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Increasing culturally relevant science media coverage: exploring the outcomes of a collaboration in Puerto Rico

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Mónica I. Feliú Mójer co-conceptualized the project, adapted the analysis protocol, validated results, prepared, reviewed and edited the manuscript, supervised and managed the project. Co-first author.

Andrea Isabel López conducted data analysis and curation, prepared data tables, validated results, prepared, reviewed and edited the manuscript, supervised and managed the project. Co-first author.

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Giovanna Guerrero-Medina co-conceptualized the project, provided project supervision, and helped review and edit the manuscript.

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Supplementary material

Available at https://doi.org/10.22323/2.23050802 CODE BOOK: Increasing culturally relevant science media coverage: exploring the outcomes of a collaboration in Puerto Rico

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Abstract

CienciaPR, a nonprofit that brings together the largest network of Puerto Rican scientists and one of the largest networks of Hispanic/Latine scientists in the world, has collaborated with El Nuevo Día (END), Puerto Rico's newspaper of record, to increase culturally relevant stories in their science section. This Practice Insight quantifies and compares the presence of culturally relevant elements (e.g., referring to Puerto Rico, local landmarks, historic figures, slang) and other content information (e.g., topics, location, focus, protagonist) in articles authored by CienciaPR members versus articles by END, news agencies, and other organizations. Results demonstrate that CienciaPR-authored articles published in END featured culturally relevant elements more often (e.g., mentioned Puerto Rico, used Puerto Rican slang, stories located in Puerto Rico) than those by other sources.

Keywords

Popularization of science and technology; Science and media

Introduction

Culture — the collection of languages, customs, beliefs, previous experiences, existing knowledge, and identities of an individual or a group — influences how people value, understand, and engage with science [Davies, Halpern, Horst, Kirby & Lewenstein, 2019; Medin & Bang, 2014]. Using culturally relevant or culturally responsive science communication, which is defined as connecting science to people's everyday lives, who they are, and what they care about by leveraging their cultural context, can enhance learning and make science more pertinent and valuable [Calabrese Barton & Tan, 2010; Baxter, 2021; Brown, 2017; Byrd, 2016; Gay, 2018; González-Espada et al., 2015; Guerrero-Medina et al., 2013; Tan & Calabrese Barton, 2018]. However, in many societies, science is seldom communicated in ways that are relevant to the culture and context of different publics, especially those who are minoritized [Canfield et al., 2020; Finlay et al., 2021]. For communities that have historically been and continue to be marginalized from the scientific enterprise, the lack of contextualization further excludes them from science [Calabrese Barton, Menezes, Mayas, Ambrogio & Ballard, 2018; Canfield et al., 2020; Finlay et al., 2021; Neeley et al., 2020].

A lack of contextualized and culturally relevant science information — in books, schools, museums, traditional mass media (e.g., newspapers, radio, TV), and other spaces — is common in Puerto Rico, the focus of this article, in minoritized communities in the United States (U.S.), and in the Global South [Guerrero-Medina et al., 2013; González-Espada et al., 2015; Massarani & Buys, 2007; Reidpath & Allotey, 2019]. Several factors may contribute to this. English is the de facto language of science in and outside of academia, which creates a gatekeeping effect and imposes certain cultural points of view over others [Márquez & Porras, 2020]. In Puerto Rico, this is exacerbated by its colonial relationship with the United States [Casillas-Martínez, Franco-Ortiz, Carrasquillo & González-Espada, 2024]. Although Spanish is the predominant language in Puerto Rico, many textbooks, media, and other sources of science information are originally in English. Even when science content is translated into Spanish, it frequently does not “culturally translate”, meaning it is not pertinent to the context and realities of local audiences.

Moreover, historically, there has been little science coverage in Puerto Rican mass media outlets. For example, out of ~20 newspapers in Puerto Rico, only El Nuevo Día (END), the newspaper of record (The City University of New York, n.d.), has a long-standing regular science section. Still, in 2006, less than 20% of the science stories published by END had Puerto Rico as its main location. More than 70% of the stories were sourced from news wires such as BBC or Associated Press, and none were written by scientific experts [Massarani & Buys, 2007]. Similar trends have been observed in parts of Africa and Asia, where science news is often sourced from Western media [Mamboleo, Chebutuk & Matu, 2023].

To address the lack of science content pertinent to Puerto Rico, in 2006, the nonprofit Ciencia Puerto Rico (CienciaPR, http://www.cienciapr.org), established a partnership with END, in which members of its network of more than 17,000 science, technology, engineering, and mathematics (STEM) experts (e.g., students, researchers, educators) publish culturally relevant science stories in the newspaper [Guerrero-Medina et al., 2013]. The collaboration with the newspaper generally works as follows: articles written by CienciaPR members that highlight science performed in Puerto Rico or by Puerto Rican scientists or that contextualize universal science concepts to Puerto Rican realities are curated and edited by expert science communicators within our network before being sent to END [Guerrero-Medina et al., 2013]. CienciaPR editors (e.g., manuscript authors Feliú Mójer and González-Espada) provide feedback to the authors to ensure the articles written are culturally relevant and accessible (e.g., use little jargon) and are scientifically accurate. Manuscript author Feliú Mójer liaises with END’s editors, sending them the finished articles and tracking their publication in the newspaper. Articles are then shared with the authors, uploaded on the CienciaPR website, and publicized in the organization’s social media channels.

Objective

This analysis sought to characterize the science content contributed by CienciaPR members to Puerto Rico’s newspaper of record, and investigate whether articles written by STEM experts from or working in Puerto Rico had higher culturally relevant elements than

other science content published in END's science section. This Practice Insight discusses lessons learned from the partnership with the newspaper, and the implications for science communication in Puerto Rico and in non-English languages.

Methods

The main goal of the analysis was to quantify elements that made articles culturally relevant to Puerto Rico and compare their presence in articles authored by members of CienciaPR vs others, to better understand the impact of CienciaPR's collaboration with END on the number of culturally relevant articles published by the newspaper. An existing protocol that has been previously used to investigate journalistic coverage of science and technology in Latin American newspapers, including END, was modified [Massarani & Buys, 2007; Ramalho, Polino & Massarani, 2012]. Out of 12 content categories included in Massarani and Buys [2007] five were selected and modified to use for the analysis (topic of the article, focus, protagonist, type of author, and location). These are each described in further detail below. These five categories were combined with a sixth (cultural relevance, described below) from Llerandi-Román, Colón-Ramos, Feliú-Mójer and González-Espada [2013] to constitute the analysis protocol. The six total categories were selected because they allowed an exploration of cultural relevance to Puerto Rico, and the overall content of the articles in the sample.

A total of 159 articles that were published in END's science section between 2012 and 2016 were randomly selected for the analysis. Eighty articles were authored by CienciaPR members and 79 by authors who were not affiliated with CienciaPR (referred to as non-CienciaPR from here on), including END reporters, newswires (e.g., Associated Press, BBC), and freelance contributors. Analyzed articles were an average of 616 words in length. Articles published between 2012 and 2016 were chosen because during that time CienciaPR was publishing at least one article per month in END's science section, with a total of 119 articles published by CienciaPR authors during that period. Between 2012 and 2016, the number of articles published by END's science section ranged from daily, to most days a week, to a few days a week, likely due to editorial and business decisions made by the newspaper. These factors and the availability of CienciaPR's volunteer writers to contribute articles also influenced the number of articles published by CienciaPR per year through the partnership. Table 1 summarizes basic information regarding the articles analyzed here.

Each article was assigned a number, and articles were anonymized by removing the name of the author and any references that could reveal the source. We recruited 10 volunteers through CienciaPR's network to serve as coders. They were all Puerto Rican scientists, familiar with Puerto Rican culture and context, had native Spanish fluency and an interest in science communication.

Each coder read and categorized approximately 30 articles. Coders were each sent their assigned anonymized articles and a spreadsheet with the categories placed into columns. Coders received instructions about how to perform article categorization via email. Definitions for each category and examples were embedded in the rubric for quick reference. Coders marked whether or not each category or element was present in the article. They did

not quantify how many times a specific element appeared in each article. Each article was independently categorized by two people. Results for each item were compared to identify any discrepancies. If any differences were identified, manuscript author López. reviewed the articles to determine which categorization reflected protocol definitions more accurately. For example, in the location section the categories for 'multiple nations' and 'other country or region' were sometimes confused when the author's nationality or publishing location differed from the location focus of the study (i.e., the article focused on one country, but the researcher was based in another). Tables with counts for each category were generated.

Author affiliation

Authors López and Feliú Mójer identified the author's affiliation as CienciaPR or non-CienciaPR. They also identified whether the authors were STEM experts, reporters, freelancers, a news wire, or from another organization.

Cultural relevance

This category included eight criteria identified through an inductive analysis to discover themes that signaled cultural relevance in the book *¡Ciencia Boricua!* [Llerandi-Román et al., 2013], a book about Puerto Rican science and scientists [González-Espada, Colón-Ramos & Feliú-Mójer, 2011]. These criteria were used to identify the presence of Puerto Rico-specific culturally relevant elements in the articles. The criteria were: if the article mentioned (1) Puerto Rico or a specific place in Puerto Rico, (2) a Puerto Rican institution, (3) local landmarks, (4) a Puerto Rican person (e.g., someone who is from Puerto Rico, such as a cultural figure like an athlete or singer), (5) colloquial vocabulary or Puerto Rican slang, (6) references to Puerto Rican culture, (7) popular Puerto Rican phrases or sayings, and (8) Puerto Rican scientific or historical figures (e.g., deceased notable or historical individuals, such as Agustín Stahl or Ana Roqué de Duprey, both famous botanists who lived in the 19th and early 20th centuries). For each article, coders indicated the types of culturally relevant criteria present. Each type of criterion could only be counted once, meaning that any one article could have a maximum of 8 culturally relevant criteria present. Coders did not quantify how many times a specific criterion appeared in an article.

Location

Location refers to the general geographic region highlighted in the article. Six locations were included in the analysis: (1) Puerto Rico, (2) the United States (U.S.), (3) Latin America or the Caribbean (excluding Puerto Rico), (4) another country or region (i.e., not Puerto Rico, the U.S., Latin America or the Caribbean), (5) multiple nations (more than one location was present), and (6) no location identified. Location is different from culturally relevant criteria 1 (Puerto Rico or a specific place in Puerto Rico) and 3 (local landmarks) in that the latter are geographically and contextually specific to Puerto Rico. Coders could mark a maximum of two locations.

Topic

Articles were classified by topic areas, based on the categories currently used by CienciaPR's website (http://www.cienciapr.org) for consistency and ease of comparison.

These were: biological or health sciences, agricultural or environmental sciences, earth or atmospheric sciences, science and society, physical or chemical sciences, engineering, math, or computer science, social sciences, and other topics. Coders were asked to select a primary topic, and if present, a secondary topic for each article.

Focus

Focus refers to the central idea of the article. A maximum of three foci could be selected per article. Our analysis included 11 foci [described in Massarani & Buys, 2007; Ramalho et al., 2012]:

- New scientific research: discusses the results of a new investigation.
- Scientific background: describes the history or background of a scientific concept or topic.
- New technology or scientific method: presents a new scientific technique or method, such as a new test or new instrument.
- Scientific event: discusses prominent scientific events, such as a total eclipse, or the launch of a shuttle into space.
- Benefits: explicitly describes the benefits of science.
- Scientific controversy: directly alludes to or discusses a scientific controversy.
- Scientist: focused mainly on an individual as a protagonist.
- Risks: focused explicitly on the risks of science.
- Economic impact: discusses the economic impact of science in general or of a specific scientific topic.
- Public policy: presents the public policy implications of science and technology for a country or region.
- Ethics: discusses the moral or ethical implications of a scientific topic or issue.

Protagonist

Protagonist refers to general type of main actor or central figure of an article (i.e., the protagonists). Coders could indicate if the protagonist was a researcher, an academic or research institution, a government organization, a scientific society or organization, industry, a nonprofit organization, or if there was no protagonist [Massarani & Buys, 2007; Ramalho et al., 2012]. A maximum of two protagonists could be selected per article.

Results

CienciaPR articles had substantially more culturally relevant elements

Almost every article authored by CienciaPR members contained at least one type of culturally relevant element (74 out of 80). Out of 80 CienciaPR articles, 71 had two or more types of culturally relevant elements present. In contrast, only 14 out of 79 articles from non-CienciaPR sources had at least one type of culturally relevant element present and

only seven had two or more. One CienciaPR article had as many as eight culturally relevant elements present. Table 2 summarizes the number of culturally relevant elements per article. Table 3 summarizes the types of culturally relevant elements present in the sample.

Across all articles, the most common element of cultural relevance is the mention of Puerto Rico in general, or a place in Puerto Rico. Out of 80 CienciaPR-authored articles, 71 mention Puerto Rico or a place there, compared to 8 out of 79 non-CienciaPR articles. It is important to note that all non-CienciaPR articles that mention Puerto Rico were written by END journalists or someone from a local Puerto Rican organization. Other common culturally relevant elements in CienciaPR-authored articles were mentioning a Puerto Rican institution (46 articles), mentioning local landmarks (43 articles), mentioning a Puerto Rican person (43 articles), using colloquial vocabulary or slang (38 articles), referring to Puerto Rican culture (31 articles), and using popular phrases and sayings (25 articles). The least common element was mentioning a Puerto Rican scientific or historical figure.

Below we share excerpts (in Spanish with English translations by the first co-authors) from two CienciaPR articles included in our sample. The excerpts were chosen to provide concrete examples of the culturally relevant elements in CienciaPR-authored articles. The first is from an article that contextualizes discoveries made in Australia and elsewhere about weight loss and dieting to Puerto Rican culture by connecting the end of the Christmas holiday season — when people tend to indulge in sweets and other high calorie foods — to New Year's weight loss resolutions that are often hard to keep.

> "Para nosotros los puertorriqueños significa la culminación de fiestas navideñas que hemos disfrutado entre familia y amigos. Pasteles, lechón asado, arroz con gandules, coquito, arroz con dulce, pitorro, entre otros placeres gastronómicos, estaban en el menú de cada una de estas fiestas. Con ello, aparece en nuestra lista de resoluciones de año nuevo rebajar aquellas libritas que bien pudieron aparecer con estas festividades."
>
> [Rosado Olivieri, 2014]

> "For us Puerto Ricans, it means the culmination of Christmas celebrations enjoyed with family and friends. Pasteles, roasted suckling pig, rice with pigeon peas, coquito, sweet rice pudding, pitorro, among other gastronomic pleasures, were on the menu of each of these parties. Thus, the list of New Year's resolutions suddenly includes losing those extra pounds we might have gained during the festivities."[1]

The author connected traditional Puerto Rican Christmas holiday foods with the main idea of the article by using colloquial vocabulary or Puerto Rican slang and making references to Puerto Rican culture. Although the research highlighted in the article was not done in Puerto Rico, connecting the findings to elements of high cultural significance was an effective way to convey factors that contribute to weight gain and loss.

The second example is an article about the contributions of Puerto Rican and Puerto Rico-based researchers to the 1000 Genomes Project, which seeks to diversify human

[1]Translated by the co-first authors.

genome databases. The article described how researchers considered Puerto Rico's racial and colonial history when collecting samples across the archipelago.

> "Para los investigadores era importante obtener una muestra representativa de la población boricua, 'puesto que la población de Puerto Rico no es homogénea', dijo el Dr. Taras Oleksyk. Dada nuestra compleja historia de mestizaje e inmigración, 'la ascendencia de la gente de Yauco es diferente a la de la gente de Loíza o la gente de Caguas', añadió Oleksyk. Para lograr esta meta el equipo de científicos realizó una campaña de reclutamiento de participantes voluntarios en las que fueron puerta por puerta, anunciaron el proyecto en plazas públicas, iglesias y a través de la radio."
>
> [Feliú-Mójer, 2014]

> "For the researchers, it was important to obtain a representative sample of the Puerto Rican population, 'since the population of Puerto Rico is not homogeneous', said Dr. Taras Oleksyk. Given our complex history of admixture and immigration, 'the ancestry of the people of Yauco is different from that of the people of Loíza or the people of Caguas', added Oleksyk. To achieve this goal, the team of scientists carried out a campaign to recruit volunteer participants in which they went door to door, announcing the project in public squares, churches and through the radio."[2]

By mentioning Puerto Rico and specific municipalities with different geographic locations and demographics (e.g., Loíza has a large Afro-descendent population) the article made a complex topic more approachable. The article also acknowledged Puerto Rico's history of slavery and colonialism, thereby connecting it to Puerto Rican reality.

CienciaPR articles took place in Puerto Rico more often

More than two-thirds (69%) of CienciaPR-authored articles (55 of 80) were located in Puerto Rico. Meanwhile, non-CienciaPR articles were predominantly located outside of Puerto Rico, with only three having Puerto Rico as their main location. Table 4 provides further details.

Most articles were about biological or health sciences

Nearly half of the 159 articles included in this analysis have biological or health sciences as their primary topic (71 or 45% of all articles). The number is higher in articles published by CienciaPR members, with 43 out of 80 articles, or 53% being primarily about biological or health sciences. Agricultural and environmental sciences, and science and society were the second and third most common primary topics for CienciaPR-authored articles, respectively. Compared with non-CienciaPR-authored articles, CienciaPR-authored articles have fewer articles about earth and atmospheric sciences, physical or chemical sciences, and social sciences. See Table 5 for details.

[2]Translated by the co-first authors.

Twenty percent of all the articles, 32 out of 159, had a secondary topic. The most common secondary topics were agricultural or environmental sciences, and science and society, with seven articles each (data table not shown).

Most articles highlighted new research

New scientific research was the most common focus amongst all the articles analyzed (38 CienciaPR, 39 non-CienciaPR). Articles that explained scientific concepts (i.e., scientific background) and discussed new technologies or methods were the second and third most common foci, respectively, in both CienciaPR and non-CienciaPR groups. Public policy and ethics were least common in our sample. Fifty-seven percent of the 159 articles, or 91, had only one focus; 48 articles (30%) had two foci, and 20 articles (13%) had three foci. Table 6 summarizes the main findings of this section.

Researcher was the most common article protagonist

Researcher was the most common protagonist of all articles in the sample. Forty-eight out of 80 CienciaPR articles (60%) and 53 out of 79 non-CienciaPR articles (67%) had researcher as their main character. Academic or research institution and government organization were the second and third most common protagonists, respectively, for both CienciaPR and non-CienciaPR articles. The least common protagonist was non-profit organization. Thirty-five articles had two protagonists, 118 had one protagonist, and six had no identifiable protagonist. All six of these articles were authored by CienciaPR members and focused on describing common birds in Puerto Rico. Table 7 summarizes these findings.

CienciaPR articles were all authored by scientific experts

All 80 CienciaPR articles in END published during the period analyzed in this manuscript were authored by 24 STEM professionals or trainees e.g., undergraduate or graduate students, or postdoctoral fellows (data not shown). These scientific experts worked in or studied biological or health sciences (18), physical or chemical sciences (3), agricultural or environmental sciences (2), engineering, math or computer sciences (1) (data not shown). Ten were faculty at the time their articles were published, 10 were undergraduate or graduate students, and four worked in another STEM profession. In comparison, 78 non-CienciaPR articles were authored by reporters, news wires, or freelancers. Only one non-CienciaPR article was written by a STEM expert (see Table 1).

Discussion

Culturally relevant or culturally responsive science communication makes science more pertinent and valuable for an audience by connecting it to their everyday lives, who they are, and what they care about [Baxter, 2021; Gay, 2018; Manzini, 2003; Medin & Bang, 2014; Mensah, 2021; UO SOJC, 2022]. Making science culturally relevant to Puerto Rican and other Spanish-speaking audiences has always been at the core of CienciaPR's work. Since 2006, one of the organization's key activities has been to increase and diversify science media coverage in Puerto Rico.

The goal of the analysis presented in this Practice Insight was to quantify CienciaPR's contributions to increasing the number of culturally relevant articles published by the newspaper of record in Puerto Rico, END. Our results show that CienciaPR contributions featured many more culturally and locally relevant references (e.g., mentioned Puerto Rico, used Puerto Rican slang, stories located in Puerto Rico) than non-CienciaPR articles. Furthermore, CienciaPR's articles more often focused on Puerto Rico and had the archipelago as their main location. These findings confirm previous anecdotal evidence that CienciaPR's contributions have boosted END's culturally relevant science content.

Nearly half of the articles in the analyzed sample were about biological or health sciences, with those authored by CienciaPR members at a slightly higher percentage. This observation is consistent with science news coverage trends in other countries, where health and medicine topics are dominant [Bauer, Howard, Romo Ramos, Massarani & Amorim, 2013; Bucchi & Mazzolini, 2003; Cacciatore et al., 2012; Maillot, 2023; Pellechia, 1997; Weitkamp, 2003]. This also reflects the composition of CienciaPR's membership (where article authors are recruited from), where at least 40% of registered members on cienciapr.org are in biological and health sciences, and the expertise of the majority of authors of CienciaPR articles in the sample. Researchers and academic or research institutions were the most common protagonists in our sample, for both CienciaPR and non-CienciaPR authored articles. This may be due to the fact that articles mostly highlighted new research which is done by researchers at academic institutions.

Although this study was not designed to be a comprehensive analysis of science content in Puerto Rican newspapers, the findings about focus, protagonist, and topics could be due to a number of factors. For example, our study only analyzed articles published in the science section of the newspaper. It may be possible that science articles featuring public health or ethics foci tend to be published in other areas of the newspaper. That said, knowing if there are disparities in the types of foci or scientific topics covered in the media, could be helpful for authors and editors to make sure that they seek out and provide more diversified content. This could be an area for further research. Another limitation of our analysis is that the sample sizes do not permit deeper investigations about how the characteristics of the CienciaPR authors (e.g., career stage, discipline of expertise, etc.) might affect the types of cultural relevance elements used, or how frequently they were used across or within articles. Future studies might want to tackle these questions.

CienciaPR's contributions to increasing culturally relevant science stories in a Puerto Rican newspaper are valuable for several reasons. The publication of articles that highlight science work done by Puerto Ricans or in Puerto Rico can help counter colonial narratives that invisibilize and devalue the contributions of Puerto Ricans in science (e.g., the idea that scientific knowledge produced in the U.S. is superior). Showcasing Puerto Rican science and, more broadly, making it relevant to the culture, identities, and realities of Puerto Rican publics can make science more approachable and allow Puerto Ricans to see themselves and appreciate the value of their contributions to the scientific enterprise.

CienciaPR's partnership with END has continued to be prolific beyond the period analyzed here. Since 2006, and as of March 2024, CienciaPR has published a total of 348 articles in

END's science section, including the 80 in this sample. In addition to the science section, CienciaPR collaborates with END's opinion section in a similar fashion, where members of the network contribute op-eds on timely science-related subjects. For example, since the beginning of the COVID-19 pandemic in March 2020 until March 2024, CienciaPR members have published 95 op-eds in END. Because of its long-standing relationship with the paper, CienciaPR has been uniquely positioned to facilitate the publication of columns by Spanish-speaking science and public health experts who could contextualize the public health emergency in timely, accurate, and pertinent ways.

CienciaPR's successful collaboration with El Nuevo Día has spurred additional initiatives and partnerships with other media outlets. Articles published by CienciaPR members in END became part of a book of essays and stories about science and Puerto Rico [González-Espada et al., 2011], which in turn led to science education collaborations with educators and schools [González-Espada et al., 2015]. In recent years, END has focused its Sunday science section (both online and print) almost exclusively on local stories, several of them written, suggested by, or about experts who are members of the CienciaPR network. Sunday is the day with the highest circulation for END, and the only time during the week the science section appears in print (the section publishes several stories a week, but only online). The editor of END's science section has shared in conversations with manuscript author Feliú Mójer that this focus on locally relevant stories has been in part inspired by the collaboration with CienciaPR.

Throughout the years, CienciaPR has established partnerships with other written media outlets in Puerto Rico, the United States, and Spain. For several years a couple of volunteers developed two podcasts: Radiocápsulas CienciaPR (short 2-minute clips explaining and contextualizing a research discovery, created by manuscript author González-Espada) and Mirada Científica (a long-format interview podcast created by Enrique Vargas). Episodes of both podcasts were broadcasted by radio stations like Casa Pueblo (a regional community-based station) and WIPR (Puerto Rico's public broadcaster) at various periods of time. Altogether, CienciaPR has collaborated with more than a dozen media outlets. The organization leveraged many of these collaborations and media connections during the COVID-19 pandemic to help facilitate more than 100 interviews of Puerto Rican science and public health experts with local, national, and international media outlets. Since December 2020, CienciaPR has hosted "Jueves de Ciencia Boricua" (Puerto Rican Science Thursdays), a weekly segment in "¡Qué es la que hay!" (which loosely translates to "What's up!"), a daily, prime time talk show hosted by political analyst Luis Herrero, broadcasted by national AM station Radio Isla. The segment is produced and co-hosted by manuscript author Feliú Mójer and features short interviews with Puerto Rican scientists and conversations about science news from a local perspective.

CienciaPR's collaboration with END (and other media outlets) have provided different benefits to its contributing STEM experts. Over the years, many have said writing articles was an opportunity to combine their expertise with their cultural knowledge and assets to convey science to their own community. Out of 24 CienciaPR authors, 10 were trainees (students or postdocs) when they published articles. Several of these early career collaborators mentioned that writing the articles, receiving feedback from CienciaPR

editors, and getting published in END provided a valuable professional development experience that allowed them to improve their science communication skills, explore science communication as a career, and give back to their community. The lessons learned from this aspect of CienciaPR's collaboration with END have led to several efforts to provide scientists with culturally relevant science communication skills and practice, including dozens of virtual and in-person workshops, panels, and seminars at academic institutions and professional conferences and embedding such trainings into professional development programs [Feliú-Mójer, 2022].

Scientists play an increasing and valuable role in sharing science publicly through different communication practices [Barel-Ben David, Garty & Baram-Tsabari, 2020; Dudo, 2015]. Beyond contributing to the publication of more culturally relevant science articles in END, having Puerto Rican or Puerto Rico-based STEM experts contributing to the newspaper showcases them as role models for the newspaper's readership. This could have the added benefit of helping challenge assumptions about who belongs in STEM fields, improving the representation of historically marginalized role models, and make science content more relevant to the culture and idiosyncrasies of communities traditionally overlooked by science communication.

Collaborations like CienciaPR's with END can be relatively easy to establish [Guerrero-Medina et al., 2013]. Such partnerships provide scientists with opportunities to develop science communication skills, to fulfill altruistic motivations such as giving back to their communities of origin, and to collaborate with journalists [Guenther & Joubert, 2021; Maillot, 2023; Martín-Sempere, Garzón-García & Rey-Rocha, 2008]. As shown here, collaborating with scientists and science organizations like CienciaPR can benefit media outlets by providing science expertise and content that is culturally relevant to their audiences. All CienciaPR articles analyzed for this manuscript were authored by scientific experts. A previous analysis had found that, before CienciaPR's collaboration with the newspaper began in 2006, none of the articles published by END's science section were written by individuals with subject matter expertise [Massarani & Buys, 2007]. Additionally, collaborations between scientists and the media can help shape editorial decisions and contribute to the publication of more science news, or as noted above, more culturally relevant science news [Barel-Ben David et al., 2020]. The work of CienciaPR is an example of how organizations that bring together scientists, such as professional and academic societies and associations, research institutions, and others can leverage or establish scientist-media partnerships to communicate science to different publics, particularly to center the voices of marginalized groups and reach overlooked populations. Moreover, CienciaPR's partnership with END can serve as a replicable model to increase science communication in Spanish and non-English languages.

Conclusion

This analysis shows that contributions by CienciaPR members to END's science section featured Puerto Rican culturally relevant elements more often than those bylined by END, news agencies, and other organizations. Furthermore, articles authored by CienciaPR were all written by scientific experts and were more often located in Puerto Rico.

CienciaPR's partnership with END has made science content more relevant for Puerto Rican audiences, celebrated the scientific contributions of Puerto Rican people and institutions, and highlighted Puerto Rican scientific role models and Puerto Rico as a place where news-worthy science is performed. This emphasis on visibilizing *ciencia boricua*, Puerto Rican science, may help counter misconceptions and stereotypes about who becomes a scientist and correct colonial legacies and mindsets that devalue the contributions of Puerto Ricans in science.

This study represents the first analysis of culturally relevant science content in mainstream Puerto Rican media. Our results provide an important baseline for understanding the science communication landscape in Puerto Rico. They serve as an example of the value of scientists-media partnerships for increasing culturally relevant science communication.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1.

Articles analyzed, by year of publication, author affiliation (CienciaPR or non-CienciaPR).

Year	*Non-CienciaPR*			*CienciaPR*
	News wires	**END**	**Other**	
2012	3	12	0	15
2013	2	11	0	12
2014	3	17	0	20
2015	0	22	1	25
2016	1	7	0	8
Subtotal	9	69	1	80
Total	79			80

Table 2.

Number of culturally relevant criteria per article, by source (CienciaPR, non-CienciaPR). Percentages based on the total articles per source.

Culturally relevant criteria	Non-CienciaPR (79 articles)		CienciaPR (80 articles)	
0	65	82%	6	8%
1	7	8%	3	4%
2	1	1%	11	14%
3	1	1%	13	16%
4	4	5%	17	21%
5	1	1%	13	16%
6	0	0%	10	13%
7	0	0%	6	8%
8	0	0%	1	1%

Table 3.

Types of culturally relevant elements present in articles, by source (CienciaPR, non-CienciaPR). Each article could have more than one type of criteria, thus numbers are not additive. Percentages based on the total articles per source.

Culturally relevant elements	Non-CienciaPR (79 articles)		CienciaPR (80 articles)	
Mentions PR or a place in PR	8	(10%)	71	(89%)
Mentions a Puerto Rican institution	5	(6%)	46	(57%)
Mentions landmarks in Puerto Rico	3	(4%)	43	(54%)
Mentions a Puerto Rican person	2	(3%)	43	(54%)
Colloquial vocabulary or Puerto Rican slang	6	(8%)	38	(47%)
References Puerto Rican culture	3	(4%)	31	(39%)
Uses popular Puerto Rican phrases or sayings	3	(4%)	25	(31%)
Mentions Puerto Rican scientific or historical figures	3	(4%)	10	(13%)

Table 4.

Main location of the articles. Each article could have more than one location, thus numbers are not additive. Percentages calculated on the total articles per source.

Main location of the article	Non-CienciaPR (79 articles)		CienciaPR (80 articles)	
Puerto Rico (PR)	3	(4%)	55	(69%)
United States (US)	19	(24%)	11	(14%)
Multiple nations	24	(30%)	5	(6%)
Other country or region	22	(28%)	0	(0%)
Not identified	7	(9%)	7	(9%)
Latin America or the Caribbean (excluding PR)	4	(5%)	2	(3%)
Location outside of Puerto Rico (excluding PR, US, Latin America, and Caribbean)	76	(96%)	26	(33%)

Table 5.

Articles grouped by primary topic and source. Percentages calculated on the total articles per source.

Primary topic	Non-CienciaPR (79 articles)		CienciaPR (80 articles)	
Biological or health sciences	28	(35%)	43	(53%)
Agricultural or environmental sciences	9	(11%)	17	(21%)
Earth or atmospheric sciences	19	(24%)	5	(6%)
Science and society	6	(8%)	6	(8%)
Physical or chemical sciences	8	(10%)	3	(4%)
Engineering, math, or computer science	4	(5%)	5	(6%)
Social sciences	3	(4%)	0	(0%)
Other topic	2	(3%)	1	(1%)

Table 6.

Articles grouped by focus and source. Each article could have more than one foci, thus numbers are not additive. Percentages calculated on the total articles per source.

Focus	Non-CienciaPR (79 articles)		CienciaPR (80 articles)	
New scientific research	39	(49%)	38	(47%)
Scientific background	16	(20%)	26	(33%)
New technology or scientific method	14	(18%)	11	(14%)
Scientific event	15	(19%)	7	(9%)
Benefits	8	(10%)	11	(14%)
Scientific controversy	9	(11%)	8	(10%)
Scientist	9	(11%)	7	(9%)
Risk	5	(6%)	5	(6%)
Economic impact	5	(6%)	4	(5%)
Public policy	4	(5%)	3	(4%)
Ethics	1	(1%)	2	(3%)

Table 7.

Articles grouped by protagonist and source. Each article could have more than one protagonist, thus numbers are not additive. Percentages calculated on the total articles per source.

Main protagonist	Non-CienciaPR (79 articles)		CienciaPR (80 articles)	
Researcher	53	(67%)	48	(60%)
Academic or research institution	17	(21%)	16	(20%)
Government organization	13	(16%)	12	(15%)
Scientific society or organization	7	(9%)	3	(4%)
Industry	7	(9%)	3	(4%)
Nonprofit organization	5	(6%)	4	(5%)
No protagonist	0	(0%)	6	(8%)