,714
9	UCSF Health (USA)	275,272	276,549
10	Mount Sinai Health System (USA)	243,274	256,692

Finally, considering the 10 indicators related to *identity* and *communication activities*, 63.1% of organizations respected only five indicators, and the institution fulfilling most criteria was *St. Jude Children's Research Hospital* (eight criteria).

Twitter

Our quantitative analysis demonstrated that 83% of organizations had a corporate profile on *Twitter*⁴. Nevertheless, many of them did not respect the indicators related to *identity*: publication of the date when they joined the platform (100%), links to corporate websites (100%), logo integrated on the main profile image (99%), corporate description about the organization (92%), health professionals or researchers as main profile image (51%), hashtags on the description (43%), publication of the company's foundation date (1%) and links to other social media platforms (0%). As to *communication activities*, 99% of organizations showcased a media section including videos; on the other hand, the best organizations by number of followings were *Radboud University Medical Center–Netherlands* (21,967), *Vanderbilt University Medical Center–USA* (16,730), and *Samsung Medical Center–South Korea* (15,153). Concerning *users' engagement*, the best organizations by number of likes were three American hospitals: *The University of Texas MD Anderson Cancer Center* (32,900), *Memorial Sloan Kettering Cancer Center* (26,800), and *Dana-Farber Cancer Institute* (21,500). Finally, *Mayo Clinic*, *Cleveland Clinic*, and *Johns Hopkins Medicine* were the best organizations by number of followers (Table 4).

Table 4. Organizations by number of followers

No	Organization	Number of followers
1	Mayo Clinic (USA)	2,039,133
2	Cleveland Clinic (USA)	1,919,511
3	Johns Hopkins Medicine (USA)	617,281
4	St. Jude Children's Research Hospital (USA)	434,509
5	The University of Texas MD Anderson Cancer Center (USA)	121,441
6	Dana-Farber Cancer Institute (USA)	106,396
7	Memorial Sloan Kettering Cancer Center (USA)	93,111
8	Mount Sinai Health System (USA)	87,826
9	Assistance Publique-Hôpitaux de Paris (France)	80,415
10	UCSF Health (USA)	73,438

YouTube

According to our results, 75% of organizations had a corporate profile on this platform⁵. However, most organizations did not respect the indicators about *identity*: logo on the main profile image (100%), links to corporate websites (99%), corporate description about the organization (81%), milestones (32%), awards

⁴ In the manner of *Facebook*, some cancer centers displayed a *Twitter* link on their corporate website published in their local language, but not on their corporate website published in English. On the other hand, some organizations displaying a *Twitter* link on their corporate website published in their local language did not even have a corporate website in English.

⁵ In the manner of *Facebook* and *Twitter*, some cancer centers displayed a *YouTube* link on their corporate website published in their local language, but not on their corporate website published in English. On the other hand, some organizations displaying a *YouTube* link on their website published in their local language did not even have a corporate website in English.

(17%), mission (9%), brand values (1%), and vision (0%). Concerning *communication activities*, 97% of organizations analyzed displayed a playlist and 75% showcased channels. With respect to *users' engagement*, the best organizations by number of subscribers were *Mayo Clinic*, *UCLA Clinic*, and *Cleveland Clinic* (Table 5), and the best ones by number of views were *Mayo Clinic* (271,901,566), *Cleveland Clinic* (114,188,806), and *Cincinnati Children's Hospital Medical Center* (98,885,847). Finally, concerning the indicators about *identity and communication activities*, 77.33% of organizations fulfilled between four and six indicators.

Table 5. Organizations by number of subscribers

No	Organization	Number of subscribers
1	Mayo Clinic (USA)	805,000
2	UCLA Health (USA)	436,000
3	Cleveland Clinic (USA)	319,000
4	Johns Hopkins Medicine (USA)	265,000
5	Cincinnati Children's Hospital Medical Center (USA)	194,000
6	Children's Hospital of Philadelphia (USA)	156,000
7	UC Davis Health (USA)	153,000
8	Michigan Medicine, U-M (USA)	135,000
9	The University of Texas MD Anderson Cancer Center (USA)	134,000
10	Singapore Health Services (Singapore)	115,000

DISCUSSION

Before implementing any communication initiative on social media platforms, health organizations should define a communication strategy: communication objectives, main and secondary targets, brand positioning and evaluation system (Triemstra et al, 2018). Our results proved that many cancer research institutions managed social media in a basic way, which reveals that many of them had not defined a communication strategy before using these platforms.

Thanks to social media platforms, health organizations achieve different communication objectives such as promoting public health-related content (Matarin Jimenez, 2015), enhancing collective decision-making processes between doctors and patients (Lim, 2016), providing patients with different emotional support networks (Gage-Bouchard et al., 2017) and improving relations with stakeholders and this way reinforce their corporate reputation (Cua et al., 2017). Nevertheless, according to our results, many cancer research institutions managed social media platforms in a basic way: they showcased their logo and other corporate images (buildings, employees, etc.), but they did not develop a content that really helped patients (health education, events about how to prevent diseases, etc.). This approach avoid hospitals to achieve their communication objectives. Even if most organizations analyzed had a *corporate website* (93%) as well as a corporate profile on *Facebook* (84%), *Twitter* (83%), or *YouTube* (75%), most of them did not fulfil many key performance indicators, especially on *YouTube*, where no organizations respected more than seven criteria, or *Twitter*, where no organization integrated this platform with their corporate profile on other social media platforms, which constitutes a true barrier when promoting a brand.

On social media platforms, cancer organizations interact with patients to enhance their empowerment (Visser et al., 2016); but also with patients' relatives, to build a social network allowing patients to control their own emotions and better understand health-related content (Badr, 2017). Besides, these institutions interact with oncologists, to develop health education initiatives (Peluchette et al., 2016); media companies, to disseminate health-related content (Brand et al., 2017); and the whole society, to promote public health values (Vraga et al., 2016). Most organizations analyzed focused their communication initiatives on many of these targets, such as *patients* (all organizations displayed on their *corporate website* a link to medical and research departments, and 70% proposed a search engine to find doctors), *patients' relatives* (on *Twitter*, 99% of organizations had a media section including videos about different topics such as for example health education), *doctors* (on *YouTube*, 97% of organizations showcased playlists on different topics such as scientific research initiatives, new treatments or corporate projects) and the *whole society* (96% of organizations displayed on *Facebook* an events section to describe different initiatives such as conferences, workshops or festivals).

Cancer organizations' brand reputation is directly influenced by their presence on social media (Huesch et al., 2014), that is why these companies should manage these platforms in a professional way: in other words, they should respect their brand architecture (Blomgren et al., 2016), collaborate with doctors so that they become brand ambassadors (Trepanier & Gooch, 2014) and disseminate accurate information in order to become a credible scientific brand (Kotsenas et al., 2018). Our results proved that most organizations analyzed did not respect branding criteria. For example, on *Facebook*, only 4% of them described their mission and vision, and just 1% their brand values. On *YouTube*, 1% of organizations explained their brand values and no of them defined their vision. On the other hand, on their *corporate website*, only 10% of cancer organizations proposed to patients a mobile app to interact with doctors in a more direct, efficient way. Finally, on *Twitter*, only 1% of cancer centers showcased their foundation date, an essential milestone to promote the brand.

Hospitals need to do an effort to integrate websites, social media platforms as well as other communication tools in a more professional way, which involves that they must present their brand architecture in every platform, disseminate meaningful content, and use a creative approach (language and image) to interact with stakeholders and establish richer relations with them. Before launching any campaign, cancer organizations conduct research to better known patients' perceptions and attitudes about cancer (Noar et al., 2018), as well as their personal opinions about these organizations' social media presence (Apenteng et al., 2020). These organizations analyze stakeholders' perceptions during the communication campaign (Triemstra et al., 2018), and after this one to prove in a quantitative way how the campaign impacted on these stakeholders' perceptions (Garga et al., 2020). According to our results, cancer research organizations resorted to different metrics to evaluate their corporate communication initiatives on social media. On *Facebook*, the best brand in terms of number of likes and followers was *St. Jude Children's Research Hospital*. On *Twitter*, the best organization by number of likes was *The University of Texas MD Anderson Cancer Center*, and the best one by number of followers, *Mayo Clinic*. Finally, the best cancer center on *Youtube* by number of views and subscribers was also *Mayo Clinic*.

This paper described different quantitative results that can help cancer research institutions to improve their communication strategies on social media. Nevertheless, we must also highlight three main limitations affecting this research. *First*, we did not have access to these organizations' corporate communication departments, which avoided us to better understand how they managed social media platforms (employees working in the Social Media Business Unit, budgets, plans, and protocols). *Second*, we did not find any information to evaluate stakeholders' perceptions about these cancer organizations' presence on social media. And *third*, we did not retrieve any other paper analyzing the same topic, which avoided us to compare our results. Based on this paper, researchers in health communication can explore during the next years other interesting areas, such as how to evaluate oncologists' initiatives on social media from a branding point of view, how to integrate social media into the hospital's medical protocols, and how to use these platforms for building the brand in a collective way along with patients.

CONCLUSION

Managing social media platforms for branding purposes constitutes an intellectual challenge because, on the one hand, cancer research institutions must respect a strict legal framework and, on the other hand, they must focus on meaningful content that positively influences stakeholders' perceptions (accurate information, emotional support). This paper aimed to analyze how cancer research institutions managed *Facebook*, *Twitter*, *YouTube*, as well as their corporate websites, to promote their corporate brand. To conclude this paper, we propose three last ideas. *First*, most cancer research institutions analyzed did not describe their brand architecture (identity, mission, vision, values and culture) on *Facebook*, *Twitter*, and *YouTube*, which constitutes a reputation risk because stakeholders cannot understand why every organization is unique. *Second*, concerning their corporate websites, these organizations should evolve from their current journalistic approach focused on disseminating medical content, to a more public health approach that prioritizes satisfying stakeholders' needs in terms of information and emotional support (patients' platform, mobile apps, online consultations with doctors, newsroom for journalists). This is what *Mayo Clinic*, *John Hopkins Medicine* and *Cleveland Clinic* carry out since many years in the USA: they propose online consultation through

social media platforms and mobile apps, they provide patients with books about healthy habits, and they organize events in their health education centers at the hospital. And *third*, these organizations should describe their social engagements with every stakeholder and explain in a clear way how these initiatives help them become more credible brands.

Based on these three conclusions, as well as the literature review and the quantitative analysis previously developed, we recommend cancer research institutions to implement three initiatives:

- (1) creating an in-house corporate communication department employing experts in communication and public health who work according to protocols and key performance indicators,
- (2) conducting an intellectual reflection about the company's brand genealogy as a previous step to develop an annual content plan for promoting the brand in a consistent, credible way, and
- (3) integrating oncologists and nurses into the company' corporate communication initiatives on social media platforms so that they become credible brand ambassadors.

Author contributions: **PM:** global structure, literature review, conclusion, writing, & formatting; **EM:** methodology & results; & **TG-P:** discussion & conclusion. All authors approved the final version of the article.

Funding: The authors received no financial support for the research and/or authorship of this article.

Ethics declaration: Authors declared that the study did not require ethics committee approval since it was based on information publicly available on websites and platforms. Informed consents were obtained from the participants. Authors further declared that the material is authors' own original work and that they have respected all institutional ethical requirements applied to quantitative research.

Declaration of interest: Authors declare no competing interest.

Data availability: Data generated or analyzed during this study are available from the authors on request.

REFERENCES

- Apenteng, B. A., Ekpo, I. B., Mutiso, F. M., Akowuah, E. A., & Opoku, S. T. (2020). Examining the relationship between social media engagement and hospital revenue. *Health Marketing Quarterly*, 37(1), 10-21. <https://doi.org/10.1080/07359683.2020.1713575>
- Attai, D. J., Sedrak, M. S., Katz, M. S., Thompson, M.A., Anderson, P. F., Kesselheim, J. C., Fisch, M. J., Graham, D. L., Utengen, A., Johnston, C., Miller, R. S., & Dizon, D. S. (2016). Social media in cancer care: Highlights, challenges & opportunities. *Future Oncology*, 12(13), 1549-1552. <https://doi.org/10.2217/fon-2016-0065>
- Badr, H. (2017). New frontiers in couple-based interventions in cancer care: Refining the prescription for spousal communication. *Acta Oncological*, 56(2), 139-145. <https://doi.org/10.1080/0284186X.2016.1266079>
- Balasooriya-Smeekens, C., Walter, F. M., & Scott, S. (2015). The role of emotions in time to presentation for symptoms suggestive of cancer: A systematic literature review of quantitative studies. *Psycho-Oncology*, 24(12), 1594-1604. <https://doi.org/10.1002/pon.3833>
- Basch, C. H., Basch, C. E., Hillyer, G. C., & Reeves, R. (2015). YouTube videos related to skin cancer: A missed opportunity for cancer prevention and control. *JMIR Cancer*, 1(1), e1. <https://doi.org/10.2196/cancer.4204>
- Becerra Munoz, E., Estevez, J. R., & Victoria Mas, J. S. (2015). Comunicación e imagen de los servicios sanitarios. El caso de los centros hospitalarios andaluces (2004-2013) [Communication and image of health services. The case of Andalusian hospitals (2004-2013)]. *Prisma Social. Revista de Ciencias Sociales [Social Prism. Journal of Social Sciences]*, 14, 1-28.
- Beesley, H., Goodfellow, S., Hocombe, C., & Salmon, P. (2016). The intensity of breast cancer patients' relationships with their surgeons after the first meeting: Evidence that relationships are not 'built' but arise from attachment processes. *European Journal of Surgical Oncology*, 42(5), 679-684. <https://doi.org/10.1016/j.ejso.2016.02.001>
- Blackstone, S. W., & Pressman, H. (2016). Patient communication in health care settings: New opportunities for augmentative and alternative communication. *Augmentative and Alternative Communication*, 32(1), 69-79. <https://doi.org/10.3109/07434618.2015.1125947>

- Blanch-Hartigan, D., Chawla, N., Moser, R. P., Finney-Rutten, L. J., Hesse, B. W., & Arora, N. K. (2016). Trends in cancer survivors' experience of patient-centered communication: Results from the health information national trends survey (HINTS). *Journal of Cancer Survivorship*, 10, 1067-1077. <https://doi.org/10.1007/s11764-016-0550-7>
- Blomgren, M., Hedmo, T., & Waks, C. (2016). Being special in an ordinary way: Swedish hospitals' strategic web communication. *International Journal of Strategic Communication*, 10(3), 177-194. <https://doi.org/10.1080/1553118X.2016.1176569>
- Brand, S. R., Fasciano, K. & Mack, J. W. (2017). Communication preferences of pediatric cancer patients: talking about prognosis and their future life. *Support Care Center*, 25, 769-774. <https://doi.org/10.1007/s00520-016-3458-x>
- Cady, S. H.; Wheeler, J. V., DeWolf, J., & Brodke, M. (2011). Mission, vision and values: What do they say? *Organizational Development Journal*, 29(1), 63-78.
- Cho, H., Silver, N., Na, K., Adams, D., Luong, K. T., & Song, C. (2018). Visual cancer communication on social media: An examination of content and effects of #Melanomasucks. *Journal of Medical Internet Research*, 20(9), e10501. <https://doi.org/10.2196/10501>
- Costa-Sánchez, C., & Míguez-González, M.-I. (2018). Use of social media for health education and corporate communication of hospitals. *El Profesional de la Información [The Information Professional]*, 27(5), 1145-1150. <https://doi.org/10.3145/epi.2018.sep.18>
- Cua, S., Moffatt-Bruce, S., & White, S. (2017). Reputation and the best hospital rankings: What does it really mean? *American Journal of Medical Quality*, 32(6), 632-637. <https://doi.org/10.1177/1062860617691843>
- De Las Heras-Pedrosa, C., Rando-Cueto, D., Jambrino-Maldonado, C., Paniagua-Rojano, J., & Feng, G. C. (2020). Analysis and study of hospital communication via social media from the patient perspective. *Cogent Social Sciences*, 6(1), 1718578. <https://doi.org/10.1080/23311886.2020.1718578>
- Epstein, R. M., Duberstein, P. R., & Fenton, J. J. (2017). Effect of a patient-centered communication intervention on oncologist-patient communication, quality of life, and health care utilization in advanced cancer. The VOICE randomized clinical trial. *JAMA Oncology*, 3(1), 92-100. <https://doi.org/10.1001/jamaoncol.2016.4373>
- Esposito, A. (2017). Hospital branding in Italy: A pilot study based on the case method. *Health Marketing Quarterly*, 34(1), 35-47. <https://doi.org/10.1080/07359683.2016.1275211>
- Falisi, A. L., Wiseman, K. P., Gaysynsky, A., Scheideler, J. K., Ramin, D. A., & Sylvia Chou, W.-Y. (2017). Social media for breast cancer survivors: A literature review. *Journal of Cancer Survivorship*, 11, 808-821. <https://doi.org/10.1007/s11764-017-0620-5>
- Fischer, S. (2014). Hospital positioning and integrated hospital marketing communications: State-of-the-art review, conceptual framework, and research agenda. *Journal of Nonprofit & Public Sector Marketing*, 26(1), 1-34. <https://doi.org/10.1080/10495142.2014.870431>
- Gage-Bouchard, E. A., La Valley, S., Mollica, M., & Beaupin, L. (2017). Examining how cancer caregivers use Facebook for cancer-related communication. *Cancer Nursing*, 40(4), 332-338. <https://doi.org/10.1097/NCC.0000000000000418>
- Garga, P., Gupta, B., Dzever, S., Sivarajah, U., & Kumar, V. (2020). Examining the relationship between social media analytics practices and business performance in the Indian retail and IT industries: The mediation role of customer engagement. *International Journal of Information Management*, 50, 102069. <https://doi.org/10.1016/j.ijinfomgt.2020.102069>
- Gilligan, C., Powell, M., Lynagh, M. C., Ward, B. M., Lonsdale, C., Harvey, P., James, E. L., Rich, D., Dewi, S. P., Nepal, S., Croft, H. A., & Silverman, J. (2016). Interventions for improving medical students' interpersonal communication in medical consultations. *Cochrane Database of Systematic Reviews*, 11, CD012418. <https://doi.org/10.1002/14651858.CD012418.pub2>
- Gombeski, W. R., Claypool, J. O., Karpf, M., Britt, J., Birdwhistell, M., Riggs, K., Wray, T., & Taylor, J. (2014). Hospital affiliations, co-branding and consumer impact. *Health Marketing Quarterly*, 31(1), 65-77. <https://doi.org/10.1080/07359683.2014.874873>

- Gonzalez-Pacanowski, T., & Medina-Aguerreberre, P. (2018). Las apps en la identidad digital hospitalaria: Implicaciones en la reputación y tendencias [*Apps in hospital digital identity: Implications for reputation and trends*]. *Revista Española de Comunicación en Salud [Spanish Journal of Health Communication]*, 9, 82. <https://doi.org/10.20318/recs.2018.4255>
- Huesch, M. D., Currid-Halkett, E., & Doctor, J. N. (2014). Public hospital quality report awareness: Evidence from National and Californian Internet searches and social media mentions, 2012. *BMJ Open*, 11(4), e004417. <https://doi.org/10.1136/bmjopen-2013-004417>
- Ivanov, A., & Sharman, R. (2018). Impact of user-generated internet content on hospital reputational dynamics. *Journal of Management Information Systems*, 35(4), 1277-1300. <https://doi.org/10.1080/07421222.2018.1523603>
- Kemp, E., Jillapalli, R., & Becerra, E. (2014). Healthcare branding: Developing emotionally based consumer brand relationships. *Journal of Services Marketing*, 28(2), 126-137. <https://doi.org/10.1108/JSM-08-2012-0157>
- Kotsenas, A., Aase, L., Arce, M., & Timimi, F. (2018). The social media DNA of Mayo Clinic—and health care. *Journal of American College of Radiology*, 15, 162-166. <https://doi.org/10.1016/j.jacr.2017.09.026>
- Lagu, T., Goff, S., Craft, B., Calcasola, S., Benjamin, E., Priya, A., & Lindenauer, P. (2016). Can social media be used as a hospital quality improvement tool? *Journal of Hospital Medicine*, 11(1), 52-55. <https://doi.org/10.1002/jhm.2486>
- Lim, W. M. (2016). Social media in medical and health care: Opportunities and challenges. *Marketing Intelligence & Planning*, 34(7), 964-976. <https://doi.org/10.1108/MIP-06-2015-0120>
- Maier, C. (2016). Beyond branding: Van Riel and Fombrun's corporate communication theory in the human services sector. *Qualitative Research Reports in Communication*, 17(1), 27-35. <https://doi.org/10.1080/17459435.2015.1088892>
- Matarín Jiménez, T. (2015). Redes sociales en prevención y promoción de la salud. Una revisión de la actualidad [Social networks in prevention and health promotion. A current review]. *Revista Española de Comunicación de Salud [Spanish Magazine of Health Communication]*, 6(1), 62-69.
- Mazor, K., Street, R., Sue, V., Williams, A., Rabin, B., & Arora, N. (2016). Assessing patients' experiences with communication across the cancer care continuum. *Patient Education and Counseling*, 99(8), 1343-1348. <https://doi.org/10.1016/j.pec.2016.03.004>
- Medina-Aguerreberre, P., Gonzalez-Pacanowski, T., & Medina, E. (2020). Online reputation management by cancer hospitals: A systematic literature review in the USA and Spain. *Profesional De La Información [Information Professional]*, 29(6), n. 6. <https://doi.org/10.3145/epi.2020.nov.17>
- Míguez-González, M. I., García-Crespo, O., & Ramahí-García, D. (2019). Análisis de vídeos sobre cáncer de mama en YouTube [Analysis of videos about breast cancer on YouTube]. *Cuadernos.info*, 44, 179-193. <https://doi.org/10.7764/cdi.44.1528>
- Mira, J. J., Lorenzo, S., & Navarro, I. (2014). Hospital reputation and perceptions of patient safety. *Medical Principles and Practice*, 23, 92-94. <https://doi.org/10.1159/000353152>
- Moore, P., Rivera, S., Bravo-Soto, G., Olivares, C., & Lawrie, T. (2018). Communication skills training for healthcare professionals working with people who have cancer. *Cochrane Database System Review*, 24(7), CD003751. <https://doi.org/10.1002/14651858.CD003751.pub4>
- Moreno, A., Wiesenber, M., & Verčič, D. (2016). Excelencia en la gestión de comunicación. Análisis de los departamentos de comunicación en España mediante el comparative excellence framework [Excellence in communication management. Analysis of communication departments in Spain using the comparative excellence framework]. *Comhumanitas: Revista Científica de Comunicación [Comhumanitas: Scientific Journal of Communication]*, 7(2), 1-15.
- Moser, R., & Greeman, G. (2014). An empirical analysis of the public's attitudes toward advertising hospital services: A comparative cross-sectional study. *Health Marketing Quarterly*, 31, 13-30. <https://doi.org/10.1080/07359683.2013.847334>
- Namkoong, K., Nah, S., Record, R., & Van-Stee, S. (2017). Communication, reasoning, and planned behaviors: Unveiling the effect of interactive communication in an anti-smoking social media campaign. *Health Communication*, 32(1), 41-50. <https://doi.org/10.1080/10410236.2015.1099501>

- Naveen, K., Anil, J., & Smruthi, T. (2014). Impact of healthcare marketing and branding on hospital services. *International Journal of Research Foundation of Hospital & Healthcare Administration*, 2(1), 19-24. <https://doi.org/10.5005/jp-journals-10035-1010>
- Nelson, W., Taylor, E., & Walsh, T. (2014). Building an ethical organizational culture. *The Health Care Manager*, 33(2), 158-164. <https://doi.org/10.1097/HCM.0000000000000008>
- Noar, S., Leas, E., Althouse, B., Dredze, M., Kelley, D., & Ayers, J. (2018). Can a selfie promote public engagement with skin cancer? *Preventive Medicine*, 111, 280-283. <https://doi.org/10.1016/j.ypmed.2017.10.038>
- Park, H., Reber, B., & Chon, M.-G. (2016). Tweeting as health communication: Health organizations' use of Twitter for health promotion and public engagement. *Journal of Health Communication*, 21(2), 188-198. <https://doi.org/10.1080/10810730.2015.1058435>
- Pelitti, P. (2016). Estrategias de comunicación interna y externa de los hospitales públicos bonaerenses de la Región Sanitaria XI [Internal and external communication strategies of Buenos Aires public hospitals in Health Region XI]. *Revista Especializada en Comunicación y Periodismo [Specialized Magazine in Communication and Journalism]*, 49(1), 368-379.
- Peluchette, J., Karl, K., & Coustasse, A. (2016). Physicians, patients, and Facebook: Could you? Would you? Should you? *Health Marketing Quarterly*, 33(2), 112-126. <https://doi.org/10.1080/07359683.2016.1166811>
- Peterson, E., Ostroff, J., Duhamel, K., D'Agostino, T., Hernandez, M., Canzona, M., & Bylun, C. (2016). Impact of provider-patient communication on cancer screening adherence: A systematic review. *Preventive Medicine*, 93, 96-105. <https://doi.org/10.1016/j.ypmed.2016.09.034>
- Prochaska, J., Coughlin, S., & Lyons, E. (2017). Social media and mobile technology for cancer prevention and treatment. *American Society of Clinical Oncology Educational Book*, 37, 128-137. https://doi.org/10.14694/EDBK_173841
- Rodrigues, A., Azevedo, C., & Calvo, V. (2016). Internal communication in organizations: Practical instruments to help the shift change. *Millenium*, 2(1), 105-114. <https://doi.org/10.29352/mill0201.09.00004>
- Salmon, P., & Bridget, Y. (2017). A new paradigm for clinical communication: Critical review of literature in cancer care. *Medical Education*, 51, 258-268. <https://doi.org/10.1111/medu.13204>
- Sedrak, M., Cohen, R., Merchant, R., & Schapira, M. (2016). Cancer communication in the social media age. *JAMA Oncology*, 2(6), 822-823. <https://doi.org/10.1001/jamaoncol.2015.5475>
- Sedrak, M., Dizon, D., Anderson, P., Fisch, M., Graham, D., Katz, M., Kesselheim, J., Miller, R., Thompson, M., Utengen, A., & Attai, D. (2017). The emerging role of professional social media use in oncology. *Future Oncology*, 13(15), 1281-1285. <https://doi.org/10.2217/fon-2017-0161>
- Sheehan, N., & Isaac, G. (2014). Principles operationalize corporate values, so they matter. *Strategy & Leadership*, 42(3), 23-30. <https://doi.org/10.1108/SL-03-2014-0021>
- Singal, A., & Jain, A. (2013). An empirical examination of the influence of corporate vision on internationalization. *Strategic Change*, 22(5-6), 243-257. <https://doi.org/10.1002/jsc.1937>
- Sutton, J., Vos, S., Olson, M., Woods, C., Cohen, E., Gibson, C., Phillips, N., Studts, J., Eberth, J., & Butts, C. (2018). Lung cancer messages on Twitter: Content analysis and evaluation. *Journal of the American College of Radiology*, 15(1), 210-217. <https://doi.org/10.1016/j.jacr.2017.09.043>
- Trepanier, S., & Gooch, P. (2014). Personal branding and nurse leader professional image. *Nurse Leader*, 12(3), 51-57. <https://doi.org/10.1016/j.mnl.2014.03.005>
- Triemstra, J., Stork, R., & Arora, V. (2018). Correlations between hospitals' social media presence and reputation score and ranking: Cross-sectional analysis. *Journal of Medical Internet Research*, 20(11), e289. <https://doi.org/10.2196/jmir.9713>
- Trong, L. (2014). Corporate governance and brand performance. *Management Research Review*, 37(1), 45-68. <https://doi.org/10.1108/MRR-08-2012-0183>
- Veltri, S., & Nardo, M. T. (2013). The intangible global report: An integrated corporate communication framework. *Corporate Communications: An International Journal*, 18(1), 26-51. <https://doi.org/10.1108/13563281311294119>
- Visser, L., Bleijenbergh, I., Benschop, Y., Van Riel, A., & Bloem, B. (2016). Do online communities change power processes in healthcare? Using case studies to examine the use of online health communities by patients with Parkinson's disease. *British Medical Journal*, 6, e012110. <https://doi.org/10.1136/bmjopen-2016-012110>

- Vraga, E., Stefanidis, A., Lamprianidis, G., Croitoru, A., Crooks, A., Delamater, P., Pfoser, D., Radzikowski, J., & Jacobsen, K. (2018). Cancer and social media: A comparison of traffic about breast cancer, prostate cancer, and other reproductive cancers on Twitter and Instagram. *Journal of Health Communication, 23*(2), 181-189. <https://doi.org/10.1080/10810730.2017.1421730>
- Welch, M., & Jackson, P. (2007). Rethinking internal communication: A stakeholder approach. *Corporate Communications: An International Journal, 12*(2), 177-198. <https://doi.org/10.1108/13563280710744847>
- Yang, P.-C., Lee, W.-C., Liu, H.-Y., Shih, M.-J., Chen, T.-J., Chou, L.-F., & Hwang, S.-J. (2018). Use of Facebook by hospitals in Taiwan: A nationwide survey. *International Journal of Environmental Research and Public Health, 15*(6), 1188. <https://doi.org/10.3390/ijerph15061188>
- Yeob, J., Hawkins, R., Baker, T., Shah, D., Pingree, S., & Gustafson, D. (2017). How cancer patients use and benefit from an interactive cancer communication system. *Journal of Health Communication, 22*(10), 792-799. <https://doi.org/10.1080/10810730.2017.1360413>
- Zerfass, A., & Viertmann, C. (2017). Creating business value through corporate communication: A theory-based framework and its practical application. *Journal of Communication Management, 21*(1), 68-81. <https://doi.org/10.1108/JCOM-07-2016-0059>
- Zhu, C., Xu, X., Zhang, W., Chen, J., & Evans, R. (2020). How health communication via TikTok makes a difference: A content analysis of TikTok accounts run by Chinese provincial health committees. *International Journal of Environmental Research and Public Health, 17*(1), 192. <https://doi.org/10.3390/ijerph17010192>

APPENDIX A: ORGANIZATIONS ANALYZED

1. The University of Texas MD Anderson Cancer Center (United States).
2. Memorial Sloan Kettering Cancer Center (United States).
3. Dana-Farber Cancer Institute (United States).
4. The University of Texas Southwestern Medical Center (United States).
5. Massachusetts General Hospital (United States).
6. Michigan Medicine (United States).
7. Duke University Health System (United States).
8. UC San Diego Health Sciences (United States).
9. Mayo Clinic (United States).
10. Brigham and Women's Hospital (United States).
11. Columbia University Irving Medical Center (United States).
12. Scientific Institute for Research, Hospitalization and Healthcare (Italy).
13. St. Jude Children's Research Hospital (United States).
14. UCLA Health (United States).
15. NYU Langone Medical Center (United States).
16. Vanderbilt University Medical Center (United States).
17. University Health Network (Canada).
18. Mount Sinai Health System (United States).
19. UCSF Health (United States).
20. Johns Hopkins Medicine (United States).
21. Netherlands Cancer Institute (Netherlands).
22. Cleveland Clinic (United States).
23. City of Hope (United States).
24. UW Medicine (United States).
25. Boston Children's Hospital (United States).
26. Beth Israel Deaconess Medical Center (United States).
27. H. Lee Moffitt Cancer Center & Research Institute (United States).
28. Spanish National Cancer Research Centre (Spain).
29. Indiana University School of Medicine (United States).
30. Sun Yat-sen University Cancer Center (China).
31. Ohio State University Wexner Medical Center (United States).
32. UNC Lineberger Comprehensive Cancer Center (United States).
33. Cincinnati Children's Hospital Medical Center (United States).
34. Health Sciences Center, Utah (United States).
35. University of Nebraska Medical Center (United States).
36. Renji Hospital (China).
37. John T. Milliken Department of Medicine (United States).
38. Abramson Cancer Center, Penn (United States).
39. Stanford Department of Medicine (United States).
40. Leiden University Medical Center (Netherlands).
41. Provincial Health Services Authority (Canada).
42. Roswell Park Cancer Institute (United States).
43. The Hospital for Sick Children, U of T (Canada).
44. The University of Texas Health Science Center at San Antonio (United States).
45. College of Medicine, MUSC (United States).
46. Houston Methodist (United States).
47. National Cancer Center (Japan).
48. Erasmus University Medical Center (Netherlands).
49. University of Pittsburgh Medical Center (United States).
50. Peter MacCallum Cancer Centre (Australia).
51. The University of Texas Health Science Center at Houston (United States).
52. Heidelberg University Hospital (Germany).
53. Fox Chase Cancer Center, Temple University (United States).
54. Cedars-Sinai Medical Center (United States).
55. TUM University Hospital Klinikum Rechts der Isar (Germany).
56. Academic Medical Center, UvA (Netherlands).

57. University of Kansas Medical Center (United States).
58. Children's Hospital of Philadelphia (United States).
59. University Medical Center Utrecht (Netherlands).
60. Stanford Department of Pathology (United States).
61. Fudan University Shanghai Cancer Center (China).
62. UC Davis Health (United States).
63. University Medical Center Groningen (Netherlands).
64. Charité-University Medicine Berlin (Germany).
65. Joan and Sanford I. Weill Department of Medicine, Cornell University (United States).
66. School of Medicine, WSU (United States).
67. Health Sciences Center, UoFL (United States).
68. Sun Yat-sen Memorial Hospital (China).
69. University Hospital Zurich (Switzerland).
70. Singapore Health Services Pte. Ltd. (Singapore).
71. University of Rochester Medical Center (United States).
72. University Medical Center Mainz (Germany).
73. UCSF Department of Medicine (United States).
74. Penn Medicine (United States).
75. Yonsei University Health System (South Korea).
76. The Winship Cancer Institute of Emory University (United States).
77. University Hospital of Lausanne (Switzerland).
78. OU Health Sciences Center (United States).
79. Samsung Medical Center (South Korea).
80. Department of Medicine, University of Chicago (United States).
81. Cancer Institute and Hospital, CAMS & PUMC (China).
82. Tianjin Medical University Cancer Institute and Hospital (China).
83. Assistance Publique-Hôpitaux de Paris (France).
84. Oslo University Hospital (Norway).
85. Department of Medicine, NU (United States).
86. VCU Medical Center (United States).
87. University Medical Center Freiburg (Germany).
88. University Hospital of Erlangen (Germany).
89. Georgia Cancer Center, Augusta University (United States).
90. Ruijin Hospital (China).
91. Sinai Health System, U of T (Canada).
92. Radboud University Medical Centre (Netherlands).
93. Hannover Medical School (Germany).
94. McGill University Health Centre (Canada).
95. University Hospital of Munich (Germany).
96. Masonic Cancer Center, UMN (United States).
97. Beijing Cancer Hospital / School of Oncology, PKU (China).
98. University of Florida Health (United States).
99. Wuhan Union Hospital, HUST (China).
100. University Medical Center Hamburg-Eppendorf (UKE), UHH (Germany).

