Imbalanced media portrayal: a content analysis of precision medicine in US news of 2015–2021

Wei Peng[1]*, Hae Yeon Seo[1], Juwhan Choi[1] and Xiaofeng Jia[2]

[1]Edward R. Murrow College of Communication, Washington State University, Pullman, WA, United States, [2]School of Communication, University of Miami, Coral Gables, FL, United States

Introduction: Engaging diverse participants is vital to precision medicine (PM) but has been limited by low knowledge and concerns about various issues related to PM research. News media is an important channel of information that can shape public understanding and perception of PM. However, how PM is represented in news media has not been sufficiently understood.

Methods: The study used quantitative content analysis to evaluate the portrayal of PM in US print news media between 2015 and 2021 ($N = 198$). Three domains of factors related to PM portrayed in news articles were coded: (1) characteristics of PM, (2) target diseases of PM and their related characteristics, and (3) non-scientific news frames.

Results: There was considerable news coverage of the treatment benefits of PM, especially for cancer. Potential risks or concerns, non-cancer diseases, and non-treatment issues that could be important to diverse populations were less covered. News articles frequently cited scientists, patients, and government officials with different focuses on PM.

Discussion: The study highlighted the need for accurate and complete information about PM in news media for diverse participants. News media should actively explore social, ethical, and legal issues to support the engagement of diverse populations.

Introduction

Precision medicine (PM) has captured widespread attention in the United States, especially since the nationwide Precision Medicine Initiative (PMI), *All of Us*, was launched in 2015 (Ashley, 2015; Ginsburg and Phillips, 2018). PM integrates genomic and molecular analyses with established clinical indices of patients to achieve more accurate classification of diseases and potentially more effective prevention and treatment for diverse population groups (Pokorska-Bocci et al., 2014; Jameson and Longo, 2015; Kosorok and Laber, 2019). As an emerging approach to health care, PM is adopted by US scientists and policymakers to focus on disease taxonomy without connoting personalized treatment (National Research Council, 2011; Collins and Varmus, 2015; Erikainen and Chan, 2019).

The development of PM relies on the participation of people with different backgrounds (Canedo et al., 2019; Chakravarthy et al., 2020). However, compared with people of European ancestry, marginalized groups, including racial and ethnic minorities, are underrepresented in PM research and services (Landry et al., 2018; Chakravarthy et al., 2020). The development of PM without the participation of diverse populations could widen existing health disparities (Adams and Petersen, 2016; Canedo et al., 2019).

Prior research suggested several challenges that could limit the engagement of diverse participants in PM. First, the public, particularly underserved communities, lacks sufficient awareness and knowledge of PM (Williams et al., 2018; Canedo et al., 2019). This likely impedes the public's ability to evaluate benefits and risks, understand enrollment information, and make informed decisions (Ginsburg and Phillips, 2018; Canedo et al., 2020). Also, negative attitudes and great concerns toward PM research are common. The uncertainty and complexity of PM can be seen as the lack of transparency (Woodbury et al., 2020). Participants from different backgrounds require complete information about different aspects of PM, including benefit delivery, costs, and social implications (Ginsburg and Phillips, 2018; Fisher et al., 2019). In particular, minoritized communities need assurance of safety, confidentiality, and ethics involving their personal data (Ginsburg and Phillips, 2018; Canedo et al., 2019).

These challenges warrant attention to the factors that explain the knowledge and perspectives of PM among diverse groups of people (Woodbury et al., 2020). Previous research examining participation in PM was mostly conducted in clinical settings but the impacts of social factors have not been fully explored (Williams et al., 2018; Fisher et al., 2019; Chakravarthy et al., 2020). Thus, we seek to assess the portrayal of PM in news media in order to provide insight into the influence of news media on the public's attitudes, and perceptions of PM.

News media and precision medicine

The development of precision medicine has led to increased coverage in the US news media (Marcon et al., 2018; Ratcliff, 2021). News media are a powerful tool for reaching a wide range of audiences with information about new technologies (Caulfield and Condit, 2012). Also, news media connect the public with the scientific community and cultivate trust by providing readily accessible definitions and interpretations of scientific findings (Caulfield, 2018). As such, news media can become an important channel for the lay public to learn PM, exerting a strong influence on their awareness, attitudes, and engagement in related research and services (Woodbury et al., 2020; Ma and Kannampallil, 2021).

However, in explaining scientific breakthroughs to a broader audience, news media often create a gap in the information accessible to the public. The public often finds media coverage of scientific research too complex to comprehend (Morosoli et al., 2024). Also, news media do not always provide factual and balanced information related to new scientific technologies. According to the framing theory, journalists routinely frame a topic by reporting selected aspects of a topic and promoting "a particular definition, causal interpretation, moral evaluation, and/or treatment recommendation" (Entman, 1993, P. 52). Frames shape public understanding by organizing different issues and ideas of a complex issue and selectively assign prominence and significance to certain aspects (Dobmeier et al., 2023). In addition, media coverage prioritizes scientific events with more sensational values and controversies, leading to inflated expectations of preliminary findings and neglecting crucial uncertainties (Ratcliff, 2021).

Consequently, a lack of accessible, accurate, and balanced information erodes public understanding and trust in scientific advancements. One-sided representations of PM in the news can generate unrealistic expectations among an uninformed public, leading to misconceptions of PM research and misinformed decisions (Benjaminy et al., 2015; Hicks-Courant et al., 2021). Under-reporting of key information may lower the significance of PM to diverse populations (Fisher et al., 2019). As a result, PM could not effectively engage different population groups in the research and implementation processes to achieve health equity (Adams and Petersen, 2016; Fisher et al., 2019). Taken together, investigating media portrayal of PM through the perspective of framing can shed light on the way news media change how the public perceives PM with findings that inform education and outreach efforts (Brossard, 2013; Hicks-Courant et al., 2021).

The present study

This study aims to examine how news articles in US print media portrayed PM between 2015 and 2021. The patterns, details, and context of news articles about PM revealed in our study will pave the way for future investigations into how news media shapes public perception of and engagement with PM. While past research directly examining media representation of PM is limited, studies of similar scientific topics, including genetic testing (Chavez-Yenter et al., 2023; Dobmeier et al., 2023), genomics research (Hendy, 2024; Morosoli et al., 2024), and personalized medicine for cancer (Hicks-Courant et al., 2021) reveal recurring frames and characteristics in media coverage. First, when reporting PM and related genomic science, news media often highlight the potential to improve medical care but may not fully convey drawbacks (Marcon et al., 2018; Ratcliff, 2021). News media tend to emphasize the promises of new findings, highlight successful cases, and expedite the delivery timeline but ignore scientific uncertainties (Garrison et al., 2019; Ratcliff, 2021). Another prominent problem is the lack of clear communication on key topics, issues, and stakeholders that are relevant to diverse participants. News media do not fully disclose critical issues involving genetic and genomic research, such as safety, privacy, and costs (Basch et al., 2023; Chavez-Yenter et al., 2023; Morosoli et al., 2024). Only a small percentage of news articles covering genetic services used sources from healthcare professionals (Basch et al., 2023; Chavez-Yenter et al., 2023).

Further research is necessary due to the scarcity of research specifically assessing the representation of PM in US media. There is one previous study by Marcon et al. (2018) that assessed "personalized medicine" covered by North American print and online news stories. The present research is different from Marcon et al. (2018) in three ways.

First, Marcon et al. (2018) sampled and combined news articles covering "personalized medicine" and "precision medicine" whereas the present study specifically focuses on precision medicine in a US context. Despite the similarity, precision medicine and personalized medicine should be distinguished by different origins and emphases (Juengst

et al., 2016). Precision medicine is a more specific research approach focusing on disease taxonomy based on synthesizing the variability of individual patients (Pokorska-Bocci et al., 2014; Kosorok and Laber, 2019). In contrast, personalized medicine is a more ambiguous term that encompasses both biological research and holistic improvement in the health care system and sociopolitical contexts for individualized health care (Pokorska-Bocci et al., 2014; Juengst et al., 2016). Thus, a specific technique of personalized medicine, such as tailored health services (Ko et al., 2016), might not be considered precision medicine by providers and patients in US health care. Thus, the media coverage of precision medicine should be examined separately from that of personalized medicine (Juengst et al., 2016).

Second, the samples of the present study and Marcon et al. (2018) were from different timeframes. Marcon et al. (2018) included news articles published before March 2016. However, the present study will sample most of the news articles published in and after 2016, which is a critical period to capture the news coverage of precision medicine as an emergent approach to health care in the US. After the launch of PMI in 2015, US scientists and policymakers formally endorsed the research approach of precision medicine, rather than personalized medicine (National Research Council, 2011; Jameson and Longo, 2015; Erikainen and Chan, 2019). Since then, precision medicine research has generated notable findings and attracted public attention (Woodbury et al., 2020; Ma and Kannampallil, 2021). As evidenced by Google Trends, "precision medicine" became the dominant terminology in the US after 2015 whereas searches for "personalized medicine" have declined (Google Trends, 2004–2024).

Third, the present study will examine more characteristics of precision medicine in news articles than Marcon et al. (2018). Certain scientific details, such as the causes of a disease, and conventional health care, were not assessed by the previous study. We will also evaluate non-scientific framing details that suggest nuances in themes, stakeholders, and interpretations (Peters and Dunwoody, 2016). The findings will help understand how news media influence public understanding and opinion of PM.

The present study will sample news articles related to PM from US regional and national print media from 2015 when PMI was launched until 2021. Through a content analysis, we will describe key characteristics and contextual issues of PM emphasized in the news, and also the theme, valence, and source used to present the information. The coded variables include three domains of factors used to report PM, including (1) target diseases and their related characteristic (e.g., affected populations, existing treatment), (2) characteristics of PM, and (3) non-scientific news frames (e.g., themes and spokespersons). Descriptive statistics and chi-square analyses will be used to describe the frequency and relationships among three domains of factors. The study will answer the following research questions.

RQ1: What characteristics of PM do news articles convey?

RQ2: What diseases and their related factors do news articles communicate about PM?

RQ3: How do news articles convey diseases and related factors when reporting the characteristics of PM?

RQ4: How do news articles use non-scientific news frames to report the characteristics of PM?

Methods

Overview

The present study conducted a quantitative content analysis of news articles in US print media. Content analysis is a systematic research method that synthesizes text data of recorded communication into quantitative forms for assessment, replication, and comparison (Lombard et al., 2002; Krippendorff, 2012). Each news article was a unit of analysis.

News articles were sampled from ProQuest Global Newsstream, one of the largest databases of news sources (ProQuest, 2022). We provide two reasons that support the sampling of news articles from print media. First, news on print media provides more factual and contextual information to examine complex issues, like PM, through a thematic scope than television news (Eveland et al., 2002). In contrast, news from television media often focuses on episodic content of single events and pursues sensational values (Iyengar, 1994). Second, print media can provide content with more depth and breadth than fully online sites. By offering both offline and online access, print media expand its reach to a large news audience across population groups (Maier, 2010; Fletcher and Nielsen, 2017). News articles published by both regional and national print media were included because multiple modes of media access blur the boundary of media markets (Chyi et al., 2010). Moreover, we sampled articles from various sections in English-language, general-interest media, aiming to capture how PM is portrayed for the general public in the US. For this reason, non-English outlets or specialized interest media (e.g., magazine) that appeal to a focused audience were not optimal sources for this study.

The sampling time frame started from January 1, 2015, until June 1, 2021. The starting date was determined based on the announcement of the national PMI in the US by the Obama Administration (Collins and Varmus, 2015). The sampling keyword "precision medicine," was used. Similar terms, such as "personalized medicine," were not used for two reasons. First, the US formally defined precision medicine as an approach to health care that should be distinguished from personalized medicine (National Research Council, 2011; Collins and Varmus, 2015). Thus, using "personalized medicine" or other similar terms could include news articles about medical approaches not considered precision medicine in the US (Juengst et al., 2016; Ko et al., 2016). Second, Google Trends shows that compared with "precision medicine," the search for "personalized medicine" has dwindled after 2015 (Google Trends, 2004–2024).

The database search initially returned 710 results containing the keyword "precision medicine." The screening process removed duplicates and included news articles that were published in US print news media, and provided at least one sentence about PM and related characteristics. The final sample included 198 articles ($N = 198$) published by 31 US news media. The names of the news media are listed in the Supplementary Material.

Coders and intercoder reliability

The sampled articles were manually coded by three coauthors as the coders. We randomly selected 20% of the full sample ($n = 41$) to train coders. The coder training reviewed and clarified the conceptual

and operational definitions of the coded variables. Three coders coded a small batch of the training articles independently and convened again to discuss any disagreements. The coding scheme was adjusted to address coder disagreement. This training process was repeated until all of the training articles were coded and the intercoder reliability reached a satisfactory level (Lombard et al., 2002). Given substantial imbalances of frequencies in different categories, we used Gwet's AC_1 to assess intercoder reliability. Gwet's AC_1 offers an optimal statistical solution to overcome the paradox of high degrees of agreement and low intercoder reliability scores that plague other indices (Gwet, 2014). Gwet's AC_1 intercoder reliability coefficients were computed and qualified by *irrCAC* in R (Gwet, 2022). The AC_1 coefficients of all variables had significant probabilities (>95%) that could reach the "substantial" or "good" level of agreement on the benchmark scales by Wongpakaran et al. (2013). All coefficients are included in the Supplementary Material. After achieving intercoder reliability, the training coding results of one coder were randomly selected and incorporated into the final results. Cumulatively, the training time was approximately 40 h.

After the training, three coders equally split the remaining sample and each manually coded one-third of the articles. After half of these articles were coded, 10% of the articles in each coder's part were randomly selected and then cross-coded by two other coders to assess reliability. The coders convened again to solve any questions and disagreements. The coders established satisfactory intercoder reliability in the first half of the sample before starting to code the second half of the sample.

Variables and coding schemes

The initial coding scheme was developed by reviewing medical and public health literature on PM research (see references in Supplementary Material), and further adjusted during coder training through inductive, open coding of a small sample. The coding scheme included three domains of variables related to the media representation of PM. The first group, characteristics of PM, includes benefits and concerns of PM, the timeframe of achieving benefits, and the present status of PM. The second group of variables was target diseases and the related factors, which included the type and name of diseases, the primary cause of the disease, the affected population, and coverage of conventional health care. The last group, non-scientific news frames, includes meta-data of a news article, main theme, framing valence, and spokespersons. The Supplementary Material provides the operational definitions and coding instructions.

Analysis

The study reported descriptive statistics to answer RQ1 and RQ2. Chi-square (χ^2) statistics were used to examine the relationships between categorical variables related to the characteristics of PM, target diseases, and non-scientific news frames.

Results

Descriptive statistics

About 58.59% of the sampled articles were published in 2015 and 2016. The main theme of 151 news articles was related to PM's function and benefits in health care, which includes treatment, prevention, and diagnosis (see Table 1). Fewer articles had a theme related to the risks and concerns of PM. Other themes were not frequently identified in the sampled articles.

Characteristics of PM

RQ1 was to describe the characteristics of PM portrayed in news articles. The analyses revealed that 92.42% of the news articles reported at least one benefit of PM. The most common benefit was improved treatment efficacy, which was followed by disease prevention (Table 2). Relatively fewer cases reported reduced adverse side effects, lower cost, and advancing science as the benefits.

Table 3 summarizes the concerns of PM described by news articles. Only 61 news articles (30.81%) discussed the concerns or risks of PM. Insurance and policy restrictions and efficacy of PM were the two most frequently discussed concerns.

Most of the articles did not provide a specific time frame for which PM can deliver its benefits. About 34.85% indicated the benefits of PM were expected to be realized in the future and another 14.65% suggested the benefits to be achieved soon. In addition, 62.63% of the news articles described PM as ongoing research whereas 19.19% portrayed PM-related products as being manufactured or readily available. Fewer articles (6.06%) described PM as a new concept.

Target diseases and the related factors

RQ2 was to identify diseases and their related factors (i.e., disease causes, non-PM conventional health care, and affected populations)

TABLE 1 Frequency of content themes in U.S. news articles about PM.

Content theme	N	Percentage (%)
Disease prevention, new medicine, treatment, and/or diagnosis	151	76.26
Risk or safety concerns	19	9.60
Economic opportunities and impacts	6	3.00
Legal or regulatory topics	5	2.53
Ethical topics	2	1.01
Other	4	2.00
Multiple themes	11	5.56
Total	198	100

TABLE 2 Frequency of benefits in U.S. news articles about PM.

Benefits of PM	N	Percentage (%)
Improving treatment efficacy	169	85.35
Reducing adverse side effects	6	3.03
Preventing disease	29	14.65
Better health care experiences	2	1.01
Advancing science	15	7.58
Improving life quality and patient autonomy	6	3.03
Lower health care cost	19	9.60
Economic opportunities	8	4.04
Positive social, political, moral or ethical impacts	0	0
Other benefits	0	0

Percentage is calculated as the ratio of the frequency of a benefit category and the total number of news articles ($N = 198$). The sum of percentages is not equal to 100 because each news article might contain more than one benefit category.

TABLE 3 Frequency of concerns or risk in U.S. news articles about PM.

Concern or risks of PM	N	Percentage (%)
Limited efficacy	22	11.11
Insurance and policy restrictions	29	14.65
Low knowledge and literacy	3	1.52
Social, political, and moral restrictions or impacts	11	5.56
Research challenges	10	5.05

Percentage is calculated as the ratio of the frequency of a concern or risk category and the total number of news articles ($N = 198$). The sum of percentages is not equal to 100 because each news article might contain more than one concern or risk category.

in news articles reporting PM. The analysis found that 61.62% of the articles ($n = 122$) mentioned cancer, making it the most common disease covered in association with PM. About 10.61% of the articles ($n = 21$) related to other non-cancer chronic diseases. Cystic fibrosis, heart disease, and diabetes were the three most common non-cancer chronic diseases. Rare genetic disorders and mental illness were found only in 6 (3.03%) and 7 (3.54%) of the articles. All three articles (1.52%) related to acute or infectious diseases were about the relationship of COVID-19 with PM. Another 15.66% did not focus on any specific disease or health condition.

In addition, about 20.71% of the news articles mentioned non-PM conventional health care. Genetic or hereditary factors were portrayed as the causes of diseases in 35.86% of the news articles ($n = 71$) but the most of the news articles (62.63%) did not provide a cause.

The majority of the news articles ($n = 166$, 83.84%) did not specify the populations affected by the disease who could potentially benefit from PM. There were 12 cases (6.06%) discussing one particular gender (women or men), and 7 (3.54%) focusing on individuals of certain genetic or family history factors.

The relationships of characteristics of PM and target diseases

RQ3 sought to understand how news articles portrayed diseases and related factors when reporting the characteristics of PM. Multiple chi-square analyses were conducted to answer RQ3. The first set of analyses was to investigate the diseases linked to

specific benefits or concerns of PM in news articles. The results showed that cancer was discussed in 64.50% of the news articles that indicated the improved efficacy as the benefit of PM. By contrast, 8.88, 3.55, and 3.55% of the articles featuring this benefit were, respectively, related to non-cancer chronic diseases, genetic conditions, and mental illness, χ^2 (6, $N = 198$) $= 12.86$, $p = 0.045$, $V = 0.26$. Most cases (62.50%) pointing to economic development as the benefit of PM did not specify any health conditions, χ^2 (6, $N = 198$) $= 14.37$, $p = 0.03$, $V = 0.27$. On the other hand, the coverage of the concerns related to PM did not specifically focus on one type of disease ($ps > 0.05$).

Second, we investigated what benefits and concerns of PM were mentioned alongside discussions of non-PM conventional health care in news articles. The chi-square analyses showed that non-PM health care was mentioned in 83.33% of the news articles framing fewer adverse side effects as a benefit of PM [χ^2 (1, $N = 198$) $= 14.78$, $p < 0.001$, $V = 0.27$]. Discussions of non-PM health care also appeared in about 66.67% of the articles that framed increased patient autonomy and life quality as the benefit from PM [χ^2 (1, $N = 198$) $= 7.96$, $p = 0.005$, $V = 0.20$]. Most of the news articles (57.89%) discussing PM's potential for reducing health care costs failed to discuss existing treatments, χ^2 (1, $N = 198$) $= 5.86$, $p = 0.02$, $V = 0.17$.

Third, benefits and concerns were reported using different time frames. About 36.69% of news articles portrayed the improved treatment efficacy of PM as something to be achieved in the future χ^2 (2, $N = 198$) $= 10.42$, $p = 0.01$, $V = 0.23$. A smaller percentage of such articles (17.16%) highlighted immediate availability of improved efficacy from PM. By contrast, most of the concerns regarding PM

TABLE 4 Frequency of spokespersons in U.S. news articles about PM.

Spokespersons	N	Percentage (%)
Research scientists or institutions	145	73.23
Public or public opinion surveys	0	0.00
Mass media	0	0.00
Non-research celebrity	0	0.00
Biotechnology companies and associated personnel	44	22.22
Patients or patient groups	40	20.20
Medical professional organizations	11	5.56
Lawyers/attorneys/legal organizations	1	0.51
Politicians or government officials	37	18.69
Other spokespersons	5	2.53

Percentage is calculated as the ratio of the frequency of a spokesperson category and the total number of news articles ($N = 198$). The sum of percentages is not equal to 100 because each news article might contain more than one spokesperson category.

were not tied to a specific time frame in news articles ($ps > 0.05$), acknowledging the uncertainty of addressing these challenging issues.

The relationships of characteristics of PM and news framing

RQ4 was proposed to identify what non-scientific news frames, including main theme, framing valence, and spokespersons, were employed in news articles reporting the characteristics of PM. To answer RQ4, one of the analyses was to examine different types of spokespersons in the news articles about PM. The descriptive analyses show that research scientists were the most cited spokesperson, followed by biotechnology companies, patients or patient groups, and politicians or government officials (Table 4). Other sources were less frequently cited as spokespersons. The chi-square analysis show that scientists were mostly cited in the news articles with a theme about PM's function and benefits in health care (78.62%) as well as those about risk or safety concerns (11.03%), χ^2 (6, $N = 198$) = 16.70, $p < 0.05$, $V = 0.29$.

To understand the relationship between spokesperson and the present status of PM research, the chi-square analysis found that patient or patient groups were cited in 39.47% of the news articles that framed PM to be a product or service being manufactured or already available, χ^2 (3, $N = 196$) = 11.05, $p = 0.01$, $V = 0.24$. Only 2.63% of the articles describing PM as an available service cited politicians or government officials, χ^2 (3, $N = 196$) = 11.19, $p = 0.01$, $V = 0.24$. By contrast, when portraying PM as a newly conceptualized idea, only 8.33% of the news articles cited patients but 41.67% cited politicians or government officials. When framing PM as an ongoing research project, the proportion of the articles citing politicians or government officials (20.97%) was slightly higher than that of the articles citing patients (16.13%). Scientists and other spokespersons were not cited differently in the articles discussing the status of PM research ($p > 0.05$).

Lastly, we examined the valence of news articles when reporting the benefits and concerns regarding PM. The chi-square analyses indicated that the vast majority (81.07%) of the news articles addressing treatment benefits of PM expressed a positive tone, χ^2 (2, $N = 198$) = 29.33, $p < 0.001$, $V = 0.39$. In contrast, about 40.9 and 50% of the news article expressed a negative tone when discussing the concern of PM related to limited efficacy [χ^2 (2, $N = 198$) = 47.50, $p < 0.001$, $V = 0.49$] or difficulty of conducting research [χ^2 (2,

$N = 198$) = 27.16, $p < 0.001$, $V = 0.37$], respectively. The proportions of the articles showing a positive tone when reporting these two concerns were lower (22.73 and 20%, respectively). The valence was more mixed in the discussion of legal, policy, and insurance-related concerns. Each framing valence was found in respective one-third of the news articles focusing on these concerns, χ^2 (2, $N = 198$) = 40.68, $p < 0.001$, $V = 0.45$.

Discussion

The present study analyzed 198 news articles published over 6 years by US print news media. The quantitative content analysis revealed the key aspects regarding the portrayal of PM. The findings provided insight into news media's influence on how people understand and perceive PM, raising important implications for future education efforts.

First, in line with previous research (Marcon et al., 2018; Hicks-Courant et al., 2021), excessive optimism about benefits remains a prevalent problem in the news articles on PM. A positive tone in the news coverage of benefits reinforced enthusiastic portrayal. While nearly every news article discussed benefits, substantially fewer cases mention risks and challenges. The undue promises of benefits in the news could cultivate unrealistic public expectations toward PM (Sumner et al., 2014; Hicks-Courant et al., 2021). Researchers criticized that the hype of emerging technologies in the news could lead to premature adoption of unproven services and products without thoroughly evaluating risk and cost, especially in marginalized populations (Diamandis and Li, 2016; Williams et al., 2018; Canedo et al., 2020). For example, precision treatment using genomic sequencing can benefit some cancer patients by targeting specific mutations (Prasad, 2016). However, these rare cases will convey misleading information because this costly approach cannot benefit most cancer patients (Prasad, 2016; Tabor and Goldenberg, 2018). More broadly, the hype of benefits could skew policy and ethical debate and resource allocation toward PM at the cost of effective alternatives for different subpopulations (Caulfield et al., 2016; Caulfield, 2018; Sabatello et al., 2018).

Another finding is the misrepresentation of research status and time frame for delivering the benefits. That means the translational gap between PM research and clinical care has not been clearly acknowledged in the news (Perry et al., 2017). These claims are alarming as laypeople may misunderstand the nature of PM research

and the limitations in the actual applications (Ratcliff, 2021). Such information may only stimulate public interest in the tangible benefits of PM, leading to a greater risk of harm (Woodbury et al., 2020).

Preventive benefits remained the second most discussed advantage of PM in the news, which was consistent with the content analysis of news articles published before March 2016 (Marcon et al., 2018). This result reflects the research approach of PM by integrating lifestyle and environmental factors into molecular biology (Khoury and Galea, 2016; Arena et al., 2018). Previous evidence indicates that preventive benefits were a leading reason that made PM attractive to racial and ethnic groups (Fisher et al., 2019). Thus, the finding suggests a positive role news media could play in helping underrepresented communities understand different benefits related to their health needs (Fisher et al., 2019; Chavez-Yenter et al., 2023).

The treatment benefit was frequently reported along with cancer, which could cater to widespread interest in PM-based cancer treatment (Ashley, 2015). However, fewer articles discussed other morbidities despite their far-reaching impacts, such as heart disease and mental health. As a result, social groups who are disproportionately affected by non-cancer diseases could feel alienated (Adams and Petersen, 2016; Fisher et al., 2019). Also, the emphasis on PM and cancer could undermine the informed consent of less knowledgeable participants (Parens, 2015; Adams and Petersen, 2016). Thus, to effectively engage diverse participants, news media should discuss PM in the context of different diseases and affected populations.

Furthermore, the issues unrelated to PM's treatment or medical functions were less covered in news articles. Also, news media did not actively engage with key players to discuss non-research issues, such as health policy, insurance, and economic opportunities. Because participants of different backgrounds need complete information to understand different aspects of PM (Post and Maier, 2016; Ginsburg and Phillips, 2018), the news media's failure to fulfill this critical responsibility could aggravate the mistrust of minorized communities in scientific research (Lee et al., 2019b). Thus, news media should actively explore social, ethical, and legal issues to support the engagement of diverse populations (Kitzinger, 1999; Post and Maier, 2016).

The result suggested the decreasing coverage of PM in recent years, which might reflect lower public awareness and interest in PM. It becomes necessary for other channels, such as health care providers and community outreach, to meet the information needs of the public to understand PM (Woodbury et al., 2020).

Lastly, it is important to point out that some population groups might not use English-language, general-interest print media to meet their information needs. For example, Spanish-language news media serves as a crucial source of information for Hispanic and Latino populations in the US (Gomez-Aguinaga et al., 2021). There is a gap in research on how these media portray PM and genetics-based health care (Chavez-Yenter et al., 2023). Also, recent survey data show that the percentage of Black or African Americans who consume television news was higher than other racial groups (Liedke and Wang, 2023). Evaluating television news could gain insight into the perception of PM in Black or African American communities. Additionally, as the main information source for young people, online news and social media present a valuable opportunity to assess young populations' understanding of PM (Woodbury et al., 2020). Thus, understanding how PM is presented across various media platforms is needed for developing effective communication strategies that can engage racially and culturally diverse participants in PM research.

Conclusion and limitation

In summary, the present study revealed several patterns and problems in the portrayal of PM in US print news media. A critical problem was the skewed representation of PM in the news, with benefits receiving significantly more press attention than potential risks. Also, cancer dominated news coverage but other critical health issues were largely overlooked. The findings raised the alarm that the misrepresentations of PM in news media could distort public understanding of PM and lower participation rates (Fisher et al., 2019; Hicks-Courant et al., 2021).

The study also highlighted the challenges that warrant the shared responsibility of stakeholder groups involved in PM to provide accurate and complete information through news media for diverse participants. When communicating with news media, scientists should emphasize the risks, harm, and limitations of PM research (Caulfield et al., 2016; Beskow et al., 2018; Ginsburg and Phillips, 2018). Research institutions and governmental agencies might leverage news media in education efforts to help the public understand the issues of PM, including the protection of patient data, that matter to diverse populations (Lee et al., 2019a). Community leaders could actively engage with news media to voice their needs and concerns (Lee et al., 2019a). The findings also suggested the responsibility of medical institutions to discuss clinically actionable PM programs only with news media (Beskow et al., 2018).

One limitation of this study is that news articles were sampled from general-interest print media in the US only. While this sampling frame was used to capture diverse news content relevant to the general public, it might not sufficiently gather the news from other sources that are consumed by different ethnic or specialized audiences. Thus, to fully understand how PM is presented to diverse populations, future research should sample news articles from different media platforms that can effectively reach various stakeholder groups.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Author contributions

WP: Conceptualization, Data curation, Formal analysis, Methodology, Resources, Supervision, Writing – original draft, Writing – review & editing. HS: Conceptualization, Formal analysis, Investigation, Methodology, Writing – original draft, Writing – review & editing. JC: Conceptualization, Investigation, Methodology. XJ: Conceptualization, Investigation.

Funding

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.

Supplementary material

The Supplementary material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fcomm.2024.1366952/full#supplementary-material

References

Adams, S. A., and Petersen, C. (2016). Precision medicine: opportunities, possibilities, and challenges for patients and providers. *J. Am. Med. Inform. Assoc.* 23, 787–790. doi: 10.1093/jamia/ocv215

Arena, R., Ozemek, C., Laddu, D., Campbell, T., Rouleau, C. R., Standley, R., et al. (2018). Applying precision medicine to healthy living for the prevention and treatment of cardiovascular disease. *Curr. Probl. Cardiol.* 43, 448–483. doi: 10.1016/j.cpcardiol.2018.06.001

Ashley, E. A. (2015). The precision medicine initiative: a new national effort. *JAMA* 313, 2119–2120. doi: 10.1001/jama.2015.3595

Basch, C. H., Hillyer, G. C., Samuel, L., Datuowei, E., and Cohn, B. (2023). Direct-to-consumer genetic testing in the news: a descriptive analysis. *J Community Genet.* 14, 63–69. doi: 10.1007/s12687-022-00613-z

Benjaminy, S., Kowal, S. P., MacDonald, I. M., and Bubela, T. (2015). Communicating the promise for ocular gene therapies: challenges and recommendations. *Am. J. Ophthalmol.* 160, 408–415.e2. doi: 10.1016/j.ajo.2015.05.026

Beskow, L. M., Hammack, C. M., and Brelsford, K. M. (2018). Thought leader perspectives on benefits and harms in precision medicine research. *PLoS One* 13:e0207842. doi: 10.1371/journal.pone.0207842

Brossard, D. (2013). New media landscapes and the science information consumer. *Proc. Natl. Acad. Sci. USA* 110, 14096–14101. doi: 10.1073/pnas.1212744110

Canedo, J. R., Miller, S. T., Myers, H. F., and Sanderson, M. (2019). Racial and ethnic differences in knowledge and attitudes about genetic testing in the US: systematic review. *J. Genet. Couns.* 28, 587–601. doi: 10.1002/jgc4.1078

Canedo, J. R., Wilkins, C. H., Senft, N., Romero, A., Bonnet, K., and Schlundt, D. (2020). Barriers and facilitators to dissemination and adoption of precision medicine among Hispanics/Latinos. *BMC Public Health* 20:603. doi: 10.1186/s12889-020-08718-1

Caulfield, T. (2018). Spinning the genome: why science hype matters. *Perspect. Biol. Med.* 61, 560–571. doi: 10.1353/pbm.2018.0065

Caulfield, T., and Condit, C. (2012). Science and the sources of hype. *Public Health Genomics* 15, 209–217. doi: 10.1159/000336533

Caulfield, T., Sipp, D., Murry, C. E., Daley, G. Q., and Kimmelman, J. (2016). Confronting stem cell hype. *Science* 352, 776–777. doi: 10.1126/science.aaf4620

Chakravarthy, R., Stallings, S. C., Williams, M., Hollister, M., Davidson, M., Canedo, J., et al. (2020). Factors influencing precision medicine knowledge and attitudes. *PLoS One* 15:e0234833. doi: 10.1371/journal.pone.0234833

Chavez-Yenter, D., Holton, A., Vega, A. S., Zamora, G., and Kaphingst, K. A. (2023). Ciencia, Genética, y ¿Desinformación?: a content analysis of genetic testing coverage from US Spanish-language news media. *J. Genet. Couns.* doi: 10.1002/jgc4.1747

Chyi, H. I., Yang, M. J., Lewis, S. C., and Zheng, N. (2010). Use of and satisfaction with newspaper sites in the local market: exploring differences between hybrid and online-only users. *J. Mass Commun. Q.* 87, 62–83. doi: 10.1177/107769901008700104

Collins, F. S., and Varmus, H. (2015). A new initiative on precision medicine. *N. Engl. J. Med.* 372, 793–795. doi: 10.1056/NEJMp1500523

Diamandis, E. P., and Li, M. (2016). The side effects of translational omics: overtesting, overdiagnosis, overtreatment. *Clin. Chem. Lab. Med.* 54, 389–396. doi: 10.1515/cclm-2015-0762

Dobmeier, C. M., Ophir, Y., Walter, D., and Hubner, A. Y. (2023). Mapping the media genome: an unsupervised machine learning analysis of news framing of direct-to-consumer genetic testing kits. *Mass Commun. Soc.*, 1–25. doi: 10.1080/15205436.2023.2240314

Entman, R. M. (1993). Framing: toward clarification of a fractured paradigm. *J. Commun.* 43, 51–58. doi: 10.1111/j.1460-2466.1993.tb01304.x

Erikainen, S., and Chan, S. (2019). Contested futures: envisioning "personalized," "stratified," and "precision" medicine. *New Genet. Soc.* 38, 308–330. doi: 10.1080/14636778.2019.1637720

Eveland, W. P., Seo, M., and Marton, K. (2002). Learning from the news in campaign 2000: an experimental comparison of TV news, newspapers, and online news. *Media Psychol.* 4, 353–378. doi: 10.1207/S1532785XMEP0404_03

Fisher, E. R., Pratt, R., Esch, R., and Kocher, M. (2019). The role of race and ethnicity in views toward and participation in genetic studies and precision medicine research in the United States: a systematic review of qualitative and quantitative studies. *Mol. Genet. Genomic Med.* 8:e1099. doi: 10.1002/mgg3.1099

Fletcher, R., and Nielsen, R. K. (2017). Are news audiences increasingly fragmented? A cross-National Comparative Analysis of cross-platform news audience fragmentation and duplication. *J. Commun.* 67, 476–498. doi: 10.1111/jcom.12315

Garrison, N. A., Brothers, K. B., Goldenberg, A. J., and Lynch, J. A. (2019). Genomic contextualism: shifting the rhetoric of genetic exceptionalism. *Am. J. Bioeth.* 19, 51–63. doi: 10.1080/15265161.2018.1544304

Ginsburg, G. S., and Phillips, K. A. (2018). Precision medicine: from science to value. *Health Aff.* 37, 694–701. doi: 10.1377/hlthaff.2017.1624

Gomez-Aguinaga, B., Oaxaca, A. L., Barreto, M. A., and Sanchez, G. R. (2021). Spanish-language news consumption and Latino reactions to COVID-19. *Int. J. Environ. Res. Public Health* 18:9629. doi: 10.3390/ijerph18189629

Google Trends (2004–2024). Precision medicine vs. personalized medicine. Google Trends. Available at: https://trends.google.com/trends/explore?date=all&q=precision%20medicine,personalized%20medicine (Accessed February 27, 2024).

Gwet, K. L. (2014). *Handbook of inter-rater reliability, 4th: the definitive guide to measuring the extent of agreement among raters.* Advanced Analytics, LLC. Available at: https://play.google.com/store/books/details?id=fac9BQAAQBAJ.

Gwet, K. L. (2022). irrCAC: computing chance-corrected agreement coefficients CAC. Comprehensive R Archive Network (CRAN). Available at: (https://cran.r-project.org/web/packages/irrCAC/index.html).

Hendy, K. (2024). Media framings of the role of genomics in "addiction" in the United States from 2015 to 2019: individualized risk, biomedical expertise, and the limits of destigmatization. *Public Underst. Sci.* 33, 158–173. doi: 10.1177/09636625231190743

Hicks-Courant, K., Shen, J., Stroupe, A., Cronin, A., Bair, E. F., Wing, S. E., et al. (2021). Personalized cancer medicine in the media: sensationalism or realistic reporting? *J Pers Med* 11:741. doi: 10.3390/jpm11080741

Iyengar, S. (1994). *Is anyone responsible?: How television frames political issues.* Chicago, Illinois, USA: University of Chicago Press.

Jameson, L. J., and Longo, D. L. (2015). Precision medicine—personalized, problematic, and promising. *Obstet. Gynecol. Surv.* 70, 612–614. doi: 10.1097/01.ogx.0000472121.21647.38

Juengst, E., McGowan, M. L., Fishman, J. R., and Settersten, R. A. Jr. (2016). From "personalized" to "precision" medicine: the ethical and social implications of rhetorical reform in genomic medicine. *Hast. Cent. Rep.* 46, 21–33. doi: 10.1002/hast.614

Khoury, M. J., and Galea, S. (2016). Will precision medicine improve population health? *JAMA* 316, 1357–1358. doi: 10.1001/jama.2016.12260

Kitzinger, J. (1999). Researching risk and the media. *Health Risk Soc.* 1, 55–69. doi: 10.1080/13698579908407007

Ko, N. Y., Snyder, F. R., Raich, P. C., Paskett, E. D., Dudley, D. J., Lee, J.-H., et al. (2016). Racial and ethnic differences in patient navigation: results from the patient navigation research program. *Cancer* 122, 2715–2722. doi: 10.1002/cncr.30109

Kosorok, M. R., and Laber, E. B. (2019). Precision Medicine. *Annu. Rev. Stat. Appl.* 6, 263–286. doi: 10.1146/annurev-statistics-030718-105251

Krippendorff, K. (2012). *Content analysis: an introduction to its methodology.* Thousand Oaks, CA: SAGE.

Landry, L. G., Ali, N., Williams, D. R., Rehm, H. L., and Bonham, V. L. (2018). Lack of diversity in genomic databases is a barrier to translating precision medicine research into practice. *Health Aff.* 37, 780–785. doi: 10.1377/hlthaff.2017.1595

Lee, S. S.-J., Cho, M. K., Kraft, S. A., Varsava, N., Gillespie, K., Ormond, K. E., et al. (2019a). "I don't want to be Henrietta lacks": diverse patient perspectives on donating biospecimens for precision medicine research. *Genet. Med.* 21, 107–113. doi: 10.1038/s41436-018-0032-6

Lee, S. S.-J., Fullerton, S. M., Saperstein, A., and Shim, J. K. (2019b). Ethics of inclusion: cultivate trust in precision medicine. *Science* 364, 941–942. doi: 10.1126/science.aaw8299

Liedke, J., and Wang, L. (2023). News platform fact sheet. Pew Research Center's Journalism Project. Available at: https://www.pewresearch.org/journalism/fact-sheet/news-platform-fact-sheet/?tabId=tab-4ef8dece-845a-4b25-8637-ceb3114503c5 (Accessed March 2, 2024).

Lombard, M., Snyder-Duch, J., and Bracken, C. C. (2002). Content analysis in mass communication: assessment and reporting of intercoder reliability. *Hum. Commun. Res.* 28, 587–604. doi: 10.1111/j.1468-2958.2002.tb00826.x

Ma, J., and Kannampallil, T. (2021). Getting more precise in public messaging on scientific and data uncertainties for precision medicine research. *Ann. Behav. Med.* 55, 1045–1047. doi: 10.1093/abm/kaab071

Maier, S. (2010). All the news fit to Post? Comparing news content on the web to newspapers, television, and radio. *J. Mass Commun. Q.* 87, 548–562. doi: 10.1177/107769901008700307

Marcon, A. R., Bieber, M., and Caulfield, T. (2018). Representing a "revolution": how the popular press has portrayed personalized medicine. *Genet. Med.* 20, 950–956. doi: 10.1038/gim.2017.217

Morosoli, J. J., Colodro-Conde, L., Barlow, F. K., and Medland, S. E. (2024). Scientific clickbait: examining media coverage and readability in genome-wide association research. *PLoS One* 19:e0296323. doi: 10.1371/journal.pone.0296323

National Research Council (2011). *Toward precision medicine: Building a knowledge network for biomedical research and a new taxonomy of disease. Committee on a Framework for Developing a New Taxonomy of Disease*. Washington D.C., USA: National Academies Press (US).

Parens, E. (2015). Drifting away from informed consent in the era of personalized medicine. *Hast. Cent. Rep.* 45, 16–20. doi: 10.1002/hast.470

Perry, J., Wöhlke, S., Heßling, A. C., and Schicktanz, S. (2017). Why take part in personalised cancer research? Patients' genetic misconception, genetic responsibility and incomprehension of stratification-an empirical-ethical examination. *Eur. J. Cancer Care* 26:e12563. doi: 10.1111/ecc.12563

Peters, H. P., and Dunwoody, S. (2016). Scientific uncertainty in media content: introduction to this special issue. *Public Underst. Sci.* 25, 893–908. doi: 10.1177/0963662516670765

Pokorska-Bocci, A., Stewart, A., Sagoo, G. S., Hall, A., Kroese, M., and Burton, H. (2014). "Personalized medicine": what's in a name? *Per. Med.* 11, 197–210. doi: 10.2217/pme.13.107

Post, S., and Maier, M. (2016). Stakeholders' rationales for representing uncertainties of biotechnological research. *Public Underst. Sci.* 25, 944–960. doi: 10.1177/0963662516645039

Prasad, V. (2016). Perspective: the precision-oncology illusion. *Nature* 537:S63. doi: 10.1038/537S63a

ProQuest (2022). ProQuest global Newsstream. ProQuest. Available at: https://about.proquest.com/en/products-services/globalnewsstream/ (Accessed September 9, 2022).

Ratcliff, C. L. (2021). Communicating scientific uncertainty across the dissemination trajectory: a precision medicine case study. *Sci. Commun.* 43, 597–623. doi: 10.1177/10755470211038335

Sabatello, M., Callier, S., Garrison, N. A., and Cohn, E. G. (2018). Trust, precision medicine research, and equitable participation of underserved populations. *Am. J. Bioeth.* 18, 34–36. doi: 10.1080/15265161.2018.1431328

Sumner, P., Vivian-Griffiths, S., Boivin, J., Williams, A., Venetis, C. A., Davies, A., et al. (2014). The association between exaggeration in health related science news and academic press releases: retrospective observational study. *BMJ* 349:g7015. doi: 10.1136/bmj.g7015

Tabor, H. K., and Goldenberg, A. (2018). What precision medicine can learn from rare genetic disease research and translation. *AMA J. Ethics* 20, E834–E840. doi: 10.1001/amajethics.2018.834

Williams, J. R., Yeh, V. M., Bruce, M. A., Szetela, C., Ukoli, F., Wilkins, C. H., et al. (2018). Precision medicine: familiarity, perceived health drivers, and genetic testing considerations across health literacy levels in a diverse sample. *J. Genet. Couns.* 28, 59–69. doi: 10.1007/s10897-018-0291-z

Wongpakaran, N., Wongpakaran, T., Wedding, D., and Gwet, K. L. (2013). A comparison of Cohen's kappa and Gwet's AC1 when calculating inter-rater reliability coefficients: a study conducted with personality disorder samples. *BMC Med. Res. Methodol.* 13:61. doi: 10.1186/1471-2288-13-61

Woodbury, R. B., Beans, J. A., Wark, K. A., Spicer, P., and Hiratsuka, V. Y. (2020). Community perspectives on communicating about precision medicine in an Alaska native tribal health care system. *Front. Commun.* 5:70. doi: 10.3389/fcomm.2020.00070