ARTICLE

If you make a mistake, fix it:

an experimental study on health news in G1 and WhatsApp

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ABSTRACT – This article analyzes the effect of news reports containing grammatical errors that have been corrected or updated, how readers perceive the credibility of this information, and their behavioral intention with the content in the news reports. We investigated these effects in a report on yellow fever vaccination with a sample of 1.648 individuals. Based on an experimental research design, we measured the effects of the vehicle (G1 or WhatsApp) and five versions of a text. The findings show that the same text assigned to G1 or a WhatsApp message was perceived as more credible in the first case. Grammatical errors, updates, and corrections, in general, did not affect the credibility of the news or the intention to be vaccinated. When the news is attributed to the G1, however, the credibility of the "corrected" message is significantly higher than the credibility of the message with serious grammar errors.
Key words: News correction. News update. Grammatical Errors in journalism. Credibility. Health journalism.

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SE ERRAR, CORRIJA: um estudo um estudo experimental sobre notícias de saúde no G1 e no WhatsApp

RESUMO – Este artigo analisa o efeito de notícias com erros gramaticais, corrigidas ou atualizadas sobre a percepção de leitoras e leitores em relação à credibilidade da informação e sobre sua intenção de comportamento associada ao conteúdo dessa notícia. Investigamos esses efeitos em uma notícia sobre a vacinação contra a febre amarela junto a uma amostra de 1.648 indivíduos. Com base num desenho experimental, mensuramos os efeitos do veículo (G1 ou WhatsApp) e de cinco versões de um texto. Os achados mostram que o mesmo texto atribuído ao G1 ou a uma mensagem de WhatsApp foi percebido como mais credível no primeiro caso. Erros gramaticais, atualizações e correções em geral não afetaram a credibilidade da notícia nem a intenção de vacinação das participantes. Quando a notícia é atribuída ao G1, porém, a credibilidade da mensagem "corrigida" é significativamente maior que a credibilidade da mensagem com erros graves de gramática.
Palavras-chave: Correção de notícias. Atualização de notícias. Erros gramaticais no jornalismo. Credibilidade. Jornalismo de saúde.

SI TE HAS EQUIVOCADO, CORRÍGELO: un estudio experimental sobre noticias de salud en G1 y WhatsApp

RESUMEN – Este artículo analiza el efecto de noticias con errores gramaticales, corregidas o actualizadas sobre la percepción de las lectoras y de los lectores con relación con la credibilidad de la información y sobre su intención de comportamiento asociada al contenido de esa noticia. Investigamos esos efectos en una nota sobre la vacunación contra la fiebre amarilla con una muestra de 1.648 individuos. A partir de un diseño experimental, medimos los efectos del medio (G1 o WhatsApp) y de cinco versiones de un texto. Los hallazgos muestran que el mismo texto asociado a G1 o a un mensaje de WhatsApp se percibió como más creíble en el primer caso. Los errores gramaticales, actualizaciones y correcciones generalmente no afectaron la credibilidad de la noticia ni la intención de vacunación. Cuando la noticia se atribuye al G1, todavía, la credibilidad del mensaje "corregido" es significativamente mayor que la credibilidad del mensaje con graves errores gramaticales.
Palabras clave: Corrección de noticias. Actualización de las noticias. Errores gramaticales en el periodismo. Credibilidad. Periodismo de salud.

1 Introduction

72% of internet users in Brazil over the age of 16 state that they look online for health information (NIC.br, 2021)[1]. Algorithms in search engines such as Google, Bing, and Yahoo favor news sites (Google, n.d.; Vilarins et al., 2021, p. 341; Hindman, 2009) so as not to expose internet users to misinformation that may be contained in personal blogs, untrustworthy websites, or web pages that go unmonitored by fact-checking agencies (Microsoft, 2017).

However, the content that internet users find in their searches is produced quite differently from the content of print journalism in the past. Online journalism has a more decentralized production process (Jorge, 2013, p. 32) and is driven by impulsivity (Moretzsohn, 2002, p. 133). This "obsession with immediacy" means journalists have to produce internet content at a rapid pace in an environment where releasing content first seems to be the most important goal (Moretzsohn, 2002, p. 133).

This immediacy can sometimes result in major errors in information and the subsequent retraction of stories by media outlets. For example, in September 2010, UOL[2] and Folha's website[3] erroneously reported the death of senator Romeu Tuma[4] (Vieira & Christofoletti, 2014, p. 91). Another example is the R7[5] portal which, in February 2013, reported that several attacks on buses in the state of Santa Catarina had resulted in 106 deaths; however, that information was incorrect as there were 106 attacks on buses, and not 106 deaths (Vieira & Christofoletti, 2014, p. 96). Sometimes the speed at which news is produced and published can lead to minor errors, such as grammatical mistakes, simple corrections, or even updates that could provide more information about the original story, making it more complete (Hettinga & Appelman, 2014, p. 51).

It is in this context that we feel it is important to investigate how these issues (grammatical errors, corrections, and updates) influence the credibility of news, particularly stories on health, and how readers interpret their health news and share information on this topic.

Are stories that contain errors or that need to be corrected or updated less credible than those which are written correctly and do not need any corrections or updates? Are updated stories seen as more credible than corrected stories, or ones with grammatical errors? Do stories with errors or corrections from a professional media outlet have the same effect as those from a social network? If they exist, do these effects on news credibility have an affect on how readers interpret their news content?

This article seeks to answer these questions by comparing different versions of a news story on yellow fever[6] to observe the credibility of this article and identify how it affected the readers' opinions about getting vaccinated against the disease and warning friends and family members to do the same. We adopted a 2x5 factorial experimental design which we used to compare the effects

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of news stories from two media outlets (the G1 portal and the WhatsApp social network) which were presented in five different ways (the original story with no grammatical errors or any indication of needing corrections or updates, another version containing small grammatical errors, another containing major grammatical errors, one indicating that it had been "corrected", and one indicating that it had been "updated").

Our data was collected from a sample of 1.648 individuals in 2019, representative of the Brazilian population with internet access. The results show that readers are not very concerned about grammatical errors and corrected or updated versions of news reports, but they do recognize the credibility of content from professional vehicles (such as the G1 portal) when compared to social networks (such as WhatsApp). In the tests we performed, the grammatical errors and whether news reports were corrected (or not) also had no effect on the participants' decisions to vaccinate or to advise friends and family about immunizing against the disease. However, a *post hoc* analysis of the G1 portal revealed that participants regarded the "corrected" version of its news report as more credible than the version that contained major grammatical errors.

The remainder of this article is organized into five sections. Section 2 reviews the existing literature on news elements such as corrections, updates, and errors, and how they affect the credibility of journalistic content and readers' decision-making. Section 3 describes the methodology adopted for this study, section 4 analyzes the data, section 5 discusses the results, and section 6 summarizes our conclusions.

2 Literature review

Since Carter and Greenberg's (1965) pioneering work on the key factors of news credibility, a number of studies have been published describing and explaining the reasons why audiences regard some journalistic content to be more credible than others (Castillo et al., 2013; Chung et al., 2012; Dochterman & Stamp, 2010; Gaziano & McGrath, 1986; Hovland & Weiss, 1951; Kang & Yang, 2011; Mayo & Leshner, 2000; Metzger et al., 2003; Metzger et al., 2010).

Appelman and Sundar (2015, p. 1) believe that it is particularly important to separate the credibility of the source, the message, and

the sender when evaluating news. The authors give the example of a story about a robbery published in a printed newspaper, where credibility will be influenced by the media outlet itself and by the journalist. The same story, if published in a different media outlet, could be perceived differently even if it were written by the same reporter and contained the same message.

In an attempt to establish a common framework among researchers on the subject, Appelman and Sundar (2015, p. 5) define message credibility as an "individual judgment of the veracity of communication content". In addition to this definition, the authors suggest that in order to measure this in surveys, participants must be asked to rate the content based on whether it is accurate, believable, and authentic (Appelman & Sundar, 2015, p. 13).

The commercial direction of journalism also draws attention to transparency in news reports (including checking and any error corrections) and how important it is to a media outlet's credibility and the information it releases. One of the dimensions of transparency in journalism is error correction (Appelman & Hettinga, 2020, p. 2). In Brazil, for instance, major media outlets recommend that once an error is discovered in a news report, it should be corrected. According to the editorial principles of the Globo Group[7] (the largest media group in Brazil) "errors must be corrected promptly and efficiently. There is no greater error than not correcting."

Similarly, the Folha de S.Paulo's Editorial Manual states that explicit and rapid correction is the best way to maintain the reader's trust and the newspaper's credibility (Manual da Redação, 2018, p. 58). The Estado de S. Paulo's[8] Manual of Writing and Style recommends that: "All erroneous information published by the Estado must be corrected in the following edition, in the same section that the error was published in, under the title 'Corrections', except for rare cases which may require greater prominence" (Martins Filho, 1997, p. 120).

In fact, this seems to be a view that is shared by news producers. A study on media credibility with newspaper editors showed that more than 60% of focus group participants said they felt "better" about the quality of a news organization if it includes corrections in its texts (Klos[9], 1998 as cited in Appelman & Hettinga, 2015, p. 418). Similarly, Anikina (2015, p. 167) found that journalists in Russia, Poland, and Sweden also hold the same expectation, although there are some significant differences in terms of what constitutes an error and correction among professionals in these countries.

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Nevertheless, experiments have shown that readers do not necessarily have the same understanding as journalists do regarding the importance of correcting errors. As Karlsson et al. (2016, p. 148) report, readers in Sweden do not generally trust the media more after it publishes corrections. There is greater tolerance for errors however when they are of lesser impact, or when the audience already does not trust the media. Corrections do not seem to be able to build any trust with readers who already have little faith in the press (p. 148).

A study by Appelman and Hettinga (2015, p. 415) also suggests that different types of errors do not lead to different perceptions about the credibility or quality of the news. Their study did not however test the credibility of the source (readers did not know it was a Times story) nor did it compare the experimental conditions with a control condition (no corrections). Regardless, the corrections always described what the mistakes were in the first version of the news report.

Another study conducted by the same authors concluded that readers better understand a news report when corrections are made without restating what the errors were and without naming the individual responsible for them. In other words, correcting the errors is enough (Hettinga & Appelman, 2016, p. 249). It is also possible that corrections are perceived according to where they are included – at the top or the bottom of the news report – (Appelman & Hettinga, 2020, p. 13) and by the ideological preferences of the participants (Nyhan & Reifler, 2010, p. 303).

In the absence of convergent empirical results, our first hypothesis is based on the standard assumption that highlighting corrections can increase the perception of transparency about the journalistic content and, consequently, the credibility of the news. In other words, informative content marked as "corrected" will tend to carry greater credibility than identical content without this reference (H1).

Another potential influencing factor for how news credibility is perceived is the information that the text has been updated. Updates may, or may not, be information or grammar corrections. For example, Folha constantly updates its online news reports by correcting problems, clarifying obscure excerpts, adding relevant information, or including new editing elements (Manual da Folha, 2018, p. 80).

Including additional information as events develop is part of the logic of online journalism and reiterates the idea of immediacy as a fetish (Moretzsohn, 2002, p. 133). News reports on the major

Brazilian portals often include something like "more information coming" or "more information to follow". There were some cases of websites that claimed the report had been updated (without stating what was updated); however, that change was actually an error correction (Vieira & Christofoletti, 2014, p. 94).

Thus, updates have a similar effect as corrections. Our second assumption, therefore, is that informative content which is labeled as "updated" will tend to carry greater credibility than identical content without this reference (H2).

Readers may find grammatical and typographical errors in uncorrected or not yet updated texts which can then give them the perception that the report is less credible. This is because if the media outlet is concerned with the grammatical correctness of its texts, it makes sense to think that it is also concerned about other aspects of the report, such as the accuracy of the reporter's investigation. Conversely, a poorly written story can give readers the idea that it may contain other errors (Appelman & Schmierbach, 2017, p. 2).

This assumption has already been empirically tested. An experiment conducted by Appelman and Bolls (2011, p. 50) showed that participants who read news stories with no grammatical or typographical errors did so in less time, rated them as more credible, and were able to recall more information than respondents who read versions of the same story with 10 grammatical errors.

Appelman and Schmierbach (2017, p. 2) later replicated this study on a larger and more representative sample of the population, also changing a few aspects of the experimental design. They concluded that a greater number of errors (30, instead of 10), including the level of grammatical knowledge and concern for the cultured norm, are factors that decrease the perception of credibility, quality, and degree of information of a news story.

At this point, our assumptions are twofold. First, we expect the presence of grammatical errors to affect the credibility of the news. This leads us to our third hypothesis which is that informative content with grammatical errors will tend to have less credibility than identical content without these errors (H3). However, the seriousness of these errors can act as a moderating variable for this effect. This means that informative content containing major grammatical errors will have less credibility than identical content with less serious grammatical errors (H4).

In line with Appelman and Sundar (2015), we consider that the effect that corrections, updates, or grammatical errors have on

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the credibility of a news report can be moderated or even mediated by attributing this content to a media outlet. According to Beed and Munix (2017, p. 323), attributing credible sources – such as CNN in the United States – can even help avoid the harmful effects of grammatical or typing errors.

Data from the Brazilian Media Survey (2016), discontinued in 2017, reported that Brazilians had little confidence in information published on the internet. Even still, the study showed that 20% of respondents trusted news sites a lot or always, a more positive result than blogs (11%) and social networks (14%).

Based on this data and the studies mentioned above, we assume that the credibility of news from a professional journalism website such as G1 (www.g1.com.br) is greater than the credibility of the same news from a social network, such as WhatsApp (H5). We do not have very clear assumptions, however, regarding the effect that corrections, updates, and grammatical errors from any media outlet have on the credibility of their content. Even so, we believe that the lower credibility of content circulating on social networks can create a horn effect (Rubin, 1982); a type of cognitive bias which happens when an individual makes a snap judgment about content from a brand based on the fact that it has already been poorly evaluated. This would leave little room for differences when assessing the credibility of versions of news reports on WhatsApp.

Journalism studies on the influence that elements of a news report can have on its credibility are still in their beginning stages, and research on how they affect behavioral intentions is even more scarce. Hu and Sundar (2010) offer a rare empirical report where they observed that when health content is on a website it is more persuasive than when it is on blogs or generally associated to the internet. More specifically, providing links to a website in a news article led to the greater likelihood that an individual would heed what that article had to say (in this case, consuming milk and using sunscreen) and recommend it to others. However, the study is based on data collected from 555 undergraduate students who were randomly assigned to no less than 20 experimental conditions, resulting in groups with an average size of just 28 participants.

Given the limited number of empirical studies on the potential effects that a news report on health and the media outlet associated with it can have on readers' behaviors, we looked at three suggestions based on the literature mentioned above on

credibility. We expect reader behavior to be positively correlated with "corrected" (H6) or "updated" (H7) reports and negatively correlated with reports containing grammatical errors (H8), the more serious the error, the more negative the reaction (H9). Furthermore, we expect reader behavior to be higher when the news reports come from a professional journalistic website such as G1 than when they come from a social network, such as WhatsApp (H10).

The following sections detail the methodology of this study, describe the variables and data used, and present the tests of these hypotheses.

3 Methodology

This study used a 2x5 factorial experimental design to examine the effect that the media outlet (G1 or WhatsApp) and the elements of a news story (original report with no grammatical errors, a report labeled "corrected", another labeled "updated", a fourth containing small grammatical errors, or a report containing major grammatical errors) can have on the credibility of a report about vaccination against yellow fever and whether it would influence the reader to get the vaccine and also to pass this information on to friends and family.

We chose G1 because it is the news branch of the Globo.com portal and ranks first[10] (in Brazil) in Amazon's online traffic ranking for news sites. The list considers the average daily number of visitors and page views. WhatsApp is the instant messaging service most used by Brazilians, installed on 98% of smartphones[11].

3.1 Participants

The experiment was included in an online survey of 2.032 Brazilians, applied between June 5th and 7th, 2019 by Netquest[12]. Participants were randomly assigned to the different experimental conditions of this study. To ensure the internal validity of the research (McDermott, 2002, p. 35), we adopted two preliminary procedures for data analysis. First, we disregarded 322 participants as they failed the attention check. Our attention check referred to the information presented in the news report that some people cannot get the yellow fever vaccine because they have egg allergy. We asked what food this was, offering as options: egg, milk, shrimp and cheese.

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A further 62 participants were disregarded because they exceeded the allotted time to complete the online questionnaire[13]. Even though they met the study's criteria, the lengthy delay in answering the questionnaire could have been due to other concomitant activities that, even if they did not weaken their attention to the experiment, may have introduced other stimuli unrelated to the experimental design. As a result, the analysis stage considered the data from 1.648 participants.

The demographics of these individuals are shown in Table 1. Due to the characteristics of the sample selection (taken from a panel of online respondents), we realize that the participants do not represent the Brazilian population as a whole, but only the population that has access to the internet, which is 75% (NIC.br, 2020)[14]. Nevertheless, this portion of the population is relevant to this study since access to the internet is paramount to being exposed to news from online news portals such as G1 or social networks such as WhatsApp.

Table 1

Sociodemographic data and information habits of participants

Variable	Values	Descriptive Statistics
Gender	Male	47.3%
	Female	52.7%
Age (years)		Average=36.1 (DP=12.2)
Education	Only Elementary	3.8%
	High School	37.1%
	Higher Education	59.0%
	Did not respond	0.1%
Region	Mid-west	8.6%
	Northeast	27.4%
	North	7.5%
	Southeast	40.6%
	South	16.0%
Main information medium	Internet	70.8%
	TV	25.7%
	Other	3.5%
N (Number of respondents)		1,648

3.2 Treatment

Participants were randomly assigned to one of the 10 experimental conditions in this study (Figure 1 shows two of the ten treatments used). As previously indicated, we used a 2x5 factorial design, where the media outlet variable had two levels (G1 and WhatsApp) and the news variable had five levels (original report, corrected report, updated report, report containing small errors, and report containing major errors). During the online survey, each individual was assigned to one of these experimental conditions and read only one of the ten versions of the report.

The report used as a reference in this study is adapted from a report on vaccination against yellow fever released by the Ministry of Health[15] which read:

> Learn more about who should and who should not be vaccinated for yellow fever.
> Vaccination against the yellow fever virus is recommended for those who have not yet been vaccinated and are exposed to forested areas. Children at nine months and adults up to 59 years old should be immunized. A single dose of the vaccine provides lifelong protection.
> For some people, however, the vaccine is contraindicated. Adults over 60 years of age, pregnant women, and women who are still breastfeeding should only be vaccinated if they reside in or are moving to areas with yellow fever cases, provided they do not have any medical contraindication to receive the vaccine.
> There are other people, however, who should not be vaccinated at all, such as people who have a severe allergic reaction to eggs. See the Ministry of Health website for a complete list of people who cannot be vaccinated against yellow fever.

To show that the report had been updated, we used the heading "Updated two hours ago" before the original text. To show that it had been corrected, we used the heading "Corrected two hours ago". In the version with minor errors we replaced the original passage "who have not yet been vaccinated and *are exposed to* forested areas" with "who have not yet been vaccinated and *expose themselves to* forested areas". In the version with major errors, this same passage was written as follows: "who have not yet been vaccinated and *are exposing themselves* to forested areas". Table 2 presents the different versions of this text. Annex 1 presents each of the ten versions shown to the participants.

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Figure 1: Two of the ten treatments used (in Portuguese)

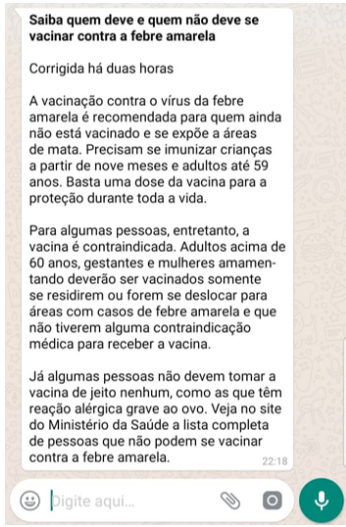

Table 2

Differences between original versions and versions with minor and major errors

Original version	Version with minor errors	Version with major errors
Learn more about who should and who should not be vaccinated for yellow fever.	Learn more about who should and who should not **vaccinate themselves** for yellow fever.	Learn more about who should and should not **vaccinate themselves** against yellow fever.
(...) who have not yet been vaccinated and are exposed to forested areas.	(...) who have not yet been vaccinated and **expose themselves** to forested areas.	(...) who have not yet been vaccinated and **are exposing themselves** to forested areas.
A single dose of the vaccine provides lifelong protection (...)	A single dose of the vaccine **provides a** lifelong protection (...)	A single dose of the vaccine **is providing a** lifelong protection (...)
There are other people (...)	There are **others** people (...)	There are **others** people (...)
(...) or are moving to areas with yellow fever cases (...)	(...) or are moving to areas **of** yellow fever cases (...)	(...) or are moving to **case areas** of yellow fever (...)
(...) such as people who have a severe allergic reaction to eggs.	(...) such as people who **has** a severe allergic reaction to eggs.	(...) such as people **whom has** severe allergic reaction to eggs.
See the Ministry of Health website (...)	See website of Ministry of Health (...)	**See website** of Ministry of Health (...)

3.3 Debriefing

At the end of the experiment, a message was displayed to all participants informing them that the content they had read had been changed. The debriefing text read: "NOTICE: The news report you have read in this survey was changed to assess the influence on behavior and perception of content. We assure you that this stage is solely for academic purposes and is not associated in any way with the G1 news portal or WhatsApp".

3.4 Dependent variables

3.4.1 News credibility

In this study, we evaluated the effects of the media outlet and the news report on peoples' mindsets regarding the news and their behavioral intentions after reading it. The attitudinal dependent variable was constructed from the three-dimensional definition of credibility of a news item proposed by Appelman and Sundar (2015, p. 1). According to these authors, news has credibility when it is perceived as accurate, authentic, and believable. After reading the text, each participant answered three independent questions indicating whether they considered the terms "accurate", "authentic" and "believable" to adequately describe the text they were given to read. A scale from 1 to 7 was used to measure each dimension, where 1 represented "very poorly" and 7 represented "very well".

As we expected, these three dimensions of news credibility were highly correlated with one another. We then performed a factor analysis that found only one latent factor. The Kaiser-Meyer-Olkin (KMO) test registered .754 (a higher number than the recommended value of .6), and Bartlett's sphericity test was significant (X^2 (3) = 4051.8; p .001). The factor resulting from the analysis, which we will call the "credibility" of the news, could explain 87.6% of the total variance of the answers given separately to the dimensions of accuracy, authenticity, and believable. The result of the analysis was given a score ranging from 1 to 7, in order to maintain the scale of the original variables. The average credibility of the news for all treatments was 5.86, with a standard deviation of 1.35, indicating a generally positive assessment of the news report. Only 8.9% of participants gave a score lower than 4, the midpoint of the scale.

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3.4.2 Behavioural intentions

Behavioral intentions were also based on a scale of 1 to 7 (where 1 represented "very unlikely" and 7 represented "very likely"), measuring the likelihood of the participants to advise friends and family members about the importance of getting vaccinated, and particularly to advise those friends and family over the age of 60, pregnant women, and women who are either breastfeeding or have children about the importance of the vaccine.

There was the added question about the probability of the reader participating in the research being vaccinated. Table 3 presents the descriptive data of the dependent variables. They show that the credibility of the news was generally high (X=5.86, from a range of 1 to 7), as were the intentions to advise others about the importance of vaccination. Of note, however, was the lower probability of participants getting vaccinated against the disease (X=4.93).

Table 3

Descriptive statistics of dependent variables

Dependent Variables	N	Min.	Max.	Average	Standard Deviation
Credibility of news	1.648	1	7	5.86	1.35
Advise friends and family	1.648	1	7	5.96	1.54
Advise friends and family over 60	1.648	1	7	5.56	1.90
Advise friends and family who are pregnant	1.648	1	7	5.53	1.96
Advise friends and family who have children	1.648	1	7	5.96	1.55
Get the vaccine	688*	1	7	4.93	2.16

* People who had already been vaccinated at the time of the study were excluded from this analysis.

4 Analysis

The effects that the media outlet and news reports have on the credibility of information and behavioral intentions were examined in univariate General Linear Models. The results, presented in Table 4, revealed statistically significant fixed effects

for the media outlet, but not for the news report or the interactive terms. This shows that trust in the news report about yellow fever was associated with the media outlet, and not with the characteristics of the text.

In addition, corrections, updates, or grammatical errors (including major ones) did not affect the participants' confidence in the report. The effects of the media outlet were also observed on the intention to advise friends and family about the vaccination, including those who are over 60 years of age or who have children. No effect was observed concerning the intention to advise friends and family members who were pregnant or breastfeeding, or the participants' decision to get the vaccine.

Statistically significant effects were generally low or average. The media outlet's effect on whether the news was considered believable was high. This means that the results only support H5 and H10 (partially). However, the analysis does not support the idea that the news reports labeled as "corrected" (H1 and H6) or "updated" (H2 and H7) increased the credibility or the behavioral intentions of participants after reading. Versions with grammatical errors (H3 and H8), including major ones (H4 and H9), did not harm the credibility of the news or the behavioral intentions.

Table 4

Univariate General Linear Models (partial eta-squared)

Dependent variable	Constant	Media Outlet	Report	Media outlet*report	R^2 adjustment
Credibility of news	.951***	.025***	.002	.006[a]	.026
Advise friends and family	.937***	.005**	.001	.000	.002
Advise friends and family over 60	.895***	.002*	.002	.002	.001
Advise friends and family who are pregnant	.888***	.002	.001	.002	.001
Advise friends and family who have children	.936***	.005**	.001	.001	.001
Get the vaccine	.838***	.004	.007	.008	.007

Note: ***p<0,001; **p<0,01; *p<0,05; [a]p=0.054.

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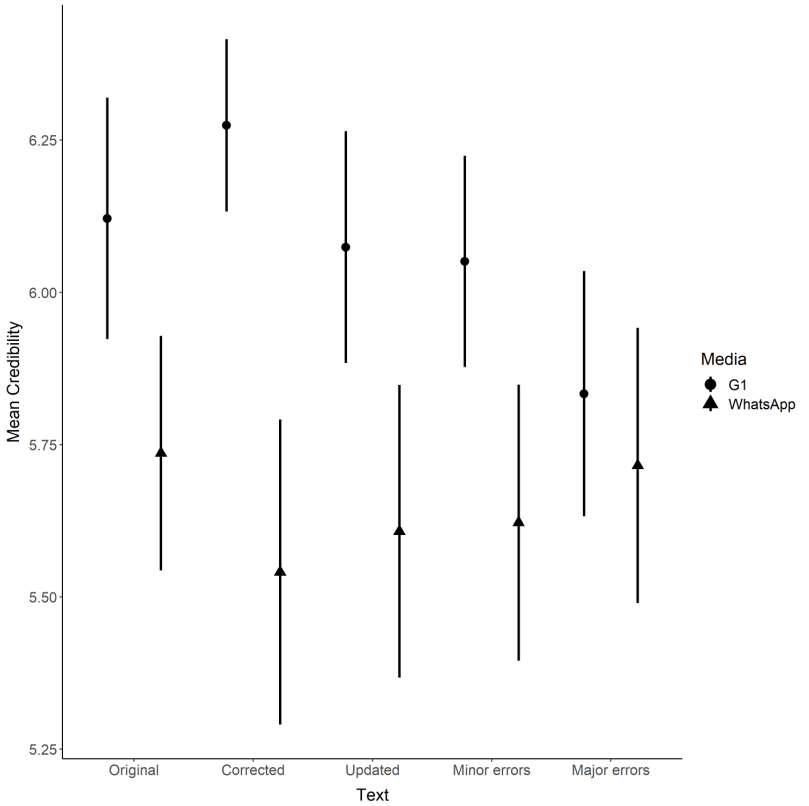
However, the data from the analysis on the credibility of the news required further examination. The interactive term "media outlet*report" recorded a partial eta-squared of 0.006 (average effect) and a p value=0.054, close to the conventional limit of 0.05. Graph 1 below shows the averages for news credibility in the ten experimental conditions. The results in the graph show the credibility of the five G1 versions of reports as higher than the same reports on WhatsApp. This advantage is sometimes significant, as in the case of the corrected version, where the average credibility for G1 (X=6.27) is 13% higher than the average credibility for WhatsApp (X=5.54). However, the difference is almost irrelevant in other cases, as with the version that includes major grammatical errors, where the average credibility for G1 (X=5.83) is only 2% higher than the average credibility for WhatsApp (X=5 .71). Considering only the G1 texts, however, the difference in credibility between the "corrected" version (X=6.27) and the one with major errors (X=5.83) is quite noticeable.

A *post hoc* analysis of variance (ANOVA) with the experimental conditions associated only with the G1 news portal showed a significant statistical difference between the credibility of the corrected version compared to the version with major errors, at the p=0.004 level. This was the only significant statistical difference, which suggests that including corrections in health reports does not undermine the credibility of its content. On the contrary, it can actually increase credibility compared to a report that has major grammatical errors. This finding, however, came from the effects observed among participants who had higher education (F(4.476) = [3.134], p = 0.015), and not from those with elementary or secondary education (F(4.342) = [1.213], p = 0.305). This pattern may indicate that the education level of individuals is a variable that mediates the effect of grammatical errors on the credibility of the news – but this conclusion would require further studies dealing more specifically with the interactive effects between education, grammatical errors, and news credibility.

Graph 1

Average news credibility in the ten experimental conditions



5 Discussion of results

The results of this experimental study suggest, understandably, that Brazilians attribute greater credibility to information from a recognized news portal, such as G1, than they do from an anonymous WhatsApp message. But the findings also show that the credibility of news on WhatsApp, such as the one investigated in this study, is not affected by corrections, updates, or grammatical errors, whether minor or major. Perhaps readers are less demanding in terms of the quality and accuracy of the content on WhatsApp as trust in this medium tends to be lower, a typical example of a "horn effect" (Rubin, 1982).

However, for a media outlet like G1, texts that contain major grammatical errors reduce the credibility of a news report, such as the "corrected" version in this study (even though this effect is small,

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at 7% (5.83/6.27). The use of the expression "corrected" does not reduce the credibility of news in G1 in relation to the control group, the "updated" version, or with minor grammatical errors. In this aspect, there seems to be no reason to advise against news portals such as G1 (which includes UOL, Terra, R7, Metrópoles and Congresso em Foco, and other major Brazilian news sites) from correcting their published content and labeling their texts "corrected". However, there may be other marketing reasons for why media outlets do not adopt these practices, such as corrected or updated reports appearing lower on search engine results pages such as Google.

The study design presented in this paper does have some limitations. The first limitation is that the analyzed text deals with a nearly consensual issue in Brazil, which is the importance of vaccination against yellow fever. We do not know, for example, whether the results would be the same if the text were on positional issues, like the ones we find in political or moral debates, or on rare or bizarre events such as the false information that circulated throughout Brazil in 2020 claiming that covid-19 vaccines had microchips in them[16]. Similarly, we do not know what the results would be for texts that try to correct misinformation (Wardle & Derakhshan, 2018). These are questions for future research.

The second limitation is that our analysis was restricted to the G1 portal and a screen print of a WhatsApp message with no authorship or source given. Other studies may focus on the effects that the characteristics we studied in this paper have on news from different portals, printed newspaper sites, radio, or television, as well as the effect of news from media outlets (such as G1) that circulate on social networks or instant messaging applications (like WhatsApp).

The third limitation is that the readers in our experiment knew that the text had been corrected or updated, but they did not know what that correction or update was. A test with versions that include errors with different levels of severity might be able to shed more light on how they influence the credibility of news and its effects on behavioral intentions.

A fourth limitation is the possibility of a pre-treatment effect (Druckman & Leeper, 2012, p. 875) since yellow fever vaccination had been a very important theme months before this study was carried out. Lastly, this work did not address the extent to which grammatical and typing errors, as well as corrections or updates, were perceived or how they were processed (Batterink & Neville, 2013, p. 8528).

6 Conclusion

This study provides some of the first results in Brazil on the influence that "corrected" and "updated" texts, or texts with minor or major grammatical errors, have on the credibility of the message and the behavioral intentions of its readers. Our findings show that news produced in digital formats is positive. One of these main results is that the credibility of the G1 report was not affected when labeled as "corrected" or "updated". There don't seem to be any negative effects on its credibility even when the text contains minor grammatical errors. However, the text with major grammatical errors seems to help the credibility of the news, but it may not affect the behavioral intention of its readers.

At the same time, the fact that WhatsApp was not significantly affected by any of these textual changes shows there is a strong correlation between message credibility and media outlet credibility. The messaging application's reputation seems to hurt the average credibility of the news it shares when compared to G1. This is not impacted by variables that are essential to journalism, such as accuracy and adherence to the cultural standards of the Portuguese language.

Despite the general limitations and reservations of this study, our findings suggest that if journalists make a mistake, they correct it and make sure that that correction is indicated in the text. This does not seem to undermine the credibility of the news, but rather increases it when compared to other inferior versions, such as those that contain major grammatical errors.

NOTES

1 NIC.br. (2020). *Pesquisa web sobre o uso da Internet no Brasil durante a pandemia do novo coronavírus*: *Painel TIC COVID-19*, ano 2020. Retrieved from: http://www.cgi.br/media/docs/publicacoes/2/20210426095323/painel_tic_covid19_livro_eletronico.pdf

2 UOL (Universo Online) is one of the largest news portals in Brazil.

3 This is the website for the Folha de S.Paulo newspaper, one of the largest periodicals in Brazil.

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4 Former São Paulo State senator, Romeu Tuma, passed away on October 26, 2010.

5 R7 is one of the largest news portals in Brazil.

6 Yellow fever is an acute febrile infectious disease transmitted by the *Aedes aegypti* mosquito that was eliminated from urban areas in Brazil in the 1940s after mass vaccination. Even still, the state of São Paulo (the largest Brazilian state) experienced an epidemic of the disease between 2016 and 2018 (Cunha et al., 2020). One of the factors associated with the resurgence of yellow fever was the recent spread of fake news about getting vaccinated against the disease, especially on social networks such as WhatsApp (Sacramento & Paiva, 2020, p. 81).

7 Retrieved from: http://g1.globo.com/principios-editoriais-do-grupo-globo.html#correcao

8 The Estado de S. Paulo newspaper is one of the largest periodicals in Brazil and a direct competitor to Folha de S.Paulo.

9 "Editors Group Releases Preliminary Journalism Credibility Study". Asne.org. December 15, 1998.

10 Retrieved from: http://www.alexa.com/topsites/countries/BR

11 Retrieved from: http://www.poder360.com.br/tecnologia/compare-os-apps-telegram-signal-e-whatsapp-e-saiba-qual-e-o-mais-seguro/

12 Netquest is a data collection and market research company that maintains a panel of respondents in Brazil with approximately 185 thousand registered individuals who participated in at least one survey in 2021.

13 Considered only the 1.710 individuals who responded correctly to the attention check, the questionnaires took participants an average of just over eight and a half minutes to answer (*M*=527 seconds; *DP*=374 seconds). The exclusion of respondents who took more than two standard deviations beyond the average eliminated questionnaires whose response time exceeded 21 minutes.

14 NIC.br. (2020). *Pesquisa sobre o uso das tecnologias de infor-*

mação e comunicação: Pesquisa TIC Domicílios, ano 2019. Retrieved from: https://cetic.br/pt/arquivos/domicilios/2019/individuos/

15 Original Ministry of Health report. Retrieved from: https://antigo.saude.gov.br/saude-de-a-z/acidentes-por-animais-peconhentos/920-saude-de-a-a-z/febre-amarela/10771-vacinacao-febre-amarela

16 In July 2020, the BBC and other Brazilian media outlets reported on the main rumors circulating about vaccination against covid-19. The list of rumors includes, in addition to the microchip, cells from aborted fetuses and claims from businessman Bill Gates. Retrieved from: www.bbc.com/portuguese/geral-53533697

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