

POLICY

Stem cell hype: Media portrayal of therapy translation

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In this Perspective, we examine the portrayal of translational stem cell research in major daily newspapers in Canada, the United States, and the United Kingdom between 2010 and 2013, focusing on how timelines for stem cell therapies were represented before and after Geron terminated its pioneering stem cell program. Our content analysis reveals that press coverage has shifted from ethical, legal, and social issues to clinical translation issues, and highly optimistic timelines were provided with no substantial change in representation over time. Scientists were the dominant voice with respect to translation timelines. The findings raise questions about the degree to which the media's overly optimistic slant fosters unrealistic expectations regarding the speed of clinical translation and highlight the ethical responsibility of stem cell researchers as public communicators.

In the past, the stem cell controversy centered primarily on the destruction of human embryos for derivation of human embryonic stem cell (hESC) lines. Recently, the clinical translation of stem cell (SC) research has raised new policy concerns, such as the management of cell lines and marketing of unproven treatments (1, 2). There is broad consensus that SC therapeutics will constitute a major treatment modality for degenerative diseases and other life-threatening conditions (3–5), although many recognize that substantial further investment and research is needed to realize the extraordinary potential of SCs (6–8). The field has witnessed numerous translational challenges and setbacks, and premature or inappropriate clinical translation continues to be a major issue (9). Hematopoietic stem cell transplantation for leukemia, lymphoma, and genetic blood disorders such as thalassemia and lymphoma remains the only established and effective SC therapy (9). Although the number of registered clinical trials has increased dramatically between 2004 and 2011, 87% of the 1058 trials with new applications of SC therapy are in the safety-testing stage and involve a limited number of participants (10).

Previous analyses established a discrepancy between the current reality in translational SC research and how therapeutic advances are represented in the media and perceived by the general public. Although

most clinical trials over the past decade have used SCs for the treatment of cancer and graft-versus-host disease, media coverage has focused extensively on applications for neurological conditions, cardiovascular diseases, and diabetes (11). A longitudinal study of the media framing of biotechnology news in the United States and the United Kingdom shows a bias in reporting biomedical discoveries, which commonly are portrayed more favorably than agricultural biotechnology (12). Public expectations remain

heightened, with opinion polls indicating that expectations about benefits associated with SC therapies outweigh perceptions of risks (13, 14). A recent online survey conducted in Japan ($n = 14,908$ respondents) revealed that 65.4% of the respondents believed regenerative medicine would become a reality within the next 10 years (15).

Here, we examine the newspaper portrayal of translational SC research from 1 January 2010 to 31 December 2013 to determine how advances in clinical translation were reported, what timelines for therapies were provided, and the overall perspective on the future of SC research. A major setback for translational SC research occurred during our study time frame, when Geron Corporation announced termination of its pioneering stem cell program on 14 November 2011. This termination put an end to the much-publicized first U.S. Food and Drug Administration (FDA)-approved clinical trial of hESC-derived treatment for spinal cord injuries. The trial had shown dramatic results in animal studies and no safety concerns during phase 1 trial with human participants (16). Geron had funded studies that led to the first hESC lines and invested heavily in translational research. Its decision to cease the development of SC therapeutics highlighted challenges faced by current

Table 1. Newspapers included in the analyzed articles data set.*

Newspapers	Country	Number (n)	Percentage
<i>Globe and Mail</i>	Canada	22	7.2
<i>Montreal Gazette</i>	Canada	6	1.9
<i>National Post</i>	Canada	8	2.6
<i>Toronto Star</i>	Canada	8	2.6
<i>Vancouver Sun</i>	Canada	33	10.5
<i>The New York Times</i>	USA	28	8.9
<i>USA Today</i>	USA	11	3.5
<i>The Wall Street Journal</i>	USA	34	10.9
<i>The Washington Post</i>	USA	8	2.6
<i>The Daily Telegraph</i>	UK	35	11.2
<i>Financial Times</i>	UK	37	11.8
<i>The Guardian</i>	UK	20	6.4
<i>The Independent</i>	UK	21	6.7
<i>The Times (London)</i>	UK	36	11.5
Total		307	100.0

*Of the 307 articles analyzed, 25.1% of the articles were published in Canada, 26.7% in the United States, and 48.2% in the United Kingdom. In the pre-Geron data set, 22.5% of the news reports were from Canada, 28.1% from the United States, and 49.4% from the UK. In the post-Geron data set, 28.6% of the articles were published in Canada, 27.1% in the United States, and 44.4% in the UK, with 11 out of these 17 articles characterizing it as a setback for the field.

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Table 2. Intercoder agreement on key analytical categories.*

Coding frame question	Cohen's κ	Number (n) of valid cases
10a. Did the article discuss timelines for the realization of the clinical promise of stem cell research (e.g., in reference to clinical trials, breakthroughs in research, animal studies, veterinary medicine, experimental treatments/transplants)?	0.675	32
10b. If yes, what was the timeframe suggested?	0.613	32
14. What was the major theme of the article?	0.718	32
15. What was the overall perspective on the future of stem cell research presented by the article?	0.705	32
Mean κ score	0.677	32

*The level of agreement between coders was interpreted based on the Landis & Koch Benchmark Scale proposed in 1977. This scale has established the following as standards for strength of agreement denoted by κ : <0 = "poor," 0.01 to 0.20 = "slight," 0.21 to 0.40 = "fair," 0.41 to 0.60 = "moderate," 0.61 to 0.80 = "substantial," and 0.81 to 1 = "almost perfect."

business models in the field of regenerative medicine (16). In order to establish whether the media hype surrounding SCs has subsided as a result of this setback, we analyzed media coverage before and after this event.

FRAMING OF SCIENCE

Mass media are the primary source of science communication to the public and can influence public attitudes toward controversial biomedical technologies (17, 18). Two interrelated processes in news production—framing and agenda-setting—provide a framework within which to analyze the impact of media content on audiences and public discourse in general. The framing theory emphasizes the selective presentation in media coverage of specific topics, facts, controversies, actors, and assertions in news stories (19, 20). Frames are routinely used in news reporting to bring attention to some aspects of reality while diverting attention from other elements (19). Through their agenda-setting effects, the news media can lend salience to an issue, frame the public discourse around it, and thus can influence, albeit indirectly, public opinion and policy-making. The agenda-setting theory has established that although mass media cannot tell people what to think, they can still influence how people think through selective highlighting of some issues for public debate and exclusion of others (21). The policy implications of media representations of biomedical discoveries could be substantial because overtly optimistic assessments can create unrealistic societal expectations and thus affect how technology is implemented (22).

We used the Factiva database to collect news reports with the following search terms: "stem cell research" AND ("breakthrough" or "treatment" or "cure" or "clinical trial"). Searches were limited to major newspapers in each country that are renowned for high-quality reporting, nationwide circulation, and popularity with the public. The search generated a population of 800 articles. For our analysis, we removed duplicate articles, nonarticles (such as content summaries and stock quotes), and topically irrelevant articles. Articles were considered irrelevant if there were no mentions of clinical trials, scientific advances, timelines for SC therapies, or more general discussions about the clinical promise or future of SC research (including its social, ethical, and policy implications). The final data set consisted of 307 publications (Table 1).

We conducted an initial in-depth analysis to identify coding categories (23) and how the press framed timelines. All analytical categories were then defined in a codebook, and content analysis was conducted by use of both quantitative and qualitative methods. We used (i) quantitative content analysis to determine frequencies of coverage by country, mentions of clinical trials, specific timelines for SC therapies, who was cited about timelines, types of SCs discussed, and mentions of Geron's clinical trials and (ii) qualitative assessment to identify the article's major theme and overall perspective on the future of SC research (that is, optimistic, pessimistic, or neutral/descriptive). In addition to the 307-article analysis, we compared press coverage before and after 14

November 2011, when Geron announced termination of its SC program. Two data sets were analyzed separately: (i) 160 news reports over 2 years of "pre-Geron" coverage (1 January 2010 to 13 November 2011) and (ii) 133 over 2 years of post-Geron coverage (1 January 2012 to 31 December 2013). All articles ($n = 14$ articles) published between 14 November 2011 and 31 December 2011 reported Geron's decision and were examined to assess how the press interpreted the future of translational SC research in the light of this story. An independent coder coded 10% of the article data set (Table 2) ($n = 32$ articles), and interrater agreement was assessed by using Cohen's kappa (κ). Scores on analytical categories that could yield interpretive differences ranged from $\kappa = 0.61$ to $\kappa = 0.71$ (Table 2), indicating substantial interrater agreement.

The dominant theme in 37.1% of the articles was clinical translation. New discoveries were the major topic of 22.8%; funding, policy, and regulatory issues of 11.4%; general discussions of the potential of SCs for regenerative medicine in 11.1%; and other related concerns (such as the use of SCs in cosmetics, the food industry, and in veterinary medicine) in 14%. Only 1.6% focused specifically on ethical issues. hESCs were discussed in 21.5% of the articles, induced pluripotent stem cells (iPSCs) in 12.1%, cord blood stem cells in 2.9%, other tissue-specific stem cells (for example, bone-marrow, mesenchymal stem cells, adipose-derived stem cells, or neural stem cells) in 23.8%, and multiple types in 18.9%; 20.8% referred broadly to stem cells without specifying types or sources.

Clinical trials were mentioned in 52.8% of the 307 articles (10.8% in Canada, 13.7% in the United States, and 28.3% in the United Kingdom), and 28.3% of all news stories suggested specific timelines for stem cell therapies (7.8% in Canada, 5.2% in the United States, and 14.7% in the United Kingdom) (Fig. 1). Scientists were cited in 69% of all reports mentioning timelines, whereas 10.3% cited industry, government, or other experts. Journalists indicated timelines without supporting evidence in 20.7%. Interestingly, 69% of all news reports that provided timelines predicted that the clinical promise of SC research would be realized within 5 to 10 years or sooner, just around the corner, or in the near future. When we correlated the type of source and the timeline suggested, we found that the following sources were cited in support of optimistic

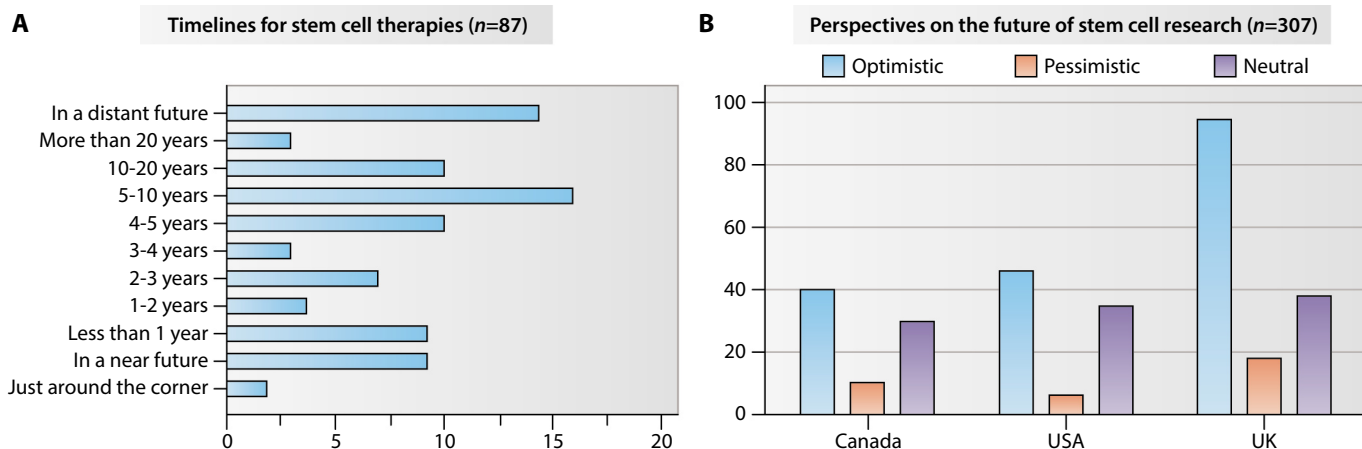


Fig. 1. Forecasting the future. (A) Suggested timelines for SC therapies. The categories “soon,” “just around the corner,” “in a near future,” and “in the distant future” indicate definitional ambiguity in the news stories concerning particular time frames ($n = 307$ articles). (B) Perspectives on the future of SC research in Canada, the United States, and the United Kingdom ($n = 307$ articles). The perspectives were divided into the three categories on the basis of the analysis shown in (A). Optimistic = 57.7%, pessimistic = 10.4%, and neutral = 31.9%.

predictions (5 to 10 years or sooner, just around the corner, or in the near future): 44.3% scientists, 17.6% journalists, 4.7% industry, 1.2% government, and 1.2% other.

Geron’s clinical trial of an hESC-derived treatment for spinal cord injuries was mentioned in 11.7% of the 307 articles analyzed. The company’s decision to halt its stem cell program was discussed in 5.5% of articles, with 11 of the 17 articles characterizing it as a setback for the field. Timelines were indicated in 29 articles in pre-Geron press coverage, with 69.7% predicting clinical translation of SC research within 5 to 10 years or sooner, just around the corner, or in the near future. The post-Geron data set included 57 news reports mentioning timelines, with 61.1% predicting SC therapies within 5 to 10 years or sooner, just around the corner, or in the near future. The most frequently cited timeline in the pre-Geron publications was within 5 to 10 years (24.1%), and post-Geron press coverage most often indicated that therapies will emerge in the distant future (19.3%). Scientists provided authoritative statements about timelines in 62% of the articles that mentioned timelines in the pre-Geron data and in 72% of the post-Geron data.

The overall perspective on the future of SC research was optimistic in 57.7% of the publications; 31.9% reported issues in a neutral tone, and 10.4% expressed pessimism. There were similarities in the tone of coverage between countries (Fig. 1B). An optimistic perspective was provided in 60.6% of the pre-Geron news reports, whereas 26.3% adopted a neutral or descriptive tone, and

13.1% adopted a pessimistic perspective. In Canada, the slant was positive in 55.6% of the reports, neutral in 25%, and pessimistic in 19.4%; in the United States, it was optimistic in 51.1%, neutral in 42.2%, and pessimistic in 6.7%; and in the United Kingdom, 68.4% were optimistic, 13.9% were neutral, and 17.7% were pessimistic. Similarly, 54.9% of the post-Geron news stories were optimistic, 38.8% neutral, and 6.8% pessimistic. Distribution by country was as follows: Canada, 47.4% optimistic, 44.7% neutral, and 7.9% pessimistic; United States, 52.8% optimistic, 38.9% neutral, and 8.3% pessimistic; and United Kingdom, 61% optimistic, 33.9% neutral, and 5.1% pessimistic.

MEDIA’S OPTIMISTIC SLANT

We noted similarities in the media portrayal of translational SC research in the three countries. The most distinctive difference is the significantly higher volume of press coverage in the United Kingdom (48.2% of all news articles). Overall, the news reporting on the clinical translation of SC therapies between 2009 and 2013 has remained optimistic and very much in tune with the predominantly optimistic slant in media reporting of emerging technologies in biomedicine and heightened public expectations established by previous studies (12–15). Remarkably, 69% of all news reports that indicated timelines predicted that SC therapies will be available within 5 to 10 years or sooner, just around the corner, or in the near future.

The analysis of pre- and post-Geron coverage showed no substantial changes in ex-

pectations. We observed a slight change that indicated an emergence of caution: Whereas only 10% of the pre-Geron predictions indicated an expectation of SC therapies in the distant future, this number increased to 19% in the post-Geron data.

Another key finding was the shift from ethical, legal, and social issues, which were central to media framing and public debates in the past, to stories about clinical translation (37.1%) and new discoveries (22.8%). Previous research on the evolution of the SC controversy has established that questions concerning the moral status of the human embryo and reproductive cloning no longer dominate public, policy, or scholarly debates; rather, clinical translation and new ethical issues arising from it have become increasingly important (1, 24). Although this change in media framing may be suggestive of the field’s normalization, the tendency to not focus on ethical and policy considerations will likely have implications, for better or worse, on the tone and nature of future public and policy debates.

Another important characteristic of media coverage between 2010 and 2013 was that only 21.5% of the articles reported exclusively about hESCs. When placed in the context of past research, this points to an interesting change in print media discourse. Research has shown that hESCs dominated discussions in the U.S. press in the early years of discovery, in 52.8% of the news reports from 1998 to 2000, and in 74.7% in 2001 when the political controversy reached its peak (25). Similarly, a review of 13,249 articles in English-language newspapers

published between 1991 and 2010 in Canada, the United States, the United Kingdom, and other countries has established that hESCs were the focus of coverage from 1998 to 2010 (11).

Our analysis shows an optimistic slant toward the future of translational SC research (57.7% of the news reports), which remained steady in both pre- and post-Geron press coverage. Print media discourse, therefore, is not an accurate reflection of the realities in clinical translation of SC therapies. This observation further raises questions about the degree to which this high optimism in media coverage might be adding to the fostering of unrealistic expectations regarding the speed of clinical translation but also to the dynamic of hope that underpins a global market for unproven SC therapies (26).

Given that media professionals traditionally rely on the scientific community as a major source of science news, our finding that scientists have provided, in most cases, authoritative statements, either by implication or through a direct quote, regarding unrealistic timelines for SC therapies raises a more general concern about the role of scientists as public communicators. There is clearly a need to raise awareness among translational SC researchers regarding the importance of conveying realistic translation timelines to the popular press.

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