A social media strategy to improve engagement in and equitable dissemination of online cancer nutrition information

Ellie Harrison, Sara Buzali-Soto, Eileen Rillamas-Sun, Heather Greenlee, Echo L Warner

Submitted to: JMIR Cancer
on: December 10, 2024

Table of Contents

A social media strategy to improve engagement in and equitable dissemination of online cancer nutrition information

Ellie Harrison[1] MPH; Sara Buzali-Soto[2] PhD, MA; Eileen Rillamas-Sun[2] MPH, PhD; Heather Greenlee[2] ND, PhD; Echo L Warner[3] MPH, PhD

[1]University of Washington Seattle US
[2]Fred Hutch Cancer Center Seattle US

Corresponding Author:
Echo L Warner MPH, PhD

Abstract

Background: Factors influencing engagement with cancer nutrition content on social media are poorly understood, despite the high prevalence of social media use for cancer information.

Objective: We explored social media and linguistic characteristics associated with user engagement on a Facebook page used to disseminate evidence-based cancer nutrition information.

Methods: This cross-sectional study analyzed N=306 cancer nutrition Facebook posts from the Fred Hutchinson Cancer Center's bilingual (English/Spanish) Cook for Your Life (CFYL) website over 12 months (9 months before (T1) and 3 months after (T2) the bilingual content strategy implementation). User demographics and engagement metrics were extracted from Meta Business Suite. Manual coding assessed posts for branding, infographics, and visual content. Linguistic Inquiry Word Count (LIWC) analyzed valence and other linguistic dimensions. Statistical analyses compared variables, revealing social media and linguistic characteristics influencing engagement (e.g., number of likes, comments, shares).

Results: Users who engaged with CFYL Facebook content were mostly female (93.2%), aged 55-64 years (26.6%), in the United States (71.4%), and English language users (93.4%). Engagement increased from T1 (mean number of engagements=5.3 (SD)=4.2) to T2 (mean=17.7 SD (37.9), $p<0.01$). There was a shift towards less complex sentence structures, increased analytical language, and a decline in emotionally charged and cognitive language in posts during T2. Posts that used bilingual content had 1.72 higher odds of audience engagement compared to English-only posts (CI: 1.05-2.80).

Conclusions: Using bilingual and visual content may promote engagement with cancer nutrition messages on Facebook. We describe how a dedicated social media strategy increases engagement.

(JMIR Preprints 10/12/2024:69886)
DOI: https://doi.org/10.2196/preprints.69886

Preprint Settings

1) Would you like to publish your submitted manuscript as preprint?

✓ **Please make my preprint PDF available to anyone at any time (recommended).**
Please make my preprint PDF available only to logged-in users; I understand that my title and abstract will remain visible to all users.
Only make the preprint title and abstract visible.
No, I do not wish to publish my submitted manuscript as a preprint.

2) If accepted for publication in a JMIR journal, would you like the PDF to be visible to the public?

✓ **Yes, please make my accepted manuscript PDF available to anyone at any time (Recommended).**
Yes, but please make my accepted manuscript PDF available only to logged-in users; I understand that the title and abstract will remain v
Yes, but only make the title and abstract visible (see Important note, above). I understand that if I later pay to participate in <a href="http

Original Manuscript

A social media strategy to improve engagement in and equitable dissemination of online cancer nutrition information

Ellie Harrison [1,2] Sara Buzali-Soto, PhD, MA [1] Eileen Rillamas-Sun, PhD, MPH [1] Heather Greenlee, ND, PhD [1,2,3] Echo L. Warner, PhD, MPH [4,5]

1 Fred Hutchinson Cancer Center, Public Health Sciences, Cancer Prevention Program

2 University of Washington, School of Public Health, Department of Epidemiology

3 University of Washington, School of Medicine, Division of Hematology/Oncology

4 University of Utah, College of Nursing, Division of Acute and Chronic Care

5 Huntsman Cancer Institute, Cancer Control and Population Sciences

Corresponding Author:

Echo L. Warner, PhD, MPH

College of Nursing University of Utah

10 South 2000 East, Salt Lake City, UT 84112-5880

Phone: 801.244.7040 | Email: echo.warner@nurs.utah.edu

Word count: 2914/3000 words | Table/Figures: 4/8

Running title: Engaging in cancer nutrition education online

Précis: Using bilingual and visual content may promote engagement with cancer nutrition messages on Facebook. Learn how a dedicated social media strategy increases engagement.

Acknowledgements: Dr. Warner was supported, in part, by the National Cancer Institute under award T32CA078447.

Conflicts of Interest: Dr. Warner receives grant funding through Merck to study HPV vaccination for cancer prevention and online social media discourse about HPV vaccination by geography.

Abstract

Background: Factors influencing engagement with cancer nutrition content on social media are poorly understood, despite the high prevalence of social media use for cancer information. We explored social media and linguistic characteristics associated with user engagement on a Facebook page used to disseminate evidence-based cancer nutrition information.

Methods: This cross-sectional study analyzed N=306 cancer nutrition Facebook posts from the Fred Hutchinson Cancer Center's bilingual (English/Spanish) Cook for Your Life (CFYL) website over 12 months (9 months before (T1) and 3 months after (T2) the bilingual content strategy implementation). User demographics and engagement metrics were extracted from Meta Business Suite. Manual coding assessed posts for branding, infographics, and visual content. Linguistic Inquiry Word Count (LIWC) analyzed valence and other linguistic dimensions. Statistical analyses compared variables, revealing social media and linguistic characteristics influencing engagement (e.g., number of likes, comments, shares).

Results: Users who engaged with CFYL Facebook content were mostly female (93.2%), aged 55-64 years (26.6%), in the United States (71.4%), and English language users (93.4%). Engagement increased from T1 (mean number of engagements=5.3 (SD)=4.2) to T2 (mean=17.7 SD (37.9), $p<0.01$). There was a shift towards less complex sentence structures, increased analytical language, and a decline in emotionally charged and cognitive language in posts during T2. Posts that used bilingual content had 1.72 higher odds of audience engagement compared to English-only posts (CI: 1.05-2.80).

Conclusions: Using bilingual and visual content may promote engagement with cancer nutrition messages on Facebook. We describe how a dedicated social media strategy increases engagement.

Keywords: Facebook, content analysis, social media, engagement, cancer prevention, nutrition education, bilingual

Introduction

The pervasive use of the internet, driven by the emergence of social media platforms, has revolutionized communication patterns, particularly within health-related contexts.[1] Social media, ranking as the third most frequent online activity, has become an integral part of human interaction, facilitating the exchange of ideas, information sharing, and the creation of online communities.[2,3] With the increasing prevalence of personal wireless devices, the popularity of social media applications continues to grow worldwide.[4–6] This observation has prompted health communication experts to explore innovative opportunities for using social media to enhance population health.[7–12]

Social media platforms are powerful tools for health communication interventions and offer opportunities to improve outreach and impact.[13–15] Notably, cancer organizations have increasingly embraced social media for outreach and patient support and have promoted technology-based interventions that use social media to support patients and caregivers after a cancer diagnosis.[16] Studies have highlighted the potential of social media to improve health through the efficient exchange of user-generated health information, increased perceived social support, and the facilitation of public health programs such as dietary interventions.[17–24]

It is valuable to study the language organizations use in online cancer communities related to oncology nutrition education, considering the rapid transformations in the communication landscape brought on by participative Internet use and social media.[25] Research studying the association between engagement and the language used within social media aligns with the National Cancer Institute's focus on bringing cancer research studies to individuals in their communities.[26] The first step in this effort is to identify the characteristics of current social media users. *Facebook* is a social media platform that allows users to share and interact with stories, images, and videos. In the United States, Facebook is used widely within the adult population, more commonly by females than males.[27] On this platform, *engagement* is defined as any action users take on a Facebook page or post.[28] The most common examples of Facebook engagement actions are reactions (e.g., likes), comments, and shares, but engagement can also include video views, link clicks, or post saves.

Understanding social media usage and engagement will inform health communication efforts aiming to utilize social media effectively.

Cook for Your Life (CFYL)

Cook for Your Life (CFYL), a website based at Fred Hutchinson Cancer Center (FHCC), stands out as a pioneer in promoting healthy cooking for individuals touched by cancer.[29] Founded in 2007 by a two-time cancer survivor as a community-based non-profit in New York City teaching in-person culinary and nutrition courses to cancer survivors, CFYL launched its website in 2012 to address the unmet need for culinary and nutrition education in the field of oncology. In 2019, the website was transferred to FHCC to continue serving as a bilingual (English/Spanish) research platform and community resource. The content produced by CFYL, which is grounded in science and supported by two advisory boards composed of FHCC leaders and experts—Scientific & Medical Advisors and Clinical Oncology Nutrition Advisors—caters to cancer patients, survivors, individuals interested in cancer prevention, as well as healthcare professionals and oncology societies. Disseminated through social media platforms such as Facebook, X, Pinterest, YouTube, and Instagram, CFYL's library comprises a rich collection of science-based recipes, articles, and videos.

In a strategic move in September 2021, CFYL implemented a bilingual multi-format social media strategy, producing content in both English and Spanish. This targeted approach, grounded in evidence-based techniques, aimed to enhance engagement and broaden the audience for oncology nutrition content. The incorporation of bilingual content into CFYL's social media strategy serves as a unique opportunity to investigate linguistic changes in Facebook content and its influence on engagement. This research endeavors to unravel the characteristics of social media posts that promote engagement with the CFYL content on Facebook, focusing on nutrition and cancer, before and after integrating targeted bilingual content into their social media approach. We aim to deepen our understanding of the factors influencing user engagement with health information via social

media platforms.

Methods & Materials

Study Timeline

This descriptive cross-sectional study utilizes linguistic content analysis to examine textual data of Facebook posts about nutrition and cancer prevention to describe (1) indicators of social engagement, (2) valence (i.e., positive/negative terms), and (3) linguistic content (e.g., emotional terms/pronouns). The study examines Cook for Your Life's (CFYL) Facebook content over a 12-month period. To delineate the two distinct time periods of the study, we designated the first nine months as "time point 1" (T1), and the subsequent three months following the implementation of the bilingual social media content strategy as "time point 2" (T2). This temporal division facilitated the examination of post characteristics that are associated with engagement, linguistic content, and other factors related to the introduction of a bilingual multi-format social media strategy by CFYL.

Facebook Metadata and Sampling

The sampling unit for this study is each original CFYL Facebook post (N=306) made during the 12-month observation period. Information extracted from Meta Business Suite included key metrics such as impressions, reach, post type (photo, link, video, or albums), and user interactions, comprising the number of likes, comments, shares, and link clicks. Meta Business Suite provided demographic information regarding users who interacted with the CFYL Facebook page, including gender, age group, language spoken, and country.

Qualitative Content Analysis

Certain variables of interest were not available directly from Meta Business Suite; These were manually collected from the CFYL Facebook page by a research assistant. This manual

extraction included the post text in both English and Spanish, the number of comments and emojis, and image content data. Each post was assigned a unique identifier to facilitate linkage to Meta Business Suite variables. Additional data included post-publication dates and hyperlinks. To ensure data accuracy, another investigator quality-checked this manually collected data. Next, to analyze how the content of posts was associated with engagement, we performed qualitative content analysis. A codebook from prior social media research was adapted and implemented to code the topical content of posts.[30] Discrepancies and inconsistencies were discussed amongst the research team, and the codebook was refined over time. User data was grouped according to categorical coding units with adequate variation for statistical comparisons.

Linguistic Variables

To analyze the linguistic content of CFYL Facebook posts, Linguistic Inquiry Word Count (LIWC) was employed. LIWC is a widely recognized content analysis platform that provides valuable insights into the linguistic characteristics of textual content.[31] It includes various dimensions, such as emotional tone, positivity, negativity, pronouns, and numerous other linguistic attributes. The selection of specific LIWC dimensions was based on the research questions, hypotheses, and preliminary findings, aligning with the study's objectives. A stop list was applied to exclude non-content words, ensuring that the analysis focused on meaningful language. Textual data from hashtags were also omitted from the analysis, as they were considered irrelevant, repetitive content. Then, LIWC was applied to estimate the percentage of terms in each post containing different language types.

Engagement outcomes

Our primary outcome variables were indicators of social engagement, defined as the number of likes, comments, and shares on each Facebook post. This definition was selected based on its prior

use and the presence of these features across social media platforms.[24,32] The total number of engaged users was another relevant outcome variable provided by Meta Business Suite, which described all actions taken by users and included total likes and comments as well as other engagement metrics such as shares, saves, and link clicks. High engagement indicated that posts were relevant to the target audience.

Statistical analysis

To facilitate statistical comparisons, textual data were grouped based on categorical coding units with sufficient variation. Bivariate analyses including t-tests and chi-square tests were applied to compare the proportion of text or mean word counts within various LIWC categories based on user characteristics. A generalized linear model was employed to estimate changes in engagement across posts throughout the 12-month observational period as a function of bilingual content, offering insights into the dynamics of engagement and linguistic content on the CFYL Facebook page.

Results

Characteristics of individuals who engaged with CFYL content on Facebook

During the period from January 2021 to December 2021, there were 306 CFYL Facebook posts. The user demographics of those who engaged with these posts revealed that the majority were female (93.2%), and the highest engagement age group was 55-64 years (26.6%). A significant portion of engaged users resided in the United States (71.4%), and the primary language used was English (93.4%) (Table 1).

Post characteristics associated with engagement with CFYL content on Facebook

Overall engagement with posts significantly increased between T1 (mean number of

engagements: 5.3, Standard Deviation (SD): 4.25) and T2 (mean: 17.7, SD: 37.9, p<0.01, Table 2). This substantial change was observed in the number of likes, shares, comments, and link clicks, underscoring a surge in user interaction with the content. There was a transition from simple image content at T1 (98.5% of T1 posts vs. 67.3% of T2 posts) to posts incorporating infographics (T1: 0.0% vs. T2: 7.7%) and branding at T2 (T1: 19.8% vs. T2 94.2%, all p<0.01, Table 2). Similarly, the presence of specific content topics within the posts exhibited significant changes. For instance, "Nutrition & Diet" (T1: 64.4% vs. T2: 84.6%, p<0.01) “Healthcare Support” (T1: 18.3% vs. T2: 40.4%, p<0.01), and diagnosis-specific posts for “Breast Cancer” (T1: 0.5% vs. T2: 9.6%, p<0.01) topics saw a substantial increase, suggesting a strategic focus on these themes to enhance engagement.

Engagement by lexical content

The average number of words per sentence significantly increased from 13.8 words in T1 to 16.8 words in T2 (p<0.01, Table 2), demonstrating a shift towards longer sentence structures. The linguistic analysis revealed that posts in the latter time period (T2) exhibited a substantial increase in the use of language related to analytical thinking (T1: 80.0% of terms vs. T2: 87.7%, p<0.01, Table 3), indicating a shift towards more analytical language. Conversely, the use of the Big Words declined significantly at T2 (mean across posts:37.2 words) compared to T1 (64.9 words across posts on average, p<0.01, Table 3), suggesting a more simplified vocabulary in T2 posts.

Affect-related categories revealed significant changes in Positive tone and Negative tone, both decreasing significantly from T1 to T2 (p<0.01, Table 3). These findings signify a shift towards less emotionally charged language in T2 posts. Cognition-related categories like Cognition, Cognitive processes, Differentiation, Tentative, Discrepancy, and Certitude all showed significant decreases at T2 (p<0.01, Table 3), suggesting a shift towards less cognitive and tentative language.

Several characteristics of posts were associated with engagement in univariate analyses. First,

bilingual posts demonstrated notably higher odds (OR) for engagement, with an OR of 1.72 (95% CI: 1.05-2.80 p=0.03, Table 4) compared to non-bilingual posts. Posts with CFYL branding also had higher odds of engagement than posts without branding (OR: 1.08, 95% CI 1.04-1.13, p<0.001). Posts that were square-shaped (OR: 1.11, 95% CI 1.06-1.17, p<0.001) had higher engagement odds versus rectangular-shaped posts, which had lower odds of engagement (OR: 0.90, 95% CI 0.85-0.94, p<0.001). Only bilingual content was associated with increased odds of engagement after adjusting for timepoint (data not shown). These findings underscore the influence of linguistic and thematic elements on user engagement with CFYL content on Facebook, even when adjusting for variations in the time period of the posts.

Discussion

Implementing a bilingual social media strategy on the Cook for Your Life (CFYL) Facebook page significantly improved engagement with online nutrition information designed for individuals affected by cancer. Over 12 months, we observed significant increases in likes, comments, and shares (500%, 100%, and 500%, respectively), underscoring the effectiveness of this bilingual strategy in promoting cancer nutrition information online. These findings emphasize the importance of strategic social media approaches in increasing user interaction with high quality cancer information on social media platforms.[33–35]

Widespread access to the internet has drastically shifted the sources of health information from health care providers to user-generated online content. Simultaneously, access to high-quality cancer information online may not be equitable. This is especially true in a global online community where the source and credibility of cancer information is not always transparent. Incorporating bilingual cancer content in the CFYL Facebook page extended accessibility for Spanish-language individuals. Bilingual social media strategies have been documented to promote user engagement with online health promotion content in other settings as well, with Latino Facebook users tending to

show more engagement with either Spanish or bilingual posts compared to English posts.[36] This suggests that cancer centers, hospitals, and cancer advocacy groups who intend to promote accessible cancer information online should strongly consider a bilingual approach, matching the linguistic needs of the target population.

Differences in health literacy on a global scale also emphasize the need for cancer information to be delivered at an appropriate literacy level, particularly given our current digital age where people worldwide have access to social media content.[37] The observed decrease in the use of complex language elements represents a conscious effort to make the content more accessible for diverse audiences, including individuals with varying levels of health literacy. Simplifying language in health communication is a recognized strategy to ensure that information is easily understood and accessible to a wider spectrum of readers. By employing more straightforward and comprehensible words, organizations like CFYL aim to bridge potential health literacy gaps, making critical information about cancer nutrition more accessible and understandable for a broader public.

Moreover, the shift towards less emotionally charged language, as evidenced by the decrease in language that uses both Positive and Negative tones, aligns with the expected findings observed in organizational communication. Previous research has indicated that organizations, especially those in the health domain, tend to use fewer emotionally charged words compared to individual users.[38] This strategic approach aims to maintain a professional and informative tone, avoiding potential misinterpretations that emotionally charged language might introduce. It is also plausible that less emotional, more objective language is interpreted as being more credible and scientifically accurate.

We found that visual content such as photo media, branding, and infographics are useful tools to improve engagement with cancer nutrition information on social media, which is supported by prior literature on the topic within the field of health information and cancer research.[33–35] Visual content is commonly used across social media platforms, and social media posts with visual content are more frequently shared with other users and are associated with engagement metrics (including

likes and comments).[35] In addition to its impact on user engagement, visual content also improves persuasive impact.[39] Other factors that associated with increased engagement across time points were branding, square shaped posts, and bilingual content. Square shaped posts represent purposively selected photos that were identified by the CFYL content creators as opposed to rectangular shaped posts which represent preselected images that are input automatically when inputting an external link into a Facebook posts. Therefore, this finding does not imply an attraction to a specific geometrical shape but suggests a preference for intentional photos over simple links. Institutions and researchers aiming to improve engagement with their social media content may use these strategies.

In the future, novel digital media, and technologic tools (e.g., eye-tracking, web-monitoring) may be useful for determining how individuals evaluate the quality of cancer nutrition information and features that promote online engagement with cancer nutrition information. This technology has been previously implemented in research to record users' viewing patterns on web-delivered information and provides a physiological measure linked to cognitive processing that may indicate the presence of active or passive engagement.[40,41] Data from eye-tracking can assess how users process online information such as social media content.[42,43] In the context of public health research, eye-tracking technology improves the understanding of how online health promotion content attracts attention from users.[40,42,44]

The association between social media use and oncology nutrition knowledge is another topic that should be explored further, particularly because engaged social media users are more likely to be aware of other prevention measures like cancer screening.[45,46] Likewise, improving engagement with oncology nutrition content on social media may promote healthy dietary choices for cancer prevention and cancer patients. The dietary needs of cancer patients undergoing treatment such as chemotherapy are different from those of cancer survivors or caregivers aiming to reduce cancer risk. Therefore, oncology nutrition interventions through social media may benefit from addressing these individualized needs through targeted social media content.

Going forward, providers and staff can leverage cancer nutrition websites and social media to guide patients to high-quality cancer information by incorporating visual content such as photos, branding, and infographics, which improve social engagement, as well as including more positive than negative language and a multi-language content strategy. It is important for providers to be aware of disparities in accessing information and to make cancer information available in different languages and literacy levels. Another area with clinical relevance is to consider the specific dietary needs of cancer patients undergoing treatment and provide targeted social media content to address these dietary needs both during treatment and across the cancer control continuum.

There are limitations of this approach that should be considered in the interpretation of our results. Although engagement from Spanish-speaking countries and users increased over time, we were limited in our ability to compare engagement by language (English/Spanish). This is because all social media content produced after implementing the social media engagement strategy was created in a bilingual format. In the future, exploring the characteristics of engaged users for an oncology nutrition social media group with Spanish content only or stratified by language would be beneficial for determining the precise impact of bilingual content on engagement. Additional threats to generalizability include an over-representation of females, and temporality (engagement may differ by time of the year).

Conclusion

In this study, we reviewed how CFYL, an online cancer nutrition community, promotes information about nutrition education and cancer prevention and the extent to which a dedicated bilingual social media strategy promoted engagement online. We described strategies to increase engagement with online social media content disseminating nutrition-related cancer prevention and survivorship information. Studying online language use may help cancer organizations strengthen the rationale for budgeting for bilingual social media cancer communication initiatives for the particular linguistic needs of their catchment areas. These findings define the context for communicating with

cancer patients, survivors, and caregivers on Facebook and other social media platforms about cancer nutrition content and are a first step toward implementing supportive interventions for high quality cancer nutrition information dissemination on social media.

References

1. Chen J, Wang Y. Social Media Use for Health Purposes: Systematic Review. *J Med Internet Res*. 2021;23(5):e17917. doi:10.2196/17917
2. PWC Health Research Institute. *Social Media "Likes" Healthcare—From Marketing to Social Business.*; 2012. Accessed April 10, 2023. https://adindex.ru/files2/access/2013_06/99606_tpc-health-care-social-media-report.pdf
3. NW 1615 L. St, Washington S 800, Inquiries D 20036 U 419 4300 | M 857 8562 | F 419 4372 | M. Three Technology Revolutions. Pew Research Center: Internet, Science & Tech. Accessed April 10, 2023. https://www.pewresearch.org/internet/three-technology-revolutions/
4. Chen J, Hou X, Zhao W. Research on the Model of Consumer Health Information Seeking Behavior via Social Media. *Int J Commun Netw Syst Sci*. 2016;09:326-337. doi:10.4236/ijcns.2016.98029artphones and social media is common across most emerging economies. Pew Research Center: Internet, Science & Tech. Published March 7, 2019. Accessed November 26, 2023. https://www.pewresearch.org/internet/2019/03/07/use-of-social mediaartphones-and-social-media-is-common-across-most-emerging-economies/
6. Della LJ, Eroglu D, Bernhardt JM, Edgerton E, Nall J. Looking to the future of new media in health marketing: deriving propositions based on traditional theories. *Health Mark Q*. 2008;25(1-2):147-174. doi:10.1080/07359680802126210
7. Chou WYS, Hunt YM, Beckjord EB, Moser RP, Hesse BW. Social Media Use in the United States: Implications for Health Communication. *J Med Internet Res*. 2009;11(4):e1249. doi:10.2196/jmir.1249
8. Thackeray R, Neiger BL, Hanson CL, McKenzie JF. Enhancing promotional strategies within social marketing programs: use of Web 2.0 social media. *Health Promot Pract*. 2008;9(4):338-343. doi:10.1177/1524839908325335
9. CDC. CDC Social Media. Centers for Disease Control and Prevention. Published January 11, 2023. Accessed April 10, 2023. https://www.cdc.gov/socialmedia/index.html
10. Norman C, McIntosh S, Selby P, Eysenbach G. Web-Assisted Tobacco Interventions: Empowering Change in the Global Fight for the Public's (e)Health. *J Med Internet Res*. 2008;10(5):e1171. doi:10.2196/jmir.1171
11. Wangberg SC, Andreassen HK, Prokosch HU, Santana social mediaV, Sørensen T, Chronaki CE. Relations between Internet use, socio-economic status (SES), social support and subjective health. *Health Promot Int*. 2008;23(1):70-77. doi:10.1093/heapro/dam039
12. Dooley JA, Jones SC, Iverson D. Using Web 2.0 for health promotion and social marketing efforts: lessons learned from Web 2.0 experts. *Health Mark Q*. 2014;31(2):178-196. doi:10.1080/07359683.2014.907204
13. Schleyer T, Spallek H, Butler B, et al. Facebook for Scientists: Requirements and Services for Optimizing How Scientific Collaborations Are Established. *J Med Internet Res*. 2008;10(3):e1047. doi:10.2196/jmir.1047
14. Bedrick SD, Sittig DF. A Scientific Collaboration Tool Built on the Facebook Platform. *AMIA Annu Symp Proc*. 2008;2008:41-45.
15. Lewis K, Kaufman J, Gonzalez M, Wimmer A, Christakis NA. Tastes, ties, and time: A new social network dataset using Facebook.com. *Soc Netw*. Published online October 1, 2008. doi:10.1016/j.socnet.2008.07.002
16. Kent EE, Rowland JH, Northouse L, et al. Caring for caregivers and patients: Research and clinical priorities for informal cancer caregiving. *Cancer*. 2016;122(13):1987-1995. doi:10.1002/cncr.29939
17. Khanna PM. Icyou: how social media is the new resource for online health information. *Medscape J Med*. 2008;10(5):113.

18. Gaysynsky A, Romansky-Poulin K, Arpadi S. “My YAP Family”: Analysis of a Facebook Group for Young Adults Living with HIV. *AIDS Behav*. 2015;19(6):947-962. doi:10.1007/s10461-014-0887-8
19. Idriss SZ, Kvedar JC, Watson AJ. The role of online support communities: benefits of expanded social networks to patients with psoriasis. *Arch Dermatol*. 2009;145(1):46-51. doi:10.1001/archdermatol.2008.529
20. Hawn C. Take two aspirin and tweet me in the morning: how Twitter, Facebook, and other social media are reshaping health care. *Health Aff Proj Hope*. 2009;28(2):361-368. doi:10.1377/hlthaff.28.2.361
21. Khan SA, McFarlane DJ, Li J, et al. Healthy Harlem: empowering health consumers through social networking, tailoring and web 2.0 technologies. *AMIA Annu Symp Proc AMIA Symp*. Published online October 11, 2007:1007.
22. Block G, Sternfeld B, Block C, et al. Development of Alive! (A Lifestyle Intervention Via Email), and Its Effect on Health-related Quality of Life, Presenteeisocial media, and Other Behavioral Outcomes: Randomized Controlled Trial. *J Med Internet Res*. 2008;10(4):e1112. doi:10.2196/jmir.1112
23. Eysenbach G. Medicine 2.0: Social Networking, Collaboration, Participation, Apomediation, and Openness. *J Med Internet Res*. 2008;10(3):e1030. doi:10.2196/jmir.1030
24. Kim SJ, Marsch LA, Brunette MF, Dallery J. Harnessing Facebook for social mediaoking Reduction and Cessation Interventions: Facebook User Engagement and Social Support Predict social mediaoking Reduction. *J Med Internet Res*. 2017;19(5):e6681. doi:10.2196/jmir.6681
25. Tobey LN, Manore MM. Social media and nutrition education: the food hero experience. *J Nutr Educ Behav*. 2014;46(2):128-133. doi:10.1016/j.jneb.2013.09.013
26. The NCI Community Oncology Research Program (NCORP). The NCI Community Oncology Research Program (NCORP). Accessed May 5, 2023. https://ncorp.cancer.gov/
27. Atske S. Social Media Use in 2021. Pew Research Center: Internet, Science & Tech. Published April 7, 2021. Accessed April 10, 2023. https://www.pewresearch.org/internet/2021/04/07/social-media-use-in-2021/
28. Post Engagement in Facebook Ads. Meta Business Help Center. Accessed May 5, 2023. https://www.facebook.com/business/help/735720159834389
29. CFYL @ Fred Hutchinson Cancer Center. About Cook for Your Life. Cook For Your Life. https://www.cookforyourlife.org/about-us/
30. Merten JW, Roberts KJ, King JL, McKenzie LB. Pinterest Homemade Sunscreens: A Recipe for Sunburn. *Health Commun*. 2020;35(9):1123-1128. doi:10.1080/10410236.2019.1616442
31. Pennebaker JW, Boyd RL, Jordan K, Blackburn K. The Development and Psychometric Properties of LIWC2015. Published online 2015. doi:10.15781/T29G6Z
32. Rebecca A. Hayes, Caleb T. Carr, Donghee Yvette Wohn. It’s the Audience: Differences in Social Support Across Social Media. Published online 2016. doi:10.1177/2056305116678894
33. Smith SJ James Kelly, Ken, ed. *Handbook of Visual Communication: Theory, Methods, and Media*. 2nd ed. Routledge; 2020. doi:10.4324/9780429491115
34. K H, A G, Aj K. Missing the Bigger Picture: The Need for More Research on Visual Health Misinformation. *Sci Commun*. 2022;44(4). doi:10.1177/10755470221113833
35. Strekalova YA, Krieger JL. A Picture Really is Worth a Thousand Words: Public Engagement with the National Cancer Institute on Social Media. *J Cancer Educ*. 2017;32(1):155-157. doi:10.1007/s13187-015-0901-5
36. Andrade EL, Evans WD, Barrett N, Edberg MC, Cleary SD. Strategies to Increase Latino Immigrant Youth Engagement in Health Promotion Using Social Media: Mixed-Methods Study. *JMIR Public Health Surveill*. 2018;4(4):e9332. doi:10.2196/publichealth.9332
37. Rivera YM, Moran MB, Thrul J, Joshu C, social mediaith KC. Contextualizing Engagement With Health Information on Facebook: Using the Social Media Content and Context Elicitation

Method. *J Med Internet Res*. 2022;24(3):e25243. doi:10.2196/25243
38. Warner EL, Ellington L, Kirchhoff AC, Cloyes KG. Acquisition of Social Support and Linguistic Characteristics of Social Media Posts About Young Adult Cancer. *J Adolesc Young Adult Oncol*. 2018;7(2):196-203. doi:10.1089/jayao.2017.0076
39. Seo K. Meta-Analysis on Visual Persuasion– Does Adding Images to Texts Influence Persuasion? In: *ATHENS JOURNAL OF MASS MEDIA AND COMMUNICATIONS*. Vol 6. ; 2020:177-190. doi:10.30958/ajmmc.6-3-3
40. Fox RJ, Krugman DM, Fletcher JE, Fischer PM. Adolescents' Attention to Beer and Cigarette Print Ads and Associated Product Warnings. *J Advert*. 1998;27(3):57-68. doi:10.1080/00913367.1998.10673563
41. Alley S, Jennings C, Persaud N, Horsley M, Plotnikoff R, Vandelanotte C. Do Personally Tailored Videos in a Web-Based Physical Activity Intervention Lead to Higher Attention and Recall? – An Eye-Tracking Study. *Front Public Health*. 2014;2. Accessed May 10, 2023. https://www.frontiersin.org/articles/10.3389/fpubh.2014.00013
42. Chou W ying S, Trivedi N, Peterson E, Gaysynsky A, Krakow M, Vraga E. How do social media users process cancer prevention messages on Facebook? An eye-tracking study. *Patient Educ Couns*. 2020;103(6):1161-1167. doi:10.1016/j.pec.2020.01.013
43. Kim SC, Vraga EK, Cook J. An Eye Tracking Approach to Understanding Misinformation and Correction Strategies on Social Media: The Mediating Role of Attention and Credibility to Reduce HPV Vaccine Misperceptions. *Health Commun*. 2021;36(13):1687-1696. doi:10.1080/10410236.2020.1787933
44. J L, J P, D K, L X, G N, L P. Do Young Adults Attend to Health Warnings in the First IQOS Advertisement in the U.S.? An Eye-Tracking Approach. *Nicotine Tob Res Off J Soc Res Nicotine Tob*. 2021;23(5). doi:10.1093/ntr/ntaa243
45. Qin L, Zhang X, Wu A, et al. Association Between Social Media Use and Cancer Screening Awareness and Behavior for People Without a Cancer Diagnosis: Matched Cohort Study. *J Med Internet Res*. 2021;23(8):e26395. doi:10.2196/26395
46. Nour M, Yeung SH, Partridge S, Allman-Farinelli M. A Narrative Review of Social Media and Game-Based Nutrition Interventions Targeted at Young Adults. *J Acad Nutr Diet*. 2017;117(5):735-752.e10. doi:10.1016/j.jand.2016.12.014

Table 1. Demographics of users who engaged with CFYL content during the 6 month monitoring period		
	N	**%**
Gender		
Female	9500	93.2
Male	626	6.1
Other	70	0.7
Location		
USA	6708	71.4
Canada	1360	14.5
UK	855	9.1
Australia	127	1.4
Mexico	102	1.1
South Africa	99	1.1
Ireland	85	0.9
India	53	0.6
Age Group		
13-17	4	0.04
18-24	86	0.1
25-34	795	7.8
35-44	1835	18.0
45-54	2486	24.4
55-64	2708	26.6
65+	2282	22.4
Language		
English	9419	93.4
Spanish	311	3.1
French	224	2.2
Portuguese	44	0.4
Italian	22	0.2
Arabic	14	0.1
Greek	13	0.1
Other	41	0.4

Table 2. Engagement with posts during 12-month monitoring period by characteristics of posts (N=306)					
	T1		T2		
	Mean	SD	Mean	SD	p-value
Total Engagement	5.3	4.2	17.7	37.9	**<0.01**
# of likes	2.5	2.0	12.5	33.5	**<0.01**
# of shares	0.4	0.7	0.8	1.1	**<0.01**
# of comments	0.1	0.6	0.5	1.3	**<0.01**
# of link clicks	2.2	2.6	3.9	7.5	**<0.01**
Words per sentence	13.8	3.8	16.8	3.8	**<0.01**
	N	%	N	%	p-value
Image Content					
Text	3	1.5	34	32.7	**<0.01**
Image	199	98.5	70	67.3	**<0.01**
Infographic	0	0.0	8	7.7	**<0.01**
GIF	0	0.0	3	2.9	**0.02**
Branding	40	19.8	98	94.2	**<0.01**
Square shape	12	5.9	94	90.4	**<0.01**
Rectangular shape	190	94.1	10	9.6	**<0.01**
Bilingual post	1	0.5	103	99.0	**<0.01**
Content Topic					
Immune system	3	1.5	7	6.7	**0.02**
Chemotherapy	1	1.5	4	3.9	0.03
Radiation	1	0.5	2	1.9	0.23
Cancer	52	25.7	61	58.6	**<0.01**
Survivorship	4	2.0	1	1.0	0.51
Caregiver	0	0.0	2	1.9	**0.05**
Healthcare Support	37	18.3	42	40.4	**<0.01**
Prevention	41	20.3	30	28.8	0.09
Nutrition & diet	130	64.4	88	84.6	**<0.01**
Heart Health	0	0.0	1	1.0	0.16
Cancer type					
Gynecological	1	0.5	0	0.0	0.47
Colorectal	1	0.5	1	1.0	0.63
Breast	1	0.5	10	9.6	**<0.01**
Blood	0	0.0	2	1.9	**0.05**
Bladder	1	0.5	0	0.0	0.47

Table 3. Lexical content by time period (N=306 posts)					
	T1		T2		
	Mean	SD	Mean	SD	p-value
Analytical thinking[CT3]	80.04	18.05	87.70	5.66	<0.01
Dictionary	64.92	8.34	37.23	5.76	<0.01
Linguistic	44.84	8.49	19.10	3.49	<0.01
Tone	39.95	34.60	28.86	19.79	<0.01
Big Words	32.85	7.48	39.66	5.27	<0.01
Function	31.18	8.48	12.36	3.02	<0.01
Authentic	19.03	21.64	1.12	0.60	<0.01
Drives					
Affiliation	1.77	2.41	1.12	1.20	<0.01
Cognition					
Cognition	7.33	4.6	3.0	1.8	<0.01
Cognitive processes	6.65	4.47	2.64	1.59	<0.01
Differentiation	3.08	2.70	0.85	0.80	<0.01
Tentative	2.38	2.22	0.50	0.61	<0.01
Insight	1.01	1.92	0.60	0.75	0.02
Discrepancy	1.00	1.48	0.49	0.76	<0.01
Certitude	0.43	1.00	0.08	0.25	<0.01
Affect					
Affect	6.11	3.83	3.76	1.50	<0.01
Positive tone	3.59	3.25	2.07	1.25	<0.01
Emotion	2.88	2.08	1.62	0.93	<0.01
Negative tone	2.44	1.54	1.65	0.83	<0.01
Negative emotion	2.15	1.26	1.34	0.64	<0.01
Positive emotion	0.59	1.38	0.24	0.42	0.01
Social Processes					
Social processes	5.96	4.05	4.17	2.54	<0.01
Social referents	4.58	3.41	2.66	1.50	<0.01
Family	0.05	0.35	0.24	0.42	<0.01
Conflict	0.04	0.36	0.14	0.27	0.01
Male references	0.01	0.14	0.23	0.43	<0.01
Culture					
Culture	2.23	1.37	1.45	0.67	<0.01
Technology	2.06	1.23	1.31	0.63	<0.01
Politics	0.01	0.12	0.07	0.22	<0.01
Physical					

Health	1.96	3.57	6.69	3.29	<0.01
Food	6.57	4.44	3.81	2.39	<0.01
Illness	0.83	2.08	5.64	3.09	<0.01
States					
Acquire	1.12	1.52	0.37	0.51	<0.01
Motives					
Allure	4.74	3.48	1.87	1.10	<0.01
Perception					
Physical	8.63	5.33	10.84	3.57	<0.01
Perception	7.26	4.30	2.09	1.46	<0.01
Space	4.87	3.15	1.06	0.97	<0.01
Present focus	2.85	2.42	1.08	0.88	<0.01
Time	2.64	2.81	1.06	1.03	<0.01
Conversational	2.18	1.36	1.47	0.69	<0.01
Netspeak	2.14	1.33	1.45	0.68	<0.01
Future focus	0.82	1.59	0.31	0.48	<0.01
Motion	0.71	1.36	0.19	0.34	<0.01
Visual	0.63	1.34	0.34	0.58	0.04
Feeling	0.59	1.34	0.19	0.42	<0.01
Fulfill	0.44	1.09	0.14	0.34	<0.01
Want	0.27	0.80	0.07	0.31	0.02

Table 4. Characteristics of posts and lexical content associated with engagement across all posts controlling for time period (N=306)			
	OR	**95% CI**	**p-value**
Post structure			
Mostly text	1.00	0.99-1.01	0.61
Mostly image	1.00	0.98-1.01	0.61
Infographic	0.99	0.93-1.06	0.78
With branding	**1.08**	**1.04-1.13**	**<0.001**
GIF	1.00	0.97-1.04	0.80
Square shape	**1.11**	**1.06-1.17**	**<0.001**
Rectangular shape	**0.90**	**0.86-0.94**	**<0.001**
Bilingual	**1.72**	**1.05-2.80**	**0.03**
Topic			
Immune system	0.99	0.95-1.04	0.83
Chemotherapy	0.97	0.84-1.13	0.74
Radiation	0.97	0.79-1.19	0.77
Cancer	1.00	0.99-1.01	0.33
Survivorship	0.98	0.96-1.12	0.77