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ORIGINAL ARTICLE

# Facebook® as a means of scientific promotion: ally or enemy?

*Facebook® como meio de divulgação científica: aliado ou inimigo?*

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## ABSTRACT

Different strategies for promoting a new health communication and interaction tool, aimed at persons with disabilities, were applied on Facebook® in order to identify which promotion strategies promoted hits to the *D Eficiência* social network, and to characterize its users. Quantitative, descriptive and longitudinal study, with data extracted from the Facebook® metrics manager. Active search promotion was higher than passive promotion, accounting for 91.4% (n=4,519) of hits, via cell phone (71%) by women (81%). Hyperlinked publications and images were more engaging. Facebook® proved to be an effective tool for reaching significant numbers of people and should be considered in the promotion of new technologies. For this, it is necessary to create attractive content and conduct an active search for users. Complementary studies should continue to evaluate this strategy, with analysis of organic promotion and paid promotion.

**Descriptors:** Online Social Networking; Publications for Science Diffusion; Disabled Persons.

## RESUMO

Diferentes estratégias para divulgação de uma nova ferramenta de comunicação e interação em saúde, voltada para pessoas com deficiência, foram aplicadas no Facebook® com o objetivo de identificar quais estratégias de divulgação aplicadas ao Facebook® promoveram mais acessos à rede social D Eficiência e caracterizar seus usuários. Estudo quantitativo, descritivo e longitudinal, com dados extraídos do gerenciador de métricas do Facebook®. A divulgação com busca ativa foi superior a passiva, sendo responsável por 91,4% (n=4.519) dos acessos, via celular (71%) por mulheres (81%). Publicações com hiperlink e imagens foram mais engajadoras. O Facebook® mostrou-se como uma ferramenta eficaz por atingir números expressivos de pessoas, e deve ser considerado na divulgação de novas tecnologias. Para tal, é necessário criar conteúdos atrativos e busca ativa de usuários. Estudos complementares devem continuar a avaliação dessa estratégia, com análise da divulgação orgânica e divulgação com impulsionamento pago.

**Descritores:** Redes Sociais Online; Publicações de Divulgação Científica; Comunicação em Saúde; Pessoas com Deficiência.

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# INTRODUCTION

The use of the internet has brought significant advances in all sectors, especially in the context of health education and inclusion of persons with disabilities (PwD). Web 2.0 enabled the evolution of social media, transforming users into content creators and not just passive consumers. Access to knowledge, which was previously restricted to specific locations, is now literally in the palm of your hand, through mobile devices with access to the internet[1,2].

In Brazil, 116 million people are connected to the internet, with virtual social networks (VSNs) being a promising communication channel[3]. This context is based on the "open access" movement started in 1990[4]. This was consolidated by three public statements: the "Budapest Open Access Initiative"[5] in 2002, the "Bethesda Statement on Open Access Publishing"[4], and the "Berlin Declaration on Open Access to Knowledge in the Sciences and Humanities", both from 2003[6]. This movement encourages free access to the results of scientific research for all people[4]. Thus, research carried out in the health field reflects benefits when applied in clinical practice and in the context of the population's life.

In this sense, VSNs have become tools for health promotion, education and inclusion. Studies show that content on health-related topics is the most accessed on the internet[1-6], mainly by people with chronic diseases or who have suffered permanent alterations to their health. On the other hand, a systematic review demonstrated difficulties in measuring whether, in fact, people apply the content they access[1]. In this context, the participation of health professionals in strategies that improve the dissemination of scientific information on such media is essential, promoting the exchange of information between professionals and patients in a secure virtual environment[1-6].

Currently, Facebook® is the most popular social media network in the world, with more than two billion users, of whom 14.3 million show interest in accessibility, social inclusion and disability, confirming the relevance of the production of research aimed at PwD audiences[5]. Therefore, access to assistive technologies together with health education, through VSNs, contribute to the inclusion, accessibility, empowerment and autonomy of PwD[7,8].

On the other hand, Facebook® cannot be considered a safe place to exchange and obtain information, since several of its pages have information without a scientific basis, which can generate serious damage to the health of its users[9,10]. These data confirm the importance of the work of researchers and health professionals in the promotion of content based on scientific evidence, aiming to minimize the dissemination of and access to misleading information by users, in addition to gaining visibility for their scientific results.

In this scenario, aspiring to maximize online health education aimed at PwD, researchers from four Brazilian public universities developed a VSN for PwD. The VSN, entitled *D Eficiência* (www.demaiseficiencia.com), was developed to promote a safe environment for the exchange of experiences, mutual support and promotion of information based on scientific evidence.

Considering Facebook® as a means of promotion widely used around the world, including in the context of health education[11-14], the aim of this study was to identify which promotion strategies applied on Facebook® promoted more hits to the *D Eficiência* VSN and to characterize its users.

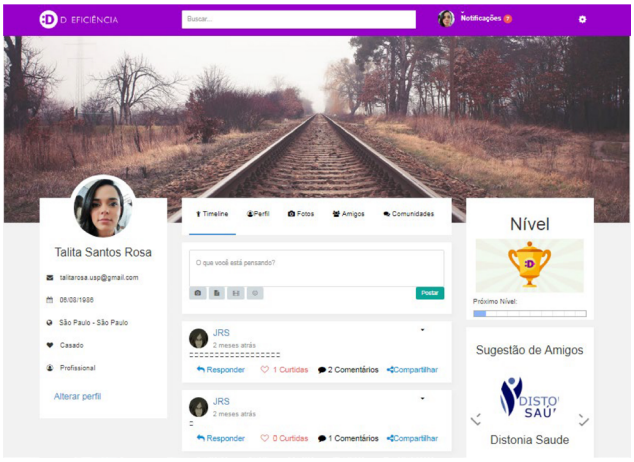
# METHODS

This is a quantitative, descriptive, comparative and longitudinal study. It was approved by the Ethics and Research Committee of the University of São Paulo, under protocol No. 74984617.8.0000.5393, in addition to following the Resolution of the National Health Council No. 510 (2016). All participants accepted the terms of use to be users of the Facebook® and *D Eficiência* VSNs.

## Development of D Eficiência

Research using social media for PwD at the Center for Research and Care in Neuropsychomotor Rehabilitation (NEUROREHAB) began in 2013, with the development of a virtual forum for people with myelomeningocele, in partnership with the Faculty of Rehabilitation Sciences at the University of Dortmund in Germany[9]. This previous study provided a basis for the development of the *D Eficiência* VSN in 2014, with the support of the Assistive Technology in Brazil and Disability Studies No. 59/2014 public notice of the Coordination for the Improvement of Higher Education Personnel[8]. Three Brazilian universities (University of São Paulo, Federal University of Pará and Federal University of Minas Gerais) were responsible for defining the scope, project and content that would be used in *D Eficiência*. The Laboratory of Computational Intelligence and Operational Research at the Federal University of Pará, in partnership with the Center for Technological Sciences at the State University of Maranhão and the Institute of Engineering and Geosciences at the Federal University of Western Pará, were responsible for the technological development of the network.

The development of the network took place over 10 months, based on the Facebook® and Twitter® format, with PHP programming language, agile development tools for Web 2.0 applications and based on the Codelgniter framework. The structural division of *D Eficiência* consists of a timeline, communities specific to different types of




Source: https://demaiseficiencia.com/. Access at: Aug. 2020
**Figure 1.** User profile page of the virtual *D Eficiência* social network. Brazil, 2020.

disabilities, discussions and surveys, as shown in Figure 1. The network was launched in May 2017.

## Data collection

### *Instruments for data collection*

For data collection, two virtual social network traffic monitoring software programs were used:

- "*Facebook Insights*®" (www.facebook.com/insights)[14], which is monitoring software that provides data such as sex, age of users, and number of people reached by publications and engagement, consisting of three elements:
  - Interaction – comments, questions or answers made by users on the publication.
  - Engagement – the number of hits that the publication received, in addition to the time spent on the publication.
  - Influence – how much the promoted content influenced users' decisions.
- "*Google Analytics*" (www.google.com/analytics)[15], which is the program that performs traffic monitoring for *D Eficiência*. It obtains data such as sex, age, number of hits, origin of hits, access devices and duration of accesses.

## Procedure for data collection and analysis

### *Promotion and analysis strategies*

The study was divided into three phases: Passive promotion phase, Active search promotion phase and Analysis of the effect of promotion on hits to the *D Eficiência* VSN phase. Initially, a profile of *D Eficiência* was created on Facebook® to post publications (www.facebook.com/demaiseficiencia). The period of analyses and promotion strategies took place between April 7 and July 7, 2017.

### *Passive promotion phase*

The passive promotion phase consisted of publications about *D Eficiência* and its purposes, only in the News Feed of the Facebook® page. Six publications were made with image, text and hyperlink content that directed the user to *D Eficiência*'s social network page. These publications took place from May 15th to June 20th. In this phase, whether the type of publication interfered in the reach and engagement of the profile was analyzed.

### *Active search promotion phase*

In the active search promotion phase, *D Eficiência*'s publications occurred in PwD groups and on other PwD Facebook® profiles. The analysis took place from June 21st to July 7th. During this period, specifically, on the 22nd and 23rd of June, 15 moderators of the research group NEUROREHAB published hyperlinks, texts and images that directed users to the social network *D Eficiência*. The PwD groups and Facebook® profiles were found using the Facebook® search engine. Terms such as accessibility, disability, inclusion, spinal cord injury, cerebral palsy, autism and myelomeningocele were applied. A total of 44 PwD groups and profiles were found, consisting of a total of 2,098,172 users.

### *Analysis of the effect of promotion on hits to the D Eficiência virtual social network phase*

In this phase, the influence of the types of promotion on the hits that the *D Eficiência* VSN received during the promotion periods was analyzed.

The collected data were exported from Google Analytics and Facebook Insight® in Excel spreadsheet format and transferred to Stata Statistical Software version 13.1 for Windows.

For the statistical tests, the Spearman correlation was chosen after applying the Shapiro-Wilk test ($p>Z=0.0000$) and bivariate analysis was performed using a logistic regression model, under the dependent variables (number of reaches of publications on Facebook®; engagement and likes) and independent variable (number of hits on the social network *D Eficiência*). A significance level of 5% was considered for the tests ($\alpha=0.05$) and ($p<0.05$).

For the descriptive analysis and characterization of the sample, such as sex, age, types of access devices and origin of the hits on social networks, calculations of absolute and relative frequency were performed for qualitative variables, and central tendency (mean) and variability (standard deviation) for quantitative variables.

# RESULTS

The two promotion strategies were carried out and analyzed according to the three phases described in the method.

## User characteristics

The sample consisted of followers of the *D Eficiência* Facebook® profile and users who accessed the *D Eficiência* VSN. The age of the sample on both VSNs ranged between 18 and 75 years, with a mean age of 35.8 years (± 12.07 years) for Facebook® and 41.19 (± 12.31) for *D Eficiência*. The predominant sex was female with 79% (n=333) on Facebook® and 81% (n=2,341) on *D Eficiência*, as shown in Figure 2.

At the time of analysis, *D Eficiência*'s Facebook® profile had 424 followers, of which 97.9% (n=415) were from Brazil, 0.7% (n=3) from Italy, 0.5% (n=2) from the United States and 0.2% (n=1) from Germany.

The *D Eficiência* VSN, received 4,945 hits over the two periods, 83.4% (n=4,125) came from Brazil, 9% from Portugal (n=444), 5.1% from the United States (n=255), 0.8% from the Philippines (n=41), 0.4% from Argentina (n=20) and 0.3% (n=15) from Canada, Spain, France and Luxembourg. As for hits and followers from Brazil, the states with the largest number of users were São Paulo, Pará, Rio de Janeiro, Minas Gerais, Rio Grande do Sul and Santa Catarina (Table 1).

Regarding the device used to access the *D Eficiência* social network, according to Table 2, in the active search promotion phase, there was an increase in hits from mobile devices in relation to passive promotion (74.2% ≠ 42.3%).

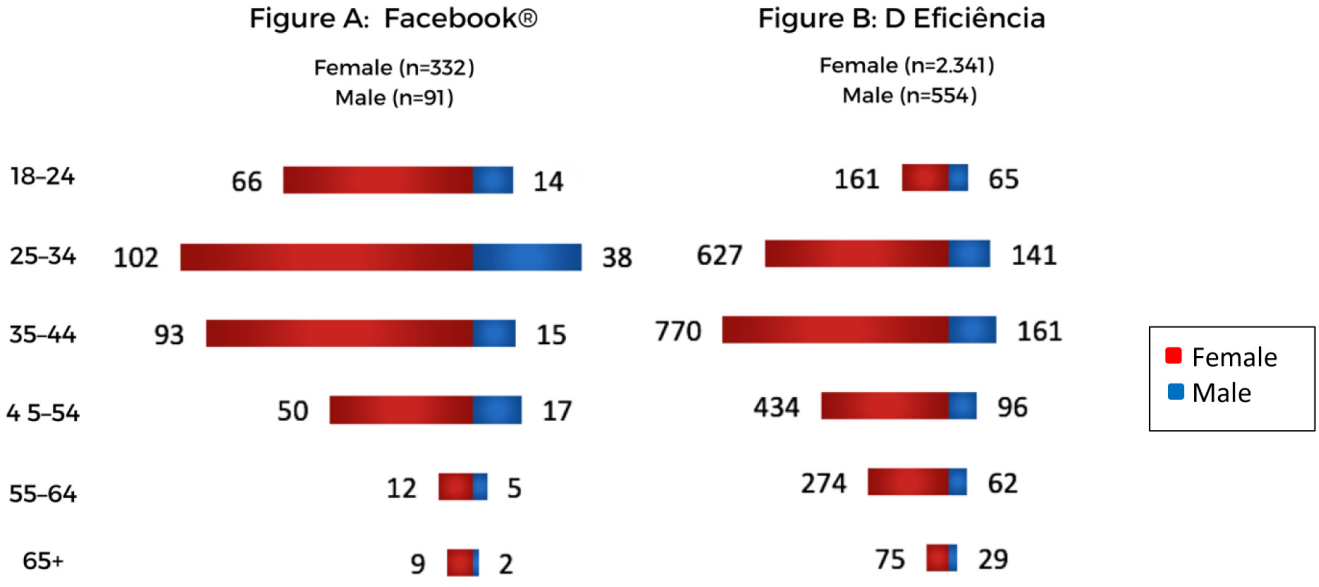
**Table 1.** Distribution of Brazilian users according to virtual social networks and origin by Brazilian state. Facebook® (n=415), *D Eficiência* (n=4,125). Brazil, 2017.

| Brazilian State | Followers on Facebook® | | *D Eficiência* Users | |
|---|---|---|---|---|
| | n | % | n | % |
| Pará | 130 | 31.3 | 383 | 9.3 |
| São Paulo | 126 | 30.4 | 1,680 | 40.7 |
| Minas Gerais | 54 | 13.0 | 610 | 14.8 |
| Rio de Janeiro | 29 | 7.0 | 514 | 12.5 |
| Rio Grande do Sul | 20 | 4.8 | 234 | 5.7 |
| Santa Catarina | 14 | 3.4 | 136 | 3.3 |
| Other states | 42 | 10.1 | 568 | 13.7 |
| Total | 415 | 100 | 4,125 | 100 |

Source: Facebook® Insight[14] and Google Analytics[15], 2017.

**Table 2.** Distribution of users according to devices used to access the *D Eficiência* social network (n=4,945) and type of promotion. Brazil, 2017.

| Devices | Passive Promotion | | Active Search Promotion | |
|---|---|---|---|---|
| | n | % | n | % |
| Mobile | 182 | 42.7 | 3,345 | 74.1 |
| Desktop | 240 | 56.3 | 1,063 | 23.5 |
| Tablet | 4 | 0.9 | 111 | 2.4 |
| Total | 426 | 100 | 4,519 | 100 |




Source: Facebook Insight[14], and Google abalytics[15]. Rosa, 2107.

**Figure 2.** Distribution of participants according to age category and sex. Brazil, 2017.

## Passive promotion strategy

During passive promotion, eight publications were posted on *D Eficiência*'s Facebook® profile feed in a period of 35 days. Five publications were made with images (62.5%) and three without images, using only hyperlinks and texts (37.5%).

The correlation between the type of publication, with the means of reach and engagement were not significant (p=0.64; CI95% = 174.22 – 685.72; p=0.23; CI95% = 6.28 – 47.03; Mann-Whitney test). This demonstrates that the content of the publication when made available in the News Feed, did not influence user reach and engagement, since access to the content published on Facebook® profiles is directed only to their followers.

With the passive promotion, *D Eficiência*'s Facebook® page, reached 140 likes in 35 days (mean of seven likes/day). In the same period, the *D Eficiência* VSN was accessed 426 times in 74 days (mean of 5.75 accesses/day), of which 48.6% (n=285) registered with the *D Eficiência* VSN. The correlation between engagement and reach of the Facebook® page's News Feed publications (Figure 3) demonstrated that the greater the reach, the greater the chances of engagement/interaction with the content by users (p<0.001, $R^2$=0.9247).

## Active search promotion strategy

During this promotion, 23 publications were posted on *D Eficiência*'s Facebook® profile feed in 17 days (average = 1.35/day), in addition to 44 publications with image, text and hyperlink in different PwD groups and on Facebook® user profiles directing users to the *D Eficiência* VSN.

The correlation of the type of publication with images (n=15; 65.22%) and hyperlinks with text (n=8; 34.78%), with reach and engagement showed that publications with images tended to reach more users (p=0.02; CI95% = 220.161 - 734.78; Mann-Whitney test). On the other hand, there was no statistically significant difference in relation to the type of publication and engagement (p=0.09; CI95% = 22.597 - 75.166; Mann-Whitney test), revealing that the image alone was not enough to generate engagement.

The total reach of *D Efficiência*'s Facebook® profile, had a mean of 477.47 (sd=500.45), with a range between 15 and 1,753 users reached. Engagement averaged 33.69 (sd=23.16) with a range from three to 93. Active promotion also boosted *D Eficiência*'s Facebook® profile, since, after publications in other groups, it reached 1,753 users and 93 interactions.

Bivariate reach and engagement analyses with Pearson's correlation coefficient and linear regression showed that both had strong positive correlations (p≤0.001; r=0.91). The r-value in the correlation between the variables, reach and engagement, suggested that 91% of the range variation can be explained by the regression as a function of engagement, that is, publications with the use of images tend to generate greater reach, leading to a 91% increase in the chances of engagement with published content (Figure 4).

These results suggest that the publications on other pages and the type of content of the publications influence reach and encourage users to interact with the content, generating engagement. During this period, *D Eficiência*'s profile on Facebook® jumped from 140 to 424 followers, an increase of 66.9% (n=284), with an average of 16.7 followers per day (Figure 5).

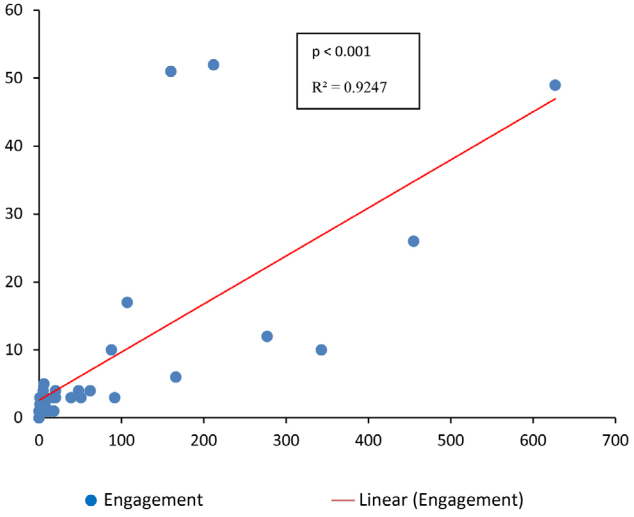
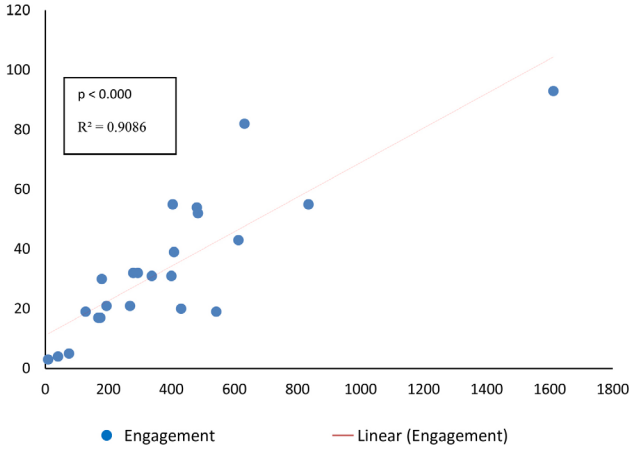



**Figure 3.** Diagram of dispersion and regression between engagement and reach of publications made on *D Eficiência*'s Facebook® profile. Brazil, 2017.




Applied test: Linear regression coefficient.

**Figure 4.** Diagram of dispersion and regression between the engagement and reach variables of *D Eficiência's* social network profile on Facebook®. Brazil, 2017.

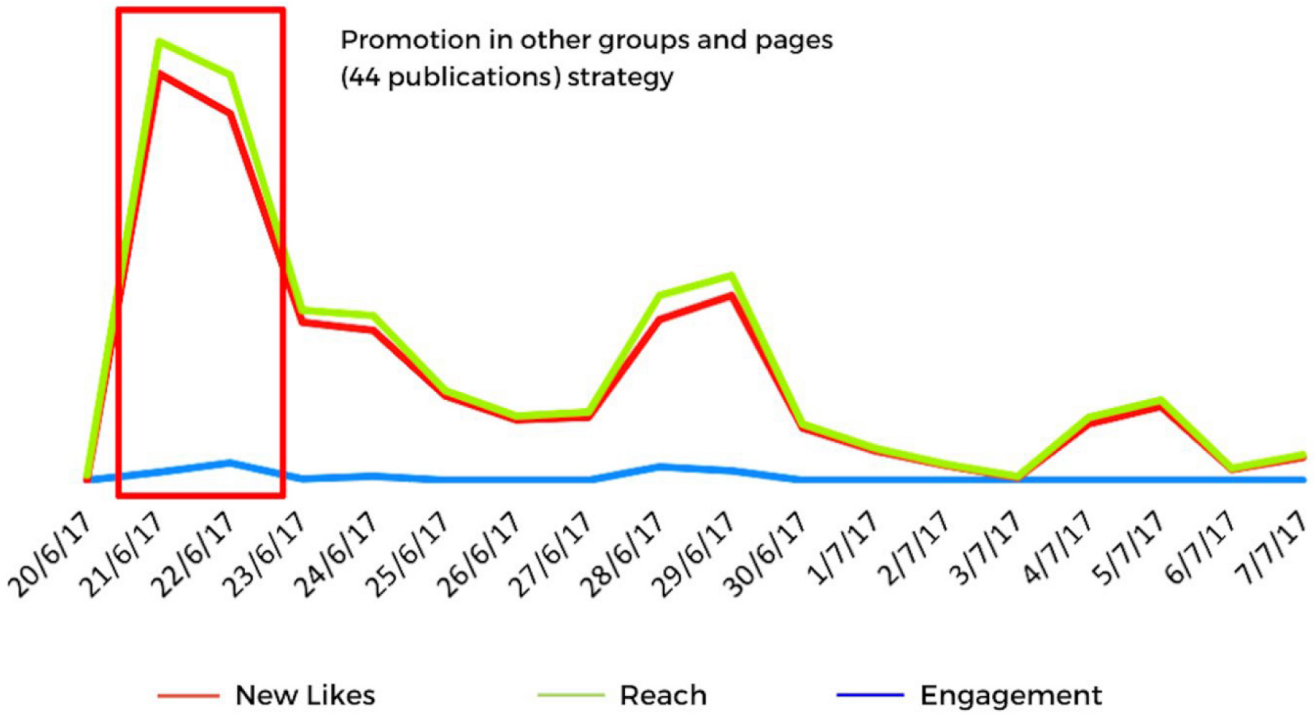



**Figure 5.** Distribution of reach, engagement and new followers of *D Eficiência's* Facebook® profile, according to the period of active promotion. Brazil, 2017.

In the active search promotion phase, the *D Eficiência* VSN received 4,519 hits in 17 days (mean of 285.8 hits/day), with 1,067 new users registered.

## Comparison between promotion strategies and their influence on access to the *D Eficiência* social network

Over the two promotion periods, the *D Eficiência* VSN received 4,945 hits, 9% (n=426) with passive promotion and 91.4% (n=4,519) with active search promotion. Active search promotion proved to be more effective, both in reaching users and in disseminating information and attracting new users to *D Eficiência*, when compared to passive promotion (p=0.02, Mann-Whitney Test, Figure 6).

There was no statistically significant difference, during passive promotion, in relation to the number of hits and reach (p=0.70, $R^2$=0.004, Pearson's correlation coefficient) and engagement (p=0.74, $R^2$=0.003, Pearson's correlation coefficient). On the other hand, in active search promotion, both demonstrated a significant correlation, which was positive and strong for reach (p≤0.001, $R^2$=0.8301, Pearson's correlation coefficient) and for engagement (p≤0.001, $R^2$=0.770, Pearson's correlation coefficient). This suggests that 83.01% of the variation in hits is explained by engagement, as a function of reach, with a strong and positive correlation between the two variables, that is, the greater the reach, the greater the number of hits (p≤0.001, R=0.910). Posts with greater reach on Facebook® increased the chances of the user engaging with the published content and accessing the *D Eficiência* social network by 77% (Figure 7).

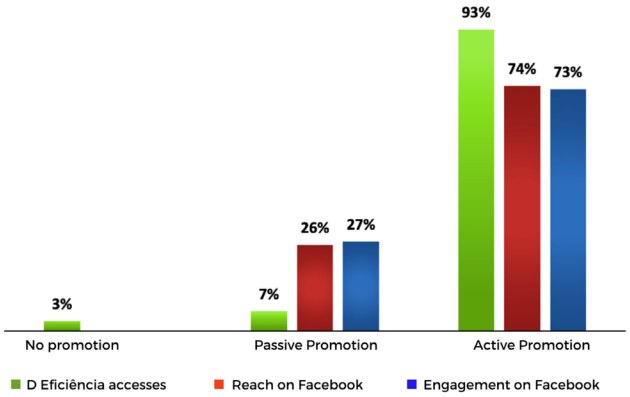
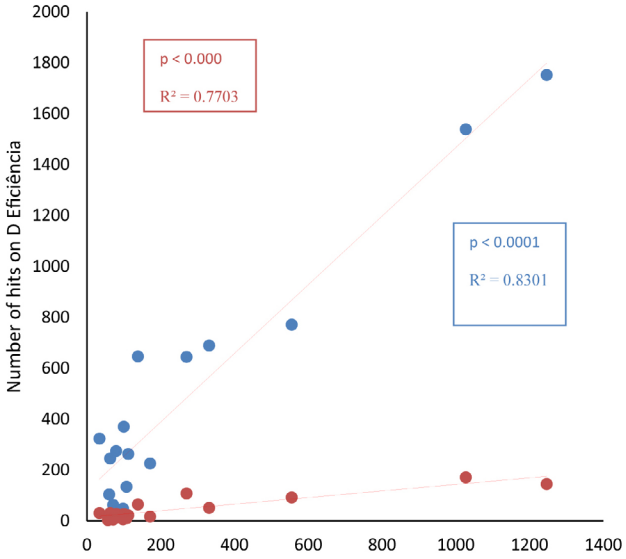



**Figure 6.** Distribution of accesses to *D Eficiência's* social network, the engagement and reach variables of *D Eficiência's* social network profile on Facebook®, according to promotion strategies (n=4.945). Brazil, 2017.

# DISCUSSION

Facebook® has changed the way people interact with each other, democratizing access to new technologies and different types of information[16,17]. However, the dissemination of content depends on the way this information is published on the VSN[9,16,17].




Applied test: Linear regression coefficient.

**Figure 7.** Diagram of dispersion and regression between the accesses to *D Eficiência's* social network, according to the engagement and reach variables of *D Eficiência's* social network profile on Facebook®. Brazil, 2017.

## Characterization of virtual social networks Users

Most of the hits came from Brazilian territory (> 90%). This is due to the Portuguese language, which is used in the publication texts, in addition to the terms applied in searches on Facebook®. However, data related to the state of origin are affected by the Facebook® content targeting algorithm[15].

This algorithm directs published content, according to the region and interest of each user. A study carried out at the University of Illinois and Michigan analyzed publications on Facebook®, and found the existence of automatic content targeting, in which the user only has access to content that Facebook® deems relevant, according to their browsing history[15].

In this sense, the states that most accessed the *D Eficiência* VSN were the states that host public universities participating in the study: São Paulo (71%), Pará (41%), Minas Gerais (27%). Users residing in these regions were more likely to receive the content of the promotions than users in other regions.

The mean age of users who accessed both the Facebook® page and the *D Eficiência* VSN ranged from 35.8 to 41.2 years. The predominant sex was female, with 79% of the hits. These data corroborate the surveys carried out in 2015, by the Brazilian Institute of Geography and Statistics (IBGE), in Brazil, and in 2018, by the Pew Research Center, in the United States. These studies showed that young adult women, between 19 and 35 years old, access VSNs 80% more than men in search of health information and new friends[16,17].

The VSN access devices differed in the promotion strategies. In active search promotion, accesses occurred via cell phones (74%), unlike passive promotion, which had the computer as the main access device (42.3%). Data from IBGE and Facebook® Brazil show that 88% of the Brazilian population (93 million people) access Facebook® by cell phone. The greater the number of users reached by active search promotion, the greater the likelihood of this accesses taking place via cell phone[9,18].

The use of cell phones and the accessibility of mobile data has meant that 64% of young adults, residing in the United States, use cell phones as the only means of accessing the internet. A study carried out in 2015, found that 41% of adolescents from low-income families accessed the internet only by cell phone, due to the low cost of obtaining a device and data plan. Of these, 62% used their cell phones to search for health information[19]. This corroborates with other studies that indicate the ease of access to information on the internet, even in isolated regions and/or by people living in precarious situations, which occurs due to the expansion of broadband and the low cost of mobile devices for internet access[20].

## Promotion strategies on Facebook® and hits on the *D Eficiência* virtual social network

In the passive promotion strategy, publications were visible only to users who followed the page. While in active search promotion, publications were posted in different groups and on the feeds of other users. Obviously, the hits were greater in the active search promotion (n=4,519). Although the promotions on Facebook® proved to be efficient, studies demonstrate that the effectiveness of promotion occurs by the type, frequency and execution of publications according to the interests shown on the network by the user[16].

In this scenario, one of these studies identified that only 40% of the content published in the News Feed actually reaches the user[21]. These findings are consistent with a study that used Facebook® to recruit research participants and states that there is interference in the reach of publications, due to the interests of users on the Web in general, through browsing history and tracking cookies[22]. Another factor that influences the reach and engagement of publications is the use of images[16]. *D Eficiência*'s publications with images reached more users, when compared to those without images, suggesting that reach and engagement increase with the use of images in publications.

This study demonstrated that searching for terms corresponding to the research aims on VSNs, as well as actively seeking users with an affinity to the study topic, contributed significantly, both in increasing the number of accesses to the published information ("*D Eficiência*"), as well as reaching more people. This strategy can be applied to various types of scientific content relevant to the population.

This is a very important contribution for people with chronic diseases, since a previous study points out that 25% of PwDs seek health information on the internet[23]. Expanding these data, studies that evaluated the attainment of health information and interference in health actions, demonstrated that PwDs considered information reliable regardless of the source, and 70% of them applied the guidelines in their daily lives and changed the proposed treatment[24].

In this perspective, what is currently being discussed in studies beyond the quality of health information are the barriers that prevent access. A study carried out in 2017 demonstrated the preference for obtaining consolidated and scientifically based online health information, as this helped both in the decision making of health professionals and in the patients' confidence in following a certain proposed conduct[25]. However, studies show that low-quality health information without scientific validation is constantly being accessed and its application in health care harms thousands of people worldwide[24,25]. Evidence of these data has been observed in the Ministry of Health's constant struggle to combat false information circulating on social networks about vaccines, which already has disastrous impacts on public health[24].

In this context, the results of these studies reinforce the importance that performance of health educators alone in the online environment, through educational actions and the creation of pages with validated content, is not enough, if these publications follow a passive promotion strategy[8].

In this sense, this article demonstrates how to circumvent barriers that prevent access to scientific information, even in the face of false information, content guidelines and VSN algorithms. Since the active search promotion strategy minimizes these access barriers, as demonstrated with 94% of the promotion effectiveness coming from this strategy. It is up to health professionals to take ownership of VSN functionalities, to identify through metrics managers what content is more accessed and generates interaction. Furthermore, they should also monitor users' behavioral changes in obtaining health information and develop actions that monitor false information, as well as advise and train their patients to obtain reliable information on the internet[24].

Building and motivating a new VSN, as well as actively involving users, is an arduous process, especially when this VSN is scientifically based. There is a need to constantly update information in conjunction with science and work on the sensitivity of professionals involved in moderating the network to identify behavioral changes in health and users. However, innovative attitudes like this, providing a safe, controlled environment that facilitates access to the exchange of information, the connection between peers, the formation of support networks between PwD, family institutions and professionals, which result in better satisfaction rates with life, autonomy and social participation, in addition to minimizing social isolation, caused by disability, are essential tools today[26]. All of these possibilities make the *D Eficiência* VSN an ally of public health care and management[21].

This study provided important data on the influence of the Facebook® algorithm, and its limitations in the promotions that aim to disseminate health information to people with disabilities. The promotions reached only a few regions and users who showed interest in the subject of disability on Facebook®. Although the study had limitations in the promotions due to the short period of time and the low frequency and quantity of publications, the *D Eficiência* VSN reached 4,945 hits on its page. This demonstrates that an actively applied promotion strategy can circumvent barriers and reach more users.

## FINAL CONSIDERATIONS

In this study, two experimental approaches to promotion on Facebook® were described. Publications that used images were more likely to reach users. Furthermore, the greater the reach, the greater the possibility of user interaction with the publication.

The active search promotion strategy was more effective in terms of the number of hits that the *D Eficiência* VSN received. To this end, Facebook® was a great ally to the promotion of scientific content.

Scientific promotion through health professionals should occur frequently, with updated publications and the use of self-explanatory images and texts, with the aid of an active search to retain, attract and maximize the health of users.

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