
Pharmaceutical Communication over Social Media Channels: 24/7 Management Challenges

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Abstract

Social media marketing is evolving rapidly and gaining popularity within academia and firms. This chapter highlights the major challenges posed by social media to the pharmaceutical industry, assessing the presence of major pharmaceutical firms on social media platforms such as Facebook, Twitter, and YouTube and characterizing their digital engagement strategies. This study gathered data from the top 20 pharmaceutical companies' official websites, Facebook, Twitter, and YouTube accounts and examined variables such as Internet presence, engagement, fans/followers, and network structure. Findings from this study show that not all pharmaceutical firms are present on social media, and some platforms are used more than others. Notably, the digital engagement strategies varied between the analyzed social media platforms and remained similar on the two periods. Results also show that the level of engagement assessed was not associated with firm size. In several firms, the communication was mostly directed to the general public. Depending on the company, country-based communities were found. This work can be of interest to practitioners aiming to compare and assess their digital activity. It could also assist future researchers focusing on pharmaceutical social media marketing activity, since few researchers have analyzed this using more than one social networking site.

Keywords: communication, social media, pharmaceutical, Facebook, Twitter, YouTube

1. Introduction

Pharmaceutical firms are increasingly facing competitive, regulatory, and community pressures. For decades, pharmaceutical firms tried using different types of promotions to affect physicians' prescribing behavior. It has now evolved to a point where it has been often said that the leading firms were spending more on marketing than on research and development [1].

This led to misconceptions related to pharmaceutical marketing practices and induced the need to unveil the true meaning of pharmaceutical marketing. Pharmaceutical marketing, as a sub branch of marketing, evolved over the years from a more product-oriented strategy to a consumer-oriented strategy, following global trends [2].

Back in 1994, Levy [3] stated “pharmaceutical marketing is the last element of an information continuum, where research concepts are transformed into practical therapeutic tools and where information is progressively layered and made more useful to the health care system” (p. 327). His definition emphasizes the value of information flow. In the last two decades, there has been a major shift from traditional media to digital media, changing profoundly the way information flows. The race for information access turned patients, physicians, and all other healthcare stakeholders more demanding. In order to reduce these pressures and establish a long-term relationship with the different stakeholders, pharmaceutical firms need to follow marketing trends and move on to digital communication channels, such as social media.

The emerging importance of social media in business organizations is raising the awareness of decision-makers toward this theme. An ongoing dialog on platforms such as Facebook, Twitter, and YouTube between firms and consumers impels the search for new management communication models. In response, this chapter analyzes the online posture of 20 major pharmaceutical firms. For this purpose, data were gathered directly from their official social media pages on Facebook, Twitter, and YouTube, and their performance online was analyzed.

This chapter is organized in the following manner. The next section summarizes the literature related to pharmaceutical marketing and social media. The third section presents empirical evidence from the pharmaceutical firms. The last section offers concluding remarks about these findings.

2. Theoretical framework

2.1. Pharmaceutical marketing

According to Fischer [4], pharmaceutical marketing practice is mutating. The author states that the major approach in the 90s and the beginning of 2000 was increasing the sales force, allowing intensified diffusion of scientific information. However, Fischer explains that spending on this approach is decreasing over time. Nowadays, pharmaceutical firms are abandoning the commercial model based on sales force and are adopting a more multifaceted communication strategy. Through **Figure 1**, Fischer explains this new strategy, composed of more channels of communication which interface with other stakeholders (e.g., patients, payers, healthcare organizations, and professionals), surpassing the almost unique channel based on communication with physicians. The spreading of communication channels and potential message recipients is perceived as a major trend in pharmaceutical marketing [4] (**Figure 1**).

2.1.1. *Physician-oriented model*

Pharmaceutical marketing budgets are largely being allocated to communicate with physicians [4]. According to Fischer [4], in this type of communication, pharmaceutical firms

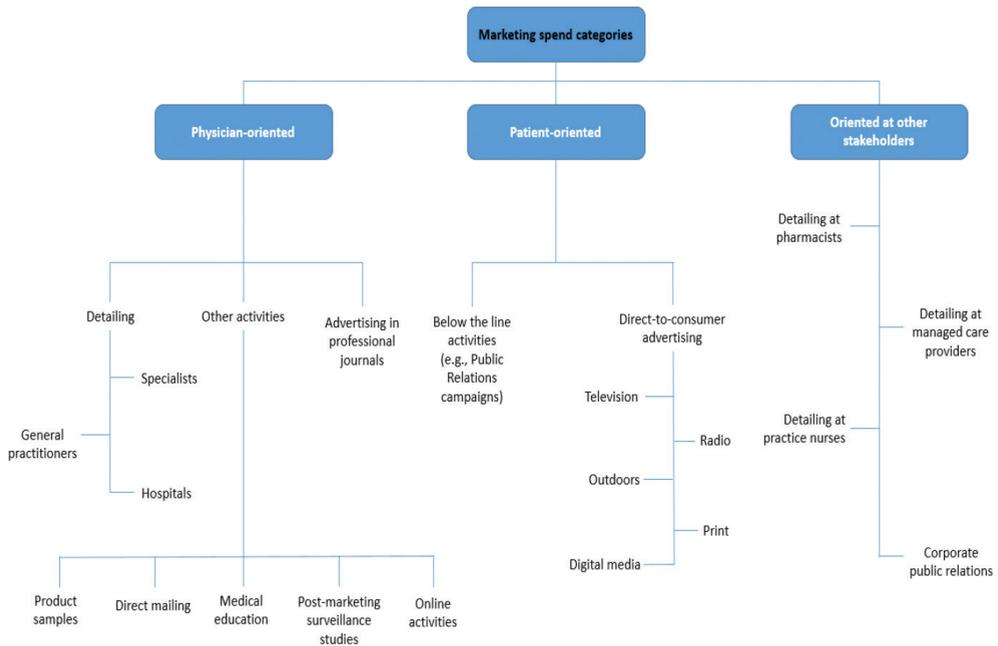


Figure 1. Pharmaceutical expenditure categories. Source: Adapted from [4], p. 560.

are using personal selling through detailing directed to physicians that are general practitioners, specialists, and hospital physicians. This regulation-dependent model can include (1) personal selling with discussion of a limited number of products, (2) delivery of some gifts and medication samples, (3) payment for meals, (4) conference-related issues, (5) financing of medical education and scientific projects, and (6) publicity in professional journals [4, 5].

Fischer states that methods like medical education and drug vigilance studies were developed to strengthen the relationship with physicians, and sometimes certain physicians can be provided with financial support from pharmaceutical firms if they are open to reporting their observations on patient trial studies associated with a promoted medication. Other channels, like direct mailing, allow pharmaceutical firms to deliver information about treatments or medicines to physicians [4].

Fischer [4] also considers that the traditional communication model is under fire from the rise of the Internet and other digital media. The author states that the study “Taking the Pulse® Europe” (p. 559), based on physicians’ behavior on the Internet, revealed that physicians are using the Internet to diversify the reach of their influence [4]. Fischer refers to the findings in this study showing that in the main European countries, 95% of physicians queried said that the Internet is useful in their professional practice, and for this reason it seems that pharmaceutical firms are walking along with physicians in this matter through the development of electronic strategies.

According to several authors, physicians are open-minded toward technology adoption [6], allowing marketers to promote products through a new channel. It is clear that a growing number of physicians are networking online, and for that reason, pharmaceutical firms see the diffusion of information through online networking platforms as a priority [6, 7].

2.1.2. Patient/consumer-oriented model

There is a segment of pharmaceutical marketing that is being oriented toward patients/consumers, but this direct activity is only accepted in a small group of countries, like New Zealand and the United States of America (USA) [4, 6]. However, in the European Union (EU), pharmaceutical firms can advertise directly to consumers when the advertised product is an over-the-counter (OTC) medicine [8].

Fischer [4] points out that direct to consumer (DTC) advertising uses channels like traditional media (e.g. print media, television, and radio) and digital media. When DTC advertising is not allowed in a country, companies use a below-the-line strategy (e.g. Public Relations campaigns associated with diseases and treatments) in order to influence patients/consumers. Usually in this type of campaign, the branded medicine's name is not promoted [4]. Nevertheless, the global reach of online platforms poses a challenge in this diversified worldwide regulation setting [7, 9].

2.1.3. Model oriented at other stakeholders

Physicians and patients/consumers are not the only stakeholders targeted by pharmaceutical marketing [4]. Pharmacists, practice nurses, care providers, and informal caregivers are an audience that demands tailored communication strategies [4, 6]. Fischer [4] adds that the influence of these stakeholders as gatekeepers changes according to the type of medicine and healthcare structure. He provides an example with the healthcare business associated with diabetes. A major part of the budget is allocated to sales representatives in order to reach practice nurses and pharmacists since these healthcare professionals usually recommend devices that measure the blood glucose in people who suffer from this disease. Also, pharmaceutical firms allocate a percentage of their global budget into corporate public relations [4].

2.2. Pharmaceutical marketing challenges

Regulation is without a doubt a factor that distinguishes the pharmaceutical industry from other types of industries [10]. Regulatory activities are present in several pharmaceutical phases, like the approval of new medicines, medicine surveillance, production, and promotion to physicians and consumers [7]. The approval of medicinal commercialization normally requires a guarantee of safety and efficacy of the product. It is supervised by the Food and Drug Administration (FDA) in the USA, by the European Medicines Agency in the EU (even though individual country members have their own regulatory bodies), and by the Ministry of Health and Welfare in Japan [11].

To Desiraju and Tran [10], the regulation of marketing practices is not uniform, and several differences exist between different areas of the world and between pharmaceutical marketing

segments. For example, since 2006 in the USA, it is not possible for a pharmaceutical company to communicate off-label medication uses to a physician, but the physician does not have restrictions on employing off-label uses for any situation in which they think the drug will work [7]. In other areas of the world, detailing practices are restricted, as well as medication samples given to physicians [7].

DTC advertising regulation differs from country to country, following the legal constraints of each country or region [10]. For instance, while in the USA DTC advertising of prescription medicines is authorized, in the EU and Canada there are restrictions for its use [10].

There have been some developments regarding DTC advertising in the EU, but they did not have a happy ending due to European Commission propositions being rejected by the European Parliament [12]. However, the European Commission, along with other industries that have interests related to medicine, is continuously pressuring the adoption of DTC advertising practices [12, 13].

In Canada, as DTC advertising is forbidden, pharmaceutical firms use two types of advertising allowed by regulatory institutions. The first type is associated with diseases, like “help-seeking” advertisements where non-branded communications increase awareness about a certain illness and appeal to consumers to seek their physician’s guidance. The second type is a “reminder” advertisement that is a branded communication without any type of information about the use of the medicine [12](p. 635).

On the other hand, with the Internet, several concerns arise since online advertising can reach places where DTC advertisement is not allowed [12]. As an example, in the GlaxoSmithKline blog or the AstraZeneca Facebook page, the information is directed only toward the USA, but users from all over the globe can access this information, surpassing any possible control [12] (p. 635).

In terms of price regulation, there are also differences between nations [10]. It was also noted that price could be regulated through direct price impositions from governments, through price comparison between specific countries, or through pricing established by comparing medicines with an identical therapeutic category [7]. In some situations, governments can limit the global revenues of pharmaceutical companies. Countries like France, Italy, and Japan directly control prices, while countries like Germany, the Netherlands, and New Zealand manipulate reimbursements through price orientations, leading to changes in the amount that consumers have to pay [10].

Another challenge posed to this industry concerns the difference between branded medicines and generic medicines. A generic medicine is a trustworthy replica of a branded medicine, which has an expired patent, and is commercialized under the name of the active ingredient from the patented medicine [14]. With the rise of generic medicines, pharmaceutical firms stopped the nerve-racking approval process necessary for biosimilar branded medicines, allowing them to save time and money while diminishing process risk [5, 10, 14].

For pharmaceutical firms with branded medicines, the key target is physicians, while consumers and payers are vital targets for the development of brand loyalty and maintaining

avored status in a formulary [5, 9]. These authors state that generic medicines are similar to commodities, and therefore, the marketing mix is focused on price. They also affirm that the key target audience of generic medicines is different from the target audience of branded medicines. Even though physicians choose medication for their patients, pharmacies are the last intervention in the supply chain of medicines to patients. For this reason, they can choose the companies that supply their stock, making them the ultimate targets for pharmaceutical marketers of generic medicines [5]. However, both physicians and pharmacies can receive financial support from payers in order to encourage the use of generic medicines [7].

2.3. Social media marketing objectives and outcomes

Social networks have been a reality for about 15 years, changing the way companies and consumers interact, both in the digital domain and by transposing into the physical realm. Both companies and researchers recognize that social networks have facilitated the narrowing of relations between companies and consumers, as they have provided consumers with an active voice and changed their behavior [15]. Therefore, the subject of social media is a high priority of discussion in the business world [16]. These authors argue that managers and marketers, as well as consultants, are forging new strategies aiming to increase companies' profitability through social media (e.g. Wikipedia, YouTube, Facebook, and Twitter).

Before social media, the Internet already allowed limited user interaction [17]. Web 1.0 (the first generation of the web) was considered to be the "read-only web." At this early stage, Internet users had limited interaction capability. Users were able to search and read information created and shared by firms [17]. Regardless of this interaction constraint, Web 1.0 revolutionized the access to information, since users could access countless diverse websites as information sources and were no longer limited to traditional vehicles like television transmissions or books [5]. Several of these websites appeared like simple brochures, whereas electronic commerce websites were similar to catalogs [5, 17].

The Web 2.0 was termed the "read-write web" [5, 17] since it allowed users to not only read but write content that could be shared to peers. This was the foundation of digital social interaction as we know it [17]. These authors recognize that with this iteration of the Web, online interaction was based on two-way communication. With Web 2.0, the sources of information considered relevant by consumers changed from firms to other online users [5]. These authors suggest that simultaneously with the rise of the Web 2.0, social network prototypes started to appear, providing new ways to facilitate interactions between people. These prototypes converted with time into modern social media platforms (e.g. Twitter and Facebook) [5].

To Kotler and Keller [18] "social media [is] a mean for consumers to share text, images, audio, and video information with each other and with companies and vice versa, encouraging brand engagement at a deeper and broader level than before" (p. 291).

Kietzmann, Hermkens, McCarthy, and Silvestre [19] contend that social media allows interaction between users based on seven functionalities: presence, sharing, conversation, identity, relationship, groups, and reputation.

From a user perspective, social networking sites (SNSs) integrate several digital formats of user-generated content (UGC) such as “blogs, virtual communities, wikis, social networks, collaborative tagging, and sites that allow shared media files” [20].

To most users, these types of SNSs are attractive because they enable them to participate in an ongoing consumption-creation cycle; the content created and shared by some become information sources for others, that can also be commented on, shared, and tagged [21].

From a brand perspective, the potential of social media lies not only in communication and sales, but also in persuasion [18]. Several researchers have pointed out the capability of electronic word of mouth (e-WoM) to influence peers’ purchasing decisions [22]. Still, not all shared content has a positive impact on brands; as it happens in non-digital contexts, negative messages are also spread. Thus, social media can provide marketers a channel to be present on the web, reinforcing brand awareness and notoriety, but it also presents several challenges that need to be taken into account, some which depend on marketers’ willingness to respond in an engaging manner to negative user comments [18].

Facebook presence has become a must for numerous companies, and Twitter can enhance business, even for small companies [18]. Social networks can leverage brand presence, brand awareness, and also reduce advertisement costs (especially important in fragile economic situations) [23]. However, it is important for companies to be aware of ethical matters (e.g. user privacy, spamming, publicity policies, data mining, and legal concerns).

2.4. Social media pharmaceutical marketing

Marketers are overwhelmed by performance promises related to new communications approaches and technologies. As noted by several authors, digital communication over social media with patients/consumers is becoming increasingly important in patient care and consumer decision-making [6, 24, 25].

Social networks allow the exchange of healthcare information associated with symptoms, possible diagnosis, treatments, adverse side effects, and medical evidence, as well as opinions about experiences with healthcare providers [26]. More, this information can lead to inappropriate decisions due to limitations in consumer health literacy [24].

In the healthcare system, there are two sides, namely patient side and provider side, that connect with each other through common platforms [6, 26]. The provider side congregates all agents related to the healthcare system, such as healthcare professionals, pharmaceutical firms, medical technology firms, and all managers and other professional groups that have access to patient data, and for this reason are able to influence the healthcare systems [6]. The patient-side integrates the patients, their informal support structure, and everyone searching for healthcare information or support. To interconnect the two sides, digital platforms must exist, such as physician-patient appointments, health services provided by hospitals and communities, organizations functioning as funding channels (e.g., Medicare), and other types of interactions between equipment/treatment providers and patients [26]. Some of these digital platforms support internal communication and information access, while others connect the

healthcare providers and patients and are relevant in the gatekeeping and mediation processes, as well as providing information access [26].

Some social media functionalities are considered “Trojan horses” to the pharmaceutical industry. Social media networks such as Twitter can present only part of what needs to be known by patients, due to character limits for shared content, which may cause errors. With this type of content limitation, marketers are challenged to find the right types of content to capture and persuade users regarding a firm value proposition [16]. Adding to this, most users tend to consider SNSs as social and non-commercial environments, thus the presence of advertising content on these platforms could be viewed by users as inappropriate or offensive [18].

Another important aspect that needs to be taken into account is the fact the content is no longer solely created by firms. Thus, firms may lose control over the content and need to consider the electronic word-of-mouth (e-WoM) phenomenon.

The rise of e-communication through social media is changing the healthcare and pharmaceutical industry [27]. Patients and providers are being empowered, since social media allows a greater control over the creation of content. All these empowered players can establish interactive connections with the pharmaceutical industry using social media as a communicational channel, especially when pharmaceutical firms are considered trustworthy and present a value proposition that is perceived as positive by users [25]. Thus, social media platforms are acknowledged for providing wonderful opportunities for pharmaceutical marketers to interact with their customers and acquire knowledge of their markets [27, 28].

These social media platforms present a set of opportunities and threats for pharmaceutical marketers related to promotion and brand management. To better reach and engage users, they firstly need to learn from and follow up with users’ voices in order to tailor their messages to each individual or group. Thus, the content created and shared needs to be customer oriented and optimized for different scenarios, taking into consideration technological limits and regulations, while promoting brand awareness or notoriety [5]. Pharmaceutical firms can gather important brand monitoring data through social media platforms and also obtain critical information about consumers [13, 27]. These two resources enable pharmaceutical firms to develop innovative marketing strategies and services that could increase brand awareness, improve customer loyalty, and increase users’ trust and compliant behavior, while at the same time take advantage of the ability to promptly respond to information requests from different users. One of the major threats posed by social media regards privacy and security, since content needs to always preserve patient-physician confidentiality, according to regulations.

Patient-side social media sites are becoming important information repositories, used to acquire health data from sources other than healthcare professionals. Still, the motivation to use these communication channels is wider, including monitoring health professionals’ decision-making, finding alternative treatments, predicting treatment results or consequences, and even self-diagnosis of minor symptoms [29]. There are several studies analyzing patient/consumer use of three specific SNSs: Facebook, Twitter, and YouTube (**Table 1**).

The fast growth of social media that facilitates online social behavior has significantly modified the nature of human activities, habitats, and interactions [23]. Patients become more

Reference	Unit of analysis			Main research areas
	Facebook	Twitter	YouTube	
[29]	x			Information-driven patient use of SNSs
[25]	x	x		Doctor-patient relationship
[24]			x	Content creation
[28]		x		Public health purposes
[30, 31]	x			Information source for patients living with chronic disease and their informal caregivers
[32]	x	x		
[33]			x	Education

Table 1. Some studies.

active and empowered by the seamless access to information. Social media provides an open channel to all healthcare stakeholders [6], with different countries’ legal frameworks restraining or opening it, as a response to the public and policy concerns related to data privacy and security, as well as ethical behaviors.

Therefore, regardless of the main topic of research, the relevance of social media to the pharmaceutical industry is evident, especially to those that are clearly focused on the consumer. Thus, it is no longer enough to consider the impact and role of digital communication at the firm and industry level; a closer look at social media interactions is now mandatory.

3. Top 20 pharmaceutical companies: empirical evidence on social media

Since the emergence of social media, pharmaceutical marketing academics and marketers have been intrigued by the influence of such media on their field. In this chapter, we argue that some of the research gaps, especially those related to barriers as well as reasons to use social media, are slowly being filled in by academic research as the industry starts to use social media with a more active posture. Thus, the current chapter explores the following two research questions: How is social media marketing being used by pharmaceutical companies? And what’s the influence of size and countries on social media activity?

In order to initiate this investigation, it was necessary to define the sample. As the subject of analysis was pharmaceutical companies’ presence on social media, the first important step was to choose the size of the sample. It was decided to use the top 20 pharmaceutical firms within a ranking of the top 50 in terms of revenue, as elaborated by Pharmaceutical Executive in 2013.

After defining the size of the sample, the social media presence of the top 20 pharmaceutical firms (on Facebook, Twitter, and YouTube) was analyzed by visiting their global homepage in order to search for evidence of their activity on social media. Two research coders retrieved

the data in two distinctive periods (May 2016 and May 2017). This month was chosen due to the fact that worldwide a higher search rate is presented for medications driven by season conditions (e.g., spring and autumn allergies). When the homepage did not have a reference to social media presence, other official websites of the companies (e.g., websites of companies in specific countries) were visited and analyzed.

Figure 2 suggests that not all the pharmaceutical firms are present in the three major social media networks.

Of the companies examined, only 12 (60%) are on all social media platforms analyzed, while merely two (10%), namely Takeda and Daiichi-Sankyo pharmaceutical companies, are completely absent on such platforms.

An interesting finding is that Twitter is the SNS chosen by most companies, even though it has communication constraints regarding content length.

With all data collected, the next step was to calculate the engagement on each platform for each pharmaceutical company, using the following formula, later used in a cluster analysis (**Table 2**):

The engagement level was assessed by applying the formulas present in **Table 3**—Engagement formulas and the results are presented below:

From the table's results, it can be inferred that Facebook engagement does not increase proportionally with a firm's revenue and number of employees, since Boehringer Ingelheim and Eli Lilly are the top performers in terms of engagement, in both periods. Similarly, Twitter engagement rates do not increase proportionally with the company size. However, one company (Teva) seems to have a high performance when compared to the other companies. The same result pattern was found on YouTube, where the size of the firm shows no correlation with the level of engagement achieved.

Looking at the activity of each SNS individually, starting with Facebook, two categories of posts were analyzed: (1) user posts and (2) brand posts. In terms of brand posts, all Facebook

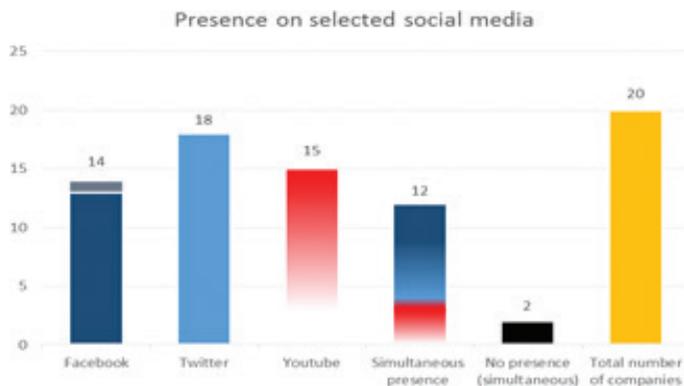


Figure 2. Pharmaceutical firms analyzed in terms of social media presence.

Platform	Engagement formulas
	$\text{Period engagement} = \frac{\text{"People Talking About This'}}{n^2 \text{ of Fans}}$ $\text{Period and Total engagement} = \frac{n^2 \text{ of Post} + n^2 \text{ of Shares} + n^2 \text{ of Likes} + n^2 \text{ of Comments}}{n^2 \text{ of Fans}}$
	$\text{Period and Total engagement} = \frac{\text{Retweets} + \text{Mentions (including replies)}}{n^2 \text{ of Followers}}$
	$\text{Total engagement} = \frac{\text{Views per video}}{n^2 \text{ of Subscribers}}$

Table 2. Engagement formulas.

pages analyzed had brand posts on their wall. The company which had the highest activity was Boehringer Ingelheim with 73 posts while the two companies with the lowest activity were Roche (Genentech) and AstraZeneca, both with 10 posts. Regarding user posts, only six Facebook pages (Merck & Co., Roche, Abbott, Bayer, Boehringer Ingelheim, and Novo Nordisk) had user posts on their wall, with each one having its own differentiated activity (see **Figure 3**). Moreover, all Facebook pages registered comment activity. Furthermore, the company which registered the largest amount of comments was Boehringer Ingelheim, with 1660 comments, corresponding to 76% of all comments registered (in 2015). The figures for 2017 were quite similar, showing slight increases.

The second biggest Facebook page in terms of comments was Roche, with 208 (10% of the comments), demonstrating a large difference between Boehringer Ingelheim and the other companies. In order to have a more precise analysis of the comments within brand posts, it was necessary to display the comments per brand post. Boehringer Ingelheim continues in front with a ratio of 22.74 (50%) comments in 2015 and with 32.22 in 2017; Roche continues in second place, but a third company, GlaxoSmithKline, emerges passing from 4.69 (10%) comments in 2015 to 16.88 in 2017.

After analyzing the quantity of brand posts per company, a qualitative analysis of these posts was made. The majority of brand posts were in the format of the photo, totaling 59% posts in 2014 and 48% in 2017. In second place are posts with links, with 24% posts in 2014 and 32% in 2017. The least frequent form of posting was in a form of status posts and video in 2014. In 2017, video popularity increased, being used more (**Figures 4 and 5**).

This characterization reflects the performance of each cluster in each parameter, recognizing that these clusters are not homogeneous and therefore the companies included can have low and high performance in the same cluster (**Table 4**).

Ranking	Facebook	Score 2015	Score 2017	Twitter	Score 2015	Score 2017	Youtube	Score 2015	Score 2017
1	Boehringer Ingelheim	0.078	0.102	Teva	18.17	19.65	Abbott	49.103	47.425
2	Eli Lilly	0.074	0.083	Eli Lilly	9.971	10.362	Astellas Pharma	17.842	21.31
3	Roche	0.041	0.042	Merck & Co.	4.84	4.73	Bayer	10.905	15.006
4	Merck & Co.	0.038	0.034	Roche (Genentech)	4.238	4.547	Novo Nordisk	9.352	9.352
5	Roche (Genentech)	0.038	0.038	Johnson & Johnson	3.252	4.382	Roche (Genentech)	7.699	7.344
6	Teva	0.025	0.025	Novo Nordisk	2.425	3.126	Amgen	4.097	6.524
7	Sanofi	0.015	0.019	Boehringer Ingelheim	2.122	4.702	Pfizer	2.88	2.99
8	Novartis	0.015	0.015	Gilead Sciences	1.782	1.885	AstraZeneca	2.595	3.198
9	GlaxoSmithKline	0.013	0.096	Bristol-Myers Squibb	1.603	1.715	Sanofi	2.163	2.192
10	Novo Nordisk	0.009	0.009	Astellas Pharma	1.257	2.055	Boehringer Ingelheim	2.088	3.702
11	Pfizer	0.007	0.01	Novartis	1.253	1.589	Eli Lilly	2.039	2.003
12	Abbott	0.007	0.007	GlaxoSmithKline	1.13	1.02	Johnson & Johnson	1.523	1.578
13	Bayer	0.006	0.008	Abbott	0.984	1.114	GlaxoSmithKline	1.437	1.474
14	AstraZeneca	0.005	0.007	Roche	0.83	1.013	Merck & Co.	1.138	1.235
15				AstraZeneca	0.824	0.992	Novartis	1.033	1.564
16				Bayer	0.817	0.977	Roche	0.917	1.246
17				Sanofi	0.73	0.72			
18				Pfizer	0.728	0.808			
19				Amgen	0.64	0.764			
20									

Table 3. Digital engagement and firm size.

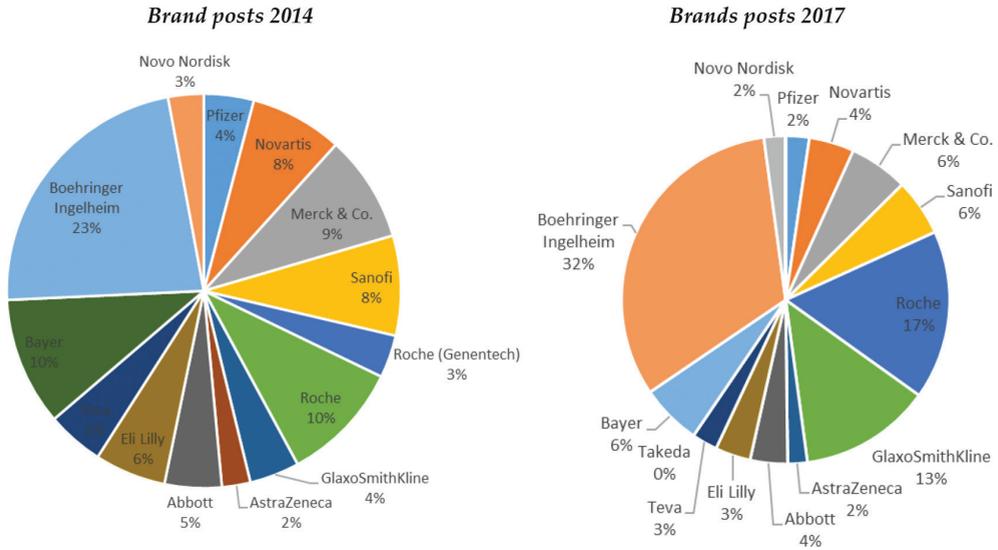


Figure 3. Activity on Facebook.

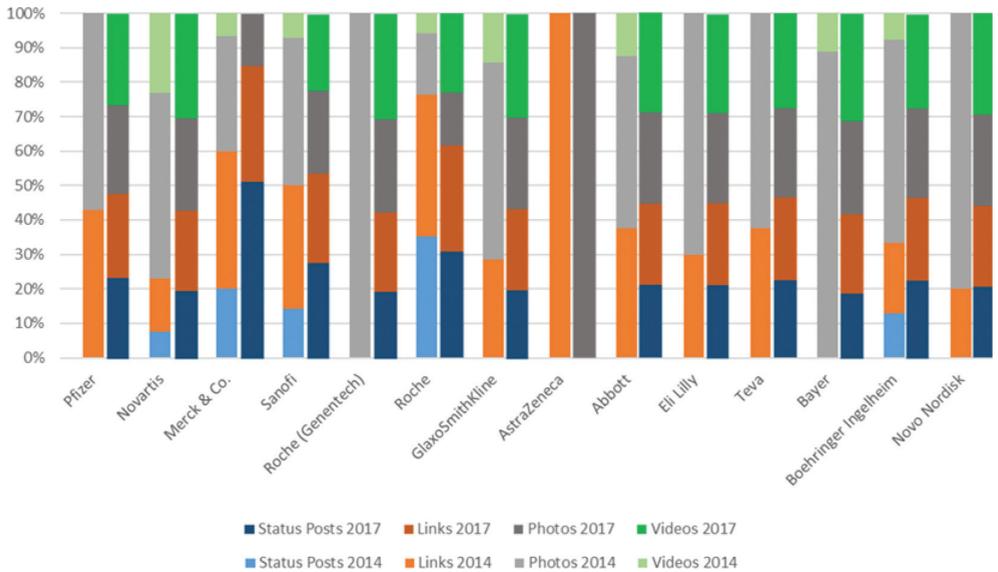


Figure 4. Type of contents posted by brands. The results from the cluster analysis conducted shows four distinctive clusters.

With regard to Twitter, 18 of the 20 pharmaceutical firms were present. Notice, however, that Teva's Twitter account is directed to the Spanish population, while the Astellas Pharma's Twitter account is dedicated to the USA population.

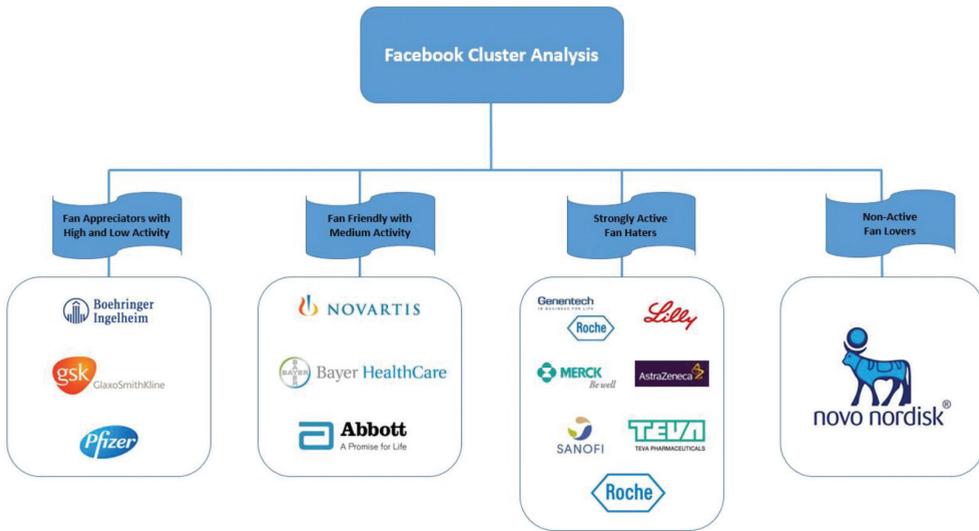


Figure 5. Facebook clustering agglomeration.

	Fan appreciators with high and low activity	Fan friendly with low to high activity	Strongly active fan haters	Non-active fan lovers
Revenue	+++/-	++/-	++/-	-
Employees	++/-	+++/-	++/-	-
Brand posts	+++/-	+/-	++/-	-
Brand post shares	+++	++/-	+/-	+/-
Brand post likes	++	+/-	+/-	++
Brand post comments	+++/-	++/-	++/-	-
User posts	+/-	++/-	+/-	+/-

Note: Each + sign reveals the positive intensity in each parameter while each - sign reveals the negative intensity in each parameter, because clusters are not homogeneous.

Table 4. Facebook clusters: characterization.

In order to have a clear view of the activity on Twitter, three important aspects were analyzed: (1) tweets, (2) retweets, and (3) mentions, which includes replies. Three companies have high activity (over 5000 tweets) since their Twitter account were opened, with Boehringer Ingelheim leading with 6940 (16%) tweets, followed by Johnson & Johnson 6069 (14%) tweets and Novartis 5641 (13%) tweets. On the other hand, five companies registered less than 1000 lifetime tweets.

The customer service responses reflect the specific interaction between pharmaceutical firms and their twitter users' requests. The company most active in this category was Johnson & Johnson

with 48 customer service responses, corresponding to 48% of their total responses. Interestingly, the only company to maintain responses in less than 1 hour was Boehringer Ingelheim during the period of analysis.

When analyzing the pharmaceutical companies' presence on Twitter through a cluster analysis, five clusters were identified (Figure 6).

After the first set of analysis, a deep analysis of the network structure of Twitter was conducted with the most recent data, using the NodeXL software, for the biggest and for the most engaging companies, aiming to establish their network structure and assess if it was linked to specific countries. The HK fast multiscale layout algorithm shows a pseudo-random network with five clusters in the case of Pfizer. Each cluster is linked to a specific country, with USA users the most active on the network (Figure 7).

Boehringer Ingelheim presents a quite uniquely structured network, denoting less spontaneous content creation and less community dispersion by country. The most relevant node is the company node. USA users are the most active on the network (31%), followed by UK users (16%), and Spanish users (9%).

The analysis of pharmaceutical presence on YouTube revealed that 15 companies have a YouTube Channel. The subscribers are an important part of the activity of YouTube channels because they receive notifications for each new video. One remarkable standout in the subscriber analysis is the dominance of Johnson & Johnson, registering the highest number of subscribers, while the second biggest company is Amgen. Johnson & Johnson outperforms in this category with 58% of the total number of views registered. Pharmaceutical companies'

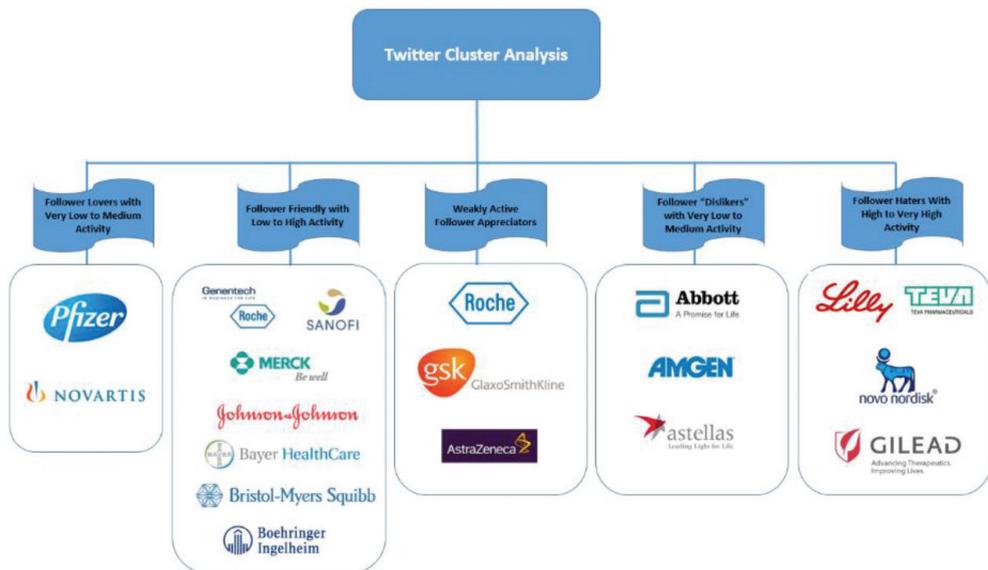


Figure 6. Twitter cluster analysis.

YouTube channels were also subjected to a cluster analysis identical to the ones performed for Facebook and Twitter (**Figure 8**).

The Japanese companies Takeda and Daiichi-Sankyo have completely abandoned the three assessed platforms, while Astellas is not in the same situation because Astellas USA possesses a Twitter account and a YouTube channel. YouTube appears to be the most abandoned social media platform, even though the use of video contents increased.

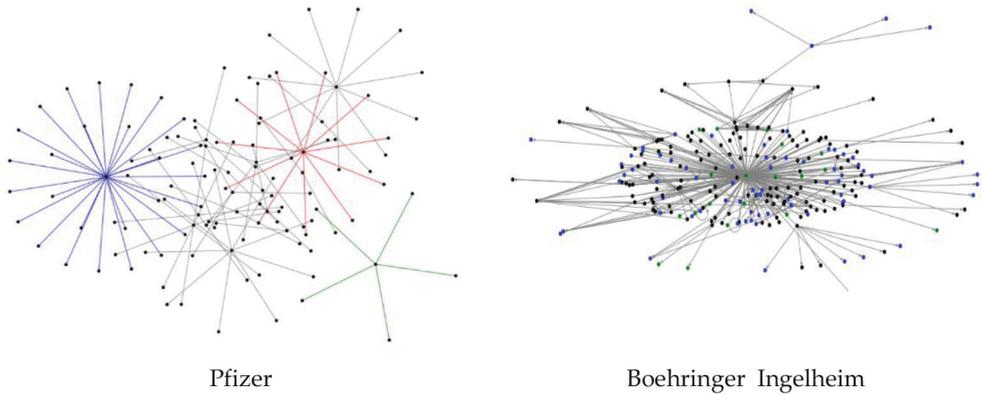


Figure 7. Network graphs obtained using the Harel-Koren Fast Multiscale layout. Legend: blue—USA, red—Greece, green—Germany.

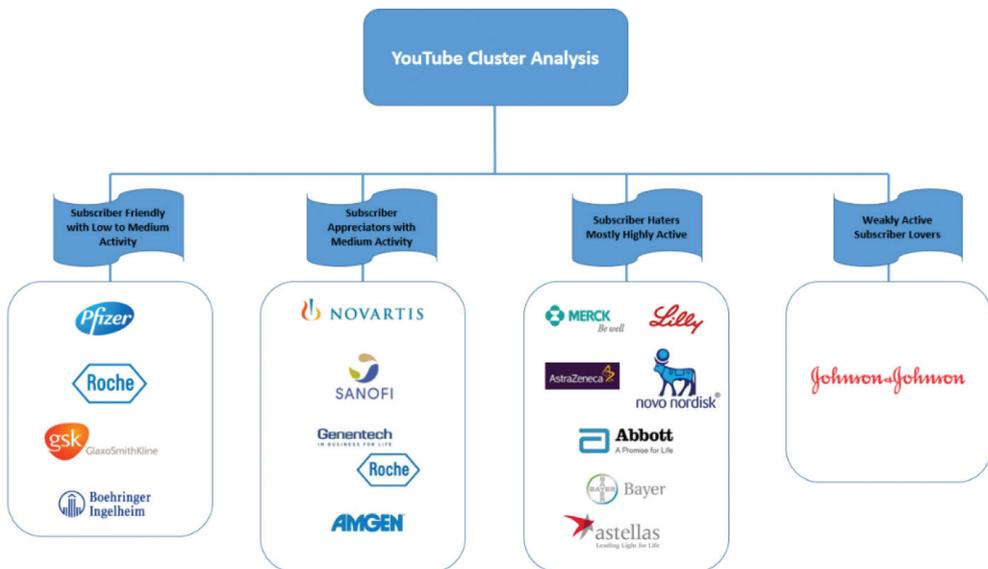


Figure 8. YouTube cluster analysis.

4. Final considerations

Over the last 15 years, social media took over the online world, connecting more people, firms, and brands. However, there are a number of industries that are still lacking in social media exposure and interaction with customers. The question that remains unanswered is what leads to a greater investment in social media by firms and in which social media?

In the pharmaceutical industry, social media is a tool that is used to communicate with consumers. However, not all pharmaceutical firms have a Facebook page, Twitter account, or YouTube channel. In fact, only a small number of the pharmaceutical firms analyzed utilize the three social media platforms simultaneously. Also, it seems that smaller pharmaceutical firms are leaving some social media platforms. These observations could be a result of an absence of official guidance in the use of such platforms associated with difficulty to calculate return on investment in the same platforms.

The analysis of the activity of pharmaceutical firms on social media revealed that in the several parameters studied for each social media platform there were diverse sets of scenarios, with some companies performing better than others in one parameter but with a poor performance in others. Also, some companies appeared almost inactive on such platforms. Moreover, when analyzing the ultimate indicator of activity (engagement ranking), smaller companies lead the ranking. However, there is not an association between good performance in this ranking with the size of the companies, in terms of revenue and employees. This suggests that other factors could influence digital engagement and therefore, should be evaluated in future research. Regarding digital engagement strategy, pharmaceutical firms do not use the same strategy between the three social media platforms analyzed and have evolved between 2014 and 2017. The cluster analysis showed that in general pharmaceutical firms behave differently on Facebook, Twitter, and YouTube. As their distribution in clusters/segments demonstrated, they present different characteristics among these platforms. However, it seems that Eli Lilly shares some similarities between Facebook and Twitter digital engagement strategy.

The multifaceted communication in the virtual world has recognized consequences besides its connectivity benefits. Pharmaceutical firms are challenged to adopt an increasing digital presence, following major social media trends. Therefore, this work is a small step toward understanding the full potential of social media in this sector, and it leaves an invitation to future research.

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