

This isn't going to end well: Fictional representations of medical research in television and film

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Abstract

Fictional television shows and films convey cultural assumptions about scientists and the research enterprise. But how do these forms of entertainment portray medical research participants? We sampled 65 television shows and films released between 2004 and 2014 to determine the ways in which medical research and human participants are represented in popular media. We found that research participants are largely represented as White, male, and lower or working class and that 40% of the participants depicted in these fictional accounts were seeking financial compensation, 34% were hoping for a therapeutic benefit, and 15% were coerced into participation. Regardless of participant motivation, media representations tended to portray a negative outcome of medical research. Interpreting the themes in these media, we argue that these fictional portrayals might provide the public with valuable representations of medical research, especially in terms of risks to research participants, scientific failure, and researchers' conflicts of interest.

Keywords

class, clinical trials, film, gender, medical research, race, risk, television

1. Introduction

In Fall 2012, as established and new television shows were making their season premieres, a leading figure from the clinical trials industry announced that television was mounting an “assault on medical research.” Blogging for the *Huffington Post*, the executive director of the Association of Clinical Research Organizations (ACRO),¹ Doug Peddicord (2012), described a trend of harmful

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representations of clinical trials infusing the airwaves in television shows and advertisements. He expressed concern that these shows and advertisements failed to depict the rigorous oversight of clinical trials that makes medical research both legitimate and safe for human participants. Moreover, Peddicord argued that the demeaning representations of research participants—epitomized in “insulting and offensive” labels like “guinea pigs” and “test monkeys”—detracted from their true status as “medical heroes.” This industry counternarrative has been adopted more broadly in recruitment of research participants to emphasize the important role they play in scientific progress and to increase the visibility of “the brave individuals who give the gift of clinical research participation [and] are all around us” (Getz, 2013: 23).

As backdrop to the industry’s preoccupation with these representations of research is its concern that negative depictions create a barrier to participants’ involvement in clinical trials. In a follow-up interview, John Lewis, a spokesman for ACRO, explained,

I think we made our point that that kind of negative image is damaging to what we’re trying to do [as an industry]. We don’t want people to think we don’t have a sense of humor, but when we see these things going over the line, that’s when we think we have to step in. (Quoted in Redfearn, 2012)

Thus, for ACRO, the media’s deployment of false representations of clinical trials for the purpose of entertainment is an assault on medical research.

ACRO’s anxiety betrays an assumption that these forms of media are not merely entertainment but that they actively shape the public’s perceptions and understandings of science. This raised an empirical question for us: How is medical research actually represented in fictional media? Beyond what could be classified as putatively “positive” or “negative” depictions of medical research, we wondered who is represented as research participants and how clinical trials are inserted into storylines. To fill this empirical void, we analyzed 65 television episodes and feature films that were aired or released between 2004 and 2014 to determine the ways in which medical research is incorporated into these media; how research participants are represented in terms of gender, race, and class; and how participants’ motivations to enroll in research as well as the outcome of their participation are depicted. Our findings reveal that research participants are primarily represented as White, male, and lower or working class. Moreover, our analysis suggests quantitative and qualitative differences in how these media mobilize social position to tell stories about research participants’ financial versus therapeutic desperation, voluntary versus coerced study enrollment, and positive versus negative outcomes of the studies. Despite industry concerns about false depictions of clinical trials, we argue that dramatic portrayals of medical research might provide the public with valuable representations of risks to research participants, scientific failure, and researchers’ conflicts of interest. While unflattering for organizations like ACRO, these representations of research may provide a counterbalance to the hopeful and dogmatic narratives promulgated by industry leaders.

2. TV, film, and public understandings of science

Concern about how fictional media affect public understandings of science is a longstanding preoccupation among different interest groups. On one hand, some have argued that popular representations of science help to inspire the next generation of scientists because children and youth are given the tools to imagine a future career in science (Long et al., 2001; Steinke, 1997; Van Gorp et al., 2014). The evidence to support this claim is often difficult to interpret. For example, the popularization of forensics through television shows like CSI (“Crime Science Investigation”) has been credited in not only dramatically increasing enrollment in related educational programs but also

contributing to poor retention rates when students find that there is more science and less “glamour” than depicted on television (Cole, 2015; Cole and Dioso-Villa, 2007). Fictional and dramatized non-fictional television shows and feature films have also been said to bring public awareness to wide-scale problems that would otherwise stay relegated to scientific discussion (Jensen, 2008; Kirby, 2003; Lowe et al., 2006). For example, fictionalized portrayals of climate change have been said to help the public understand what is at stake in the future should countermeasures not be taken to slow or reverse its effects (Lowe et al., 2006). As such, television and film are often regarded as highly effective pedagogical tools for the science classroom (Farré et al., 2004; Rose, 2003).

On the other hand, however, others worry that dramatized versions of science create ignorance, especially in distracting audiences from real scientific information about which an educated populace should have working knowledge (Bourdaa et al., 2015; Dingwall and Aldridge, 2006; O’Neill, 2006). Even documentaries and news segments can give too much credibility to non-mainstream science or pseudo-science, such as when describing the medical options for patients with attention deficit hyperactivity disorder (ADHD) (Bourdaa et al., 2015) or the evolution versus “intelligent design” of species (Dingwall and Aldridge, 2006). In a similar vein, popular depictions of scientists have also prompted audiences to form more negative views of science (Dudo et al., 2010) or particular types of scientists (Chimba and Kitzinger, 2010; Orthia, 2010). Thus, popular media have the potential to skew public support in favor of or against different research trajectories (O’Neill, 2006; Reid, 2012).

Part of the tension in the question about the relationship between mass media and science is the degree to which television and film educate versus engage the public. Even within science and technology studies (STS), there remain debates about what the public is supposed to understand about science, how scientific governance should operate, and how to reconcile competing forms of expertise between scientists and lay communities (see Stilgoe et al., 2014). Despite interest in connecting popular media to public understandings of science, most empirical research has analyzed the content and meanings of media representations because it is much more challenging to assess the effects of the media on viewers’ perceptions of or attitudes toward science (Schäfer, 2012). One important exception to this has been with inquiry into the so-called “CSI Effect” or the television show’s alleged tainting of juries by creating misconceptions about forensic science’s ability to provide unambiguous and accurate information (Cole and Dioso-Villa, 2007). Cole and Dioso (2011) assert that the CSI effect does not bear out in evidence of actual courtroom proceedings, but the news media nonetheless continue to credit such an effect when prosecutors lose their cases against criminals (Cole, 2015). Interestingly, news media critiques of the false promises of forensics as depicted in CSI might actually lack nuance because Ley et al. (2010) found through content analysis of the television shows that characters are, in fact, shown to question the importance of DNA in solving cases and the assumption that humans are reducible to their DNA.

This study has similarities to these scholarly inquiries into the CSI effect. Rather than try to measure the effects of television and film representations of medical research on “the public,” we are interested in how the content of fictional media compares to the criticism from the clinical trials industry that television has made an assault on medical research. Additionally, by examining these popular depictions of medical research for more nuanced themes about who enrolls as research subjects and what outcomes they experience, we explore the implications of such representations for how diverse publics could engage—if not understand—medical research as a form of science.

3. Methods

This study analyzed television shows and films that feature research participants in medical research and clinical trials. We set the scope of our sample to include only fictional media aired or released in English between 2004 and 2014 that depict clinical trials or medical research participants

Table 1. Sample of media portraying medical research subjects, 2004–2014 (sorted alphabetically with date of production/air date as well as season and episode numbers when relevant).

1. <i>2 Broke Girls</i> (S1, E20) 2012	29. <i>House of the Dead 2</i> 2005	55. <i>Testeos</i> (S1, E7) 2008
2. <i>All Saints</i> (S12, E6) 2009	30. <i>House, M.D.</i> (S5, E3) 2008	56. <i>Testeos</i> (S1, E8) 2008
3. <i>American Dad!</i> (S4, E8) 2009	31. <i>House, M.D.</i> (S5, E11) 2008	57. <i>Testeos</i> (S1, E9) 2008
4. <i>Archer</i> (S3, E5) 2012	32. <i>House, M.D.</i> (S5, E14) 2009	58. <i>The Amazing Spiderman</i> 2012
5. <i>Bipolar</i> 2014	33. <i>Inspector Lewis</i> (S5, E3) 2011	59. <i>The Big Bang Theory</i> (S1, E15) 2008
6. <i>Blind Dating</i> 2006	34. <i>Inspector Lewis</i> (S6, E1) 2012	60. <i>The Big C</i> (S2, E2) 2011
7. <i>Boston Legal</i> (S2, E11) 2006	35. <i>It's Always Sunny in Philadelphia</i> (S9, E8) 2013	61. <i>The Big C</i> (S2, E4) 2011
8. <i>Bug</i> 2006	36. <i>Law & Order</i> (S15, E4) 2004	62. <i>The Facility</i> 2012
9. <i>Control</i> 2004	37. <i>Law & Order: SVU</i> (S10, E1) 2008	63. <i>The Normals</i> 2012
10. <i>Dallas Buyers Club</i> 2013	38. <i>Leverage</i> (S3, E5) 2010	64. <i>Two and a Half Men</i> (S5, E5) 2007
11. <i>Diagnosis Death</i> 2009	39. <i>Lost Girl</i> (S2, E15) 2012	65. <i>Vile</i> 2011
12. <i>Drop Dead Diva</i> (S5, E1) 2013	40. <i>Malcolm in the Middle</i> (S6, E20) 2005	
13. <i>Extraordinary Measures</i> 2010	41. <i>Max Payne</i> 2008	
14. <i>Extreme Cheapskates</i> (S2, E3) 2013	42. <i>Murdoch Mysteries</i> (S7, E5) 2013	
15. <i>Fresh Meat</i> (S3, E4) 2013	43. <i>No Angels</i> (S3, E3) 2006	
16. <i>Fringe</i> (S1, E17) 2009	44. <i>PMS Cop</i> 2014	
17. <i>Fringe</i> (S1, E6) 2008	45. <i>Push</i> 2009	
18. <i>Grey's Anatomy</i> (S4, E13) 2008	46. <i>Rise of the Planet of the Apes</i> 2011	
19. <i>Grey's Anatomy</i> (S4, E14) 2008	47. <i>Special</i> 2006	
20. <i>Grey's Anatomy</i> (S4, E15) 2008	48. <i>Subject Two</i> 2006	
21. <i>Grey's Anatomy</i> (S4, E16) 2008	49. <i>Testeos</i> (S1, E1) 2008	
22. <i>Grey's Anatomy</i> (S4, E17) 2008	50. <i>Testeos</i> (S1, E2) 2008	
23. <i>Grey's Anatomy</i> (S7, E13) 2011	51. <i>Testeos</i> (S1, E3) 2008	
24. <i>Grey's Anatomy</i> (S7, E16) 2011	52. <i>Testeos</i> (S1, E10) 2008	
25. <i>Grey's Anatomy</i> (S7, E17) 2011	53. <i>Testeos</i> (S1, E12) 2008	
26. <i>Grey's Anatomy</i> (S7, E19) 2011	54. <i>Testeos</i> (S1, E13) 2008	
27. <i>Grey's Anatomy</i> (S7, E22) 2011		
28. <i>Grey's Anatomy</i> (S8, E7) 2011		

and excluded all non-medical experiments. We excluded documentaries from our sample in order to tap into the types of media representations that ACRO found so problematic. Following other media studies (e.g. Steinke, 2005), to locate relevant media we used the online movie database imdb.com and conducted multiple searches using keywords like “human guinea pig,” “human test subject,” “medical research,” and “clinical trial.” A total of 103 distinct television episodes and films were identified using this method. We used a number of online rental and streaming services to access the content, including Netflix, Hulu, Amazon Instant Video, and Crackle, as well as network websites and YouTube. Among the 103 items identified, 20 were unavailable through these services. In addition, 18 of the 103 items were deemed irrelevant to the study after viewing because they did not actually depict medical research subjects. This left 65 television episodes and films as our final sample (Table 1).

We divided the media items in our sample and independently collected data on the genre of the media item; the race, gender, class, and motive of the participants represented; and the depiction of informed consent for and the outcome of the research. Race and gender were classified based on the viewer’s assessment using visual cues as well as explicit references to race and nationality. Socioeconomic class was not always discernible from the content, but occupations and/or material possessions were the primary cues used to determine a subjects’ socioeconomic class whenever possible. We quantified these assessments to more easily test for differences based on social position by importing the data into the statistical program SPSS. As in other analyses of representations of science (e.g. Christidou and Kouvatas, 2013), we used a chi-square test to detect and interpret statistical relationships between these group categories and motives (Agresti and Finlay, 2009).

Splitting our sample into three timeframes with roughly equivalent numbers of test subjects, we also tested if and how representations of test subjects may have changed between 2004 and 2014.

Along with quantitative analysis, we also analyzed media items using strategies in line with “qualitative media analysis” (Altheide, 1996) to capture broad themes about how medical research was integrated into the broader content of the television show or film, the ways in which relationships among researchers and participants were depicted, and how participants’ experiences in the research study were represented. Our methods are based on an interpretive understanding of popular media as sites where cultural discourses on medical research are communicated. Specifically, we used both pre-structured categories to initially code media items and then inductively refined our categories based on the data. For classifying motives, for example, we initially coded for “financial,” “therapeutic,” “coercion,” “altruism,” and “other.” We then inductively saw a pattern of “non-financial personal gain” and “unclear motive” categories emerge from the data. Similarly for research outcome, we deductively categorized each media item as “positive,” “negative,” “mixed,” and “unknown” while also writing detailed descriptions of those outcomes. We determined the outcome based on how well the research turned out for the participant. Outcomes such as death and severe side effects were negative while a cure was positive. The category “mixed” allowed us to capture instances when the result of the research had both positive and negative elements. This classification process allowed us to see patterns in how these outcome types were represented, especially while we attended to differences along characters’ gender, race, and class.

Additionally, we took notes on scenes in these media items that had important framings of medical research, such as characters talking about how risky research participation is and how easy a source of money it is. In order to better capture how medical research was perceived by the characters, we also transcribed relevant dialogue for additional analysis. The combination of a quantitative and qualitative content analysis of these 65 television episodes and films facilitated finding broad patterns in these representations of medical research as well as discovering nuanced differences in the array of television and film genres that depict medical research.

4. Results: TV and film representations of medical research, 2004–2014

Our review of the 65 English-language television episodes and films included in our sample revealed diverse storylines incorporating medical research over the past decade. From desperate patients seeking miracle cures to unwitting victims caught in evil military experiments to cash-strapped but healthy individuals seeking financial gain, medical research representations took multiple forms. Distributed across genres, 40% of the media we viewed were dramas ($n=26$), 32% were comedies ($n=21$), 15% were horror/thrillers ($n=10$), and 12% were action or crime-themed ($n=8$). An interesting characteristic of this sample is that medical research served many roles in these television shows and films. In some cases, a clinical trial was central to the story, whereas in others, medical research was merely a background element or small subplot in an otherwise unrelated story. Despite this diversity, there were notable patterns in how medical research was represented even across genres. First, a strong commonality across the media was in who demographically were depicted as research participants as well as how participants’ motives were embedded in stories. Second, medical research was woven into stories primarily to highlight negative outcomes of research and the vulnerability or victimhood of participants, which—intentionally or not—created plots focusing on risks to participants, failure of investigational drugs or techniques, and conflicts of interest inherent in pharmaceutical companies’ and clinicians’ financial or personal investment in their research. This section explores these two aspects of our findings

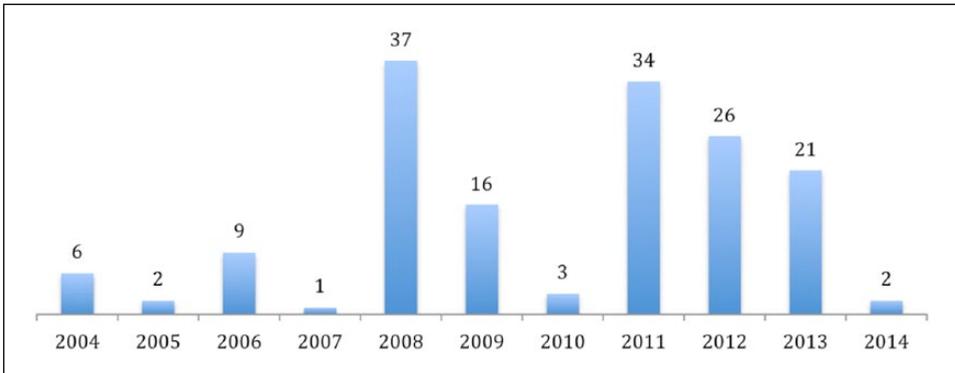


Figure 1. Number of test subjects per year of media release/air date ($N = 157$).

providing both quantitative data of the entire dataset and more in-depth descriptions of illustrative television episodes or films.

Media profile of fictional research participants

The characters in our sample are portrayed in stereotypically gendered, raced, and classed positions. A total of 157 subjects were depicted across the 65 media items (Figure 1),² and these representations of research participants were skewed heavily as male, White, and working class (see Table 2). Actual clinical trials are often criticized for their poor representation of women and minorities as research participants (e.g. Wendler et al., 2006; Yang et al., 2009), making diversifying clinical trials a focus of federal intervention as part of research funded by the US National Institutes of Health (Epstein, 2007). Media representations of clinical trial participants have lagged behind these changes with the vast majority of subjects cast in television shows and films using male and White actors. Of the 157 participant representations, 68% were men or boys, 31% were women or girls, and 1 subject was a transwoman (whom we classified as a woman for analytic purposes).³ Most of the characters were adults or in their late-teens, but four children were also depicted in the sample. The lack of diversity was worse for racial and ethnic representation in these media; a stunning 87% of the research participants depicted were White. Among the non-White research participants, eight were Black, five Asian, three Indian (South Asia), two biracial, two Hispanic, and one described as Iranian.⁴ In fictional media more broadly, however, the representation of research participants is likely reflective of trends toward characters being predominantly White, but it is nonetheless lower than the general representation of minorities on television (Tukachinsky et al., 2015).

Unlike gender and race, it was more difficult to assess research participants' socioeconomic class. Indeed, one-third of our sample had no clear markers of class. Other characters, however, were easily identified as students, teachers, or millionaires. Grouping together college students, criminals, and the unemployed, among others, 47% could be considered lower- or working-class characters who became involved in medical research. Of the remaining characters, we grouped roughly 10% as middle class and another 10% as upper class and affluent. We classified occupations such as schoolteachers, journalists, and real estate agents as middle class, whereas we used the upper-class category to include physicians, researchers, and executives (or their children) when they appeared as research subjects. Given the sample size, we combined middle- and upper-class subjects into a single category for the sake of further quantitative analysis of the data. Aside from

Table 2. Gender, race, and class of subjects (N= 157).

Men	68% (107)
Women	31% (49)
Transwoman	0.6% (1)
White	87% (136)
Black	5% (8)
Asian	3% (5)
Other (Indian, Iranian, Hispanic, biracial)	5% (8)
Lower/working class	47% (74)
Middle/upper class	20% (31)
Class unknown	33% (52)

a spike in the portrayal of women and middle/upper-class subjects between 2009 and 2011, these findings for gender and class were consistent across the entire timeframe of the sample.

The demographics of research participants depicted on television and in film are intriguing on their own, but we also examined the intersection of characters' social position with the tenor of their involvement in clinical trials. Classifying research participants' motives, we identified six types: financial (40%), therapeutic (34%), coerced (15%), other personal gain (8%), altruistic (0.6%), and unclear (1%). Given the small sample size of the latter three categories (other personal gain, altruistic, and unclear), our analysis and discussion focus on the first three motives.

An example of a typical financial motivation for research participation can be found in an episode of the US sitcom *Two and a Half Men*. The conceit of the television show is that Alan, a White man in his 40s, and his son move in with his playboy brother following Alan's divorce. In this particular episode (Season 5, Episode 5), Alan is concerned about his and his brother's cash flow, so he enrolls in a clinical trial for an anxiety medication to help pay the bills. Interestingly, the episode depicts him as not knowing how much he might actually get from the research study until he is sitting across from the doctor, at which point he worries about the possible side effects but is ecstatic to learn that he will be paid US\$1000 for taking the pills for just 1 week.⁵ In an altogether different depiction of medical research, the US television courtroom drama *Boston Legal* highlighted the therapeutic impetus for enrolling in clinical trials. In this episode (Season 2, Episode 11), an attorney in the firm is hired to represent a White male client in his 40s who has been accused of using his wealth to guarantee access to the investigational drug instead of a placebo in a clinical trial for stage IV lung cancer. The suit is brought by another participant in the clinical trial (who is also a White man in his 40s but not affluent) who received the placebo and accuses the rich man of "conspiracy." Despite the conflict between them, the episode underscores the degree to which terminal diseases make people desperate to find a cure, leading one man to break protocol in a clinical trial and the other to spend his final days in a lawsuit. The final type of motivation represented in our sample was coerced or forced research participation. A clear example of this theme was seen in the US horror film *Vile*. Featuring a demographically diverse cast, this film centers on a group of friends who are drugged and kidnapped after naively picking up a hitchhiker. They awaken inside an abandoned warehouse with a device implanted in their heads to collect brain fluid each time they feel pain. Although the participants are not a part of a clinical trial in the classic sense, their bodies are being used to develop a new drug and, as such, are part of a basic research project that requires human materials. As would be expected with a horror film, the experiment does not end well for the kidnapped participants: all but one (the main character) die over the course of the film. The coercion theme, while having many variations, nonetheless hinges on

Table 3. Results of chi-square test between motive and representations of gender, class, and informed consent.

	Financial	Therapeutic	Coercion
Gender			
χ^2	4.491*	1.880	9.157**
df	1	1	1
Class			
χ^2	14.645***	30.496***	3.255
df	1	1	1
Informed consent			
χ^2	0.777	11.515***	10.358***
df	1	1	1

We include the results for informed consent and coercion for the sake of thoroughness, but acknowledge that coercive forms of research by definition exclude any informed consent. The only exception to this was the movie "Control" in which the subject is a prisoner who is given the choice between medical research or court-ordered lethal injection. The risks of the research are described to the subject as he is given this choice, but we classified the motive as coercion.

* $p < .05$; ** $p < .01$; *** $p < .001$.

participants being tricked, kidnapped, or otherwise forced into research with no financial or therapeutic benefit for their participation.

Within these major themes, we found interesting patterns in the depictions of characters based on their gender and class.⁶ First, financial motivation was primarily associated with male characters who were more likely lower or working class. In all, 46% of men were financially motivated versus 28% of women research subjects. Using a chi-square test of significance, the relationship between gender and financial motive was statistically significant (Table 3). Class was also significantly related to financial motive, with 64% of lower/working-class characters having a financial motive versus 23% of the middle/upper-class characters. These representations of research participants, while problematic, might nonetheless echo some trends in the demographics of actual participation. Typically, financially motivated participants who enroll in clinical trials are like their fictional counterparts. They tend to be economically struggling but healthy people who volunteer for studies in which they cannot gain any therapeutic benefit but potentially have sizeable compensation (Abadie, 2010; Fisher, 2015).

In comparison, therapeutic motivation had a more even gender representation but was heavily skewed toward middle- and upper-class characters. In all, 42% of female characters were therapeutically motivated versus 31% of male characters in the sample. This was not statistically significant, but underscores a tendency in the media to associate men more strongly with financial motivations and women with therapeutic ones. The more striking difference was found, however, in how the relationship between socioeconomic class and therapeutic motivation was depicted. Specifically, 55% of the middle- and upper-class characters participated in medical research hoping for a therapeutic benefit compared to only 7% of the lower- and working-class subjects. The relationship between class and therapeutic motivation was statistically significant. While some might argue that such media representations of research could normalize therapeutic research participation by portraying it as a middle-class or affluent activity (e.g. Fisher, 2007), it also problematically reifies class relations marking lower-income and working-class individuals as both financially desperate and stigmatizing their decision to enroll in research (Hennink-Kaminski et al., 2014). Notably, portrayals of upper/middle-class participants, as well as women

and therapeutically motivated subjects increased between 2009 and 2011, only to return to pre-2009 levels from 2012 to 2014.

Finally, turning to coerced research participation, this subset of participants was disproportionately represented by women (split roughly 60–40, women to men). In total, 28% of all women versus 9% of all men were coerced into research. The relationship between gender and coercion was statistically significant. Examining class, a sizeable portion of the coerced participants ($n = 10$, 42%) did not have any specific class markers, but of those who did, 9% of lower- and working-class characters were represented as coerced versus 23% of middle- and upper-class characters. This relationship was not statistically significant, but it nonetheless indicates that storylines emphasizing forced research participation—whether through kidnapping, deception, or manipulation—tend to overplay the vulnerability of middle- and upper-class women to these threats. The depiction of coerced subjects was relatively consistent across the years sampled.

To summarize, our sample of television shows and films depicted little diversity in the type of individuals participating in research or their motivations to do so. White men predominated, and representations of social class differed significantly depending on participants' motivation to be involved in research, with lower- and working-class individuals typically shown as being financially driven into research and middle- and upper-class individuals typically shown as seeking therapeutic benefit from clinical trials. Among those coerced into research, women were overrepresented. To understand the broader meanings of these representations, however, we turn to the results of our qualitative analysis.

Media depictions of risk, research failure, and conflicts of interest

When viewed holistically, the most remarkable commonality across all the television shows and films is that they mainly depict the outcome of medical research as negative. This is true even across the genres of action/crime, comedy, drama, and horror/thriller. Out of the 65 media items, 68% depicted a primarily negative outcome to the research participants, whereas only 9% depicted a positive outcome to the research. The remaining media showed mixed outcomes (11%) or simply did not include any representation of the results of the medical study (12%). Typically, negative outcomes in these television shows and films focused on side effects, but they also included cases in which someone who hoped for a therapeutic benefit from the research simply was not cured or helped. The positive outcomes were all part of media that represented characters' motivations as therapeutic and depicted the medical research as saving the lives of the individuals who received the experimental treatment. The cases in which there was a positive outcome were primarily represented in television dramas (five out of the six media items). In contrast, a mixed outcome included cases in which either a single character or multiple characters experienced varying outcomes from the research. One example of a mixed outcome was in the US cartoon *American Dad*. In the relevant episode (Season 4, Episode 8), the titular character is depicted in a flashback as having such severe acne in high school that he is motivated to enroll in a therapeutic clinical trial. The investigational drug works to clear up his acne, but he loses all his hair the next day and has been bald and worn a toupee ever since. In other words, the outcome was both positive and negative, and we used the category of "mixed" to represent media items like this.

Given the preponderance of negative outcomes represented in these media, risk was an important theme, which took on a different role in the storyline depending on the genre. It was, therefore, typical for comedies to use a negative outcome of medical research for comedic effect; dramas to build pathos; and action, crime, horror, and thrillers to create suspense or fear. For example, one of the television shows in our sample (including nine episodes) was the Canadian

sitcom *Testees*, so named because it revolves around two friends who are paid human guinea pigs for a fictional research company called “Testico.” The formula for each episode is to frame the friends beginning a new research study and follow them through the bad results that occur and their eventual recovery (so they can do the next study). The humor primarily revolves around the side effects that they experience, including a pregnancy scare, shrinking penises, developing breasts, hyper-aging, and “werewolf” syndrome, as well as a range of more mundane effects like dry skin, lumps, and pain. Thus, within the world created by the television show, the medical research needs to have a negative outcome in order to create humor and mock the friends who choose to earn their living in such a way.

In other examples, medical research itself was a source of comic relief from an otherwise unrelated storyline. This was the case in an episode of the British soap opera *No Angels* (Season 3, Episode 3). In this hospital-themed series, the primary focus of the episode was on dramatic clashes between the doctors and nurses, as well as a wedding party that gets admitted for mass food poisoning, but a clinical trial is offered as a funny alternate storyline when one of the doctors enrolls in a study so that he can get enough money to buy a new couch. This allows for playful banter when his nurse colleagues tease him that he might wake up one morning with breasts and “mutate into some girlie-lizard-man-thing.” Ultimately, the two nurses join the trial too, and the real comedy is that the doctor had never been ingesting the investigation drug (opting to spit it out instead), so the nurses end up developing severe insomnia, itchiness, and hunger all while the doctor sleeps serenely in the clinic. By the end, the nurses discover his secret and all three characters are shown to spit out the drug instead of taking it during the study. Despite the humor surrounding medical research in television shows like this, these representations nonetheless emphasize that participation in research can carry significant (although typically short-term) risks. This representation of research participants “cheating” the trial also raises important validity concerns about the results of such clinical studies.

In contrast, representations of the negative outcomes of medical research also illustrate the extent to which research might end in scientific failure as well as the conflicts of interest that are inherent to the research enterprise. With the volume of negative outcomes depicted even for storylines that highlighted a therapeutic motivation for characters to get involved in research, there is a strong message in these media that medical research is indeed *research* not therapy, that the safety and/or efficacy of an investigational drug is unproven. Several episodes in the popular US television show *Grey’s Anatomy* underscore this point quite dramatically (Season 4, Episodes 13–17). Two of the physicians in this hospital drama are conducting a clinical trial on inoperable brain tumors. Over the course of five episodes, the trial enrolls eight patients who undergo surgery and receive an injection of an experimental serum into the tumor. The first seven patients die, five of whom appear to die on the operating table and two within hours of receiving the procedure. The drama of these deaths culminates in the announcement that the institutional review board overseeing the clinical trial is going to shut down the trial if one more patient dies. With this news and the personal moral distress around these deaths, the doctors are divided on whether to continue with another participant. Ultimately, they do and the patient not only lives through the procedure, but also at the end of the episode the doctors see evidence that her tumor is shrinking. The bottom line in this television show as well as many of the media items in our sample is that medical research can have high risks and uncertain rewards. This might be a reasonable representation of research given—at least in the medical realm—that there is a fairly high failure rate for investigational drugs and devices. For example, some evidence suggests that 81% of all investigational drugs that are tested in clinical trials will never make it to market (DiMasi et al., 2010; Fisher et al., 2015).

Not only is there no guarantee that experimental therapies will succeed, these television shows and films also highlight some of the multiple conflicts of interest that can emerge. One dominant

theme is the malevolence of the pharmaceutical industry ($n=14$, 22%). For example, a *Law & Order* episode (Season 15, Episode 4) involves an investigation into two suicides that turn out to be connected to a clinical trial for an antidepressant. The detectives trace it back to the pharmaceutical company sponsoring the study and find that the company may have known about and covered up the host of negative side effects associated with their drug. The profit motive of pharmaceutical companies is even more central in an episode of a different US courtroom drama *Drop Dead Diva* (Season 5, Episode 1). In it, a child who had been responding well to an experimental treatment for cancer is in critical condition because the pharmaceutical company decided to stop the clinical trial. The attorney leading the investigation discovers that the company's decision was intended to prevent it from negatively affecting their profits on an existing chemotherapy drug. In the end, the attorney prevails and secures the child's access to the investigational therapy. Nonetheless, pharmaceutical companies are cast as having no concern for the health or life of patients. While these tend to be extreme representations of the industry, many of the critiques resonate with those made by scholars (e.g. Angell, 2004; Light et al., 2013). Pharmaceutical companies are prone to financial decision-making and—at times—knowingly leave dangerous drugs on the market (Biddle, 2007). Thus, some of these media provide dramatized representations of real-world dilemmas.

Another represented conflict of interest is the deep personal investment of the principal investigators in the outcome of the research. Returning to the hospital drama *Grey's Anatomy*, a later season features the same physicians now conducting a clinical trial for Alzheimer's disease (Season 7). The physician's conviction that the investigational drug will be efficacious leads her to manipulate the clinical trial, in one instance ensuring that the wife of a colleague receives the investigational drug instead of the placebo (to which she was randomized) (Season 7, Episode 19). This leads to the downfall of the entire clinical trial when the physician's tampering is revealed, effectively eliminating all patients' access to the investigational drug. In a more bizarre example from the US television show *Fringe* (Season 1, Episode 6), a physician is working with families to develop a cure for a rare disease, and he naively reports his findings and personal information about the patients to a pharmaceutical company. While he believes the company will become interested in developing a drug, the company is, in fact, evil and instead kidnaps and weaponizes the patients. When the Federal Bureau of Investigation (FBI) agents confront the physician about his involvement in the trial, he provides the name of the pharmaceutical company executive, then pulls out a gun, and shoots himself in the head. While this is an extreme and quite preposterous representation of the investment of physicians in their research (as well as the evils of the pharmaceutical industry), it does provide a warning about how even well-meaning investigators can be dangerous for robust science (in the case of *Grey's Anatomy*) or the safety of their participants (in the case of *Fringe*). Science studies scholars know well how researchers' interests shape the type of science they conduct as well as the outcomes of their research (see Hess, 1995), but this is something not well understood by the public. Television shows and films about medical research have the potential to translate such themes into a form digestible by multiple audiences.

Within these media, there is a clear depiction of the vulnerability of participants. This is true regardless of their motivation for enrollment; financial, therapeutic, and coerced participation all had predominantly negative outcomes for the research subjects. Indeed, only six examples of positive research outcomes appear in the sample, and all of these cases were for therapeutic trials. Importantly, those benefits were all imparted to middle- and upper-class participants, underscoring further the greater vulnerability of lower-income and working-class participants. In real life, informed consent is often viewed as the corrective to the potential vulnerability of participants because the process gives them the opportunity to consider information about the risks and benefits of the research as they make their decision. Overall, informed consent was shown in just over a quarter of the media items (17 of the 65 television shows and films) and for approximately 32% of

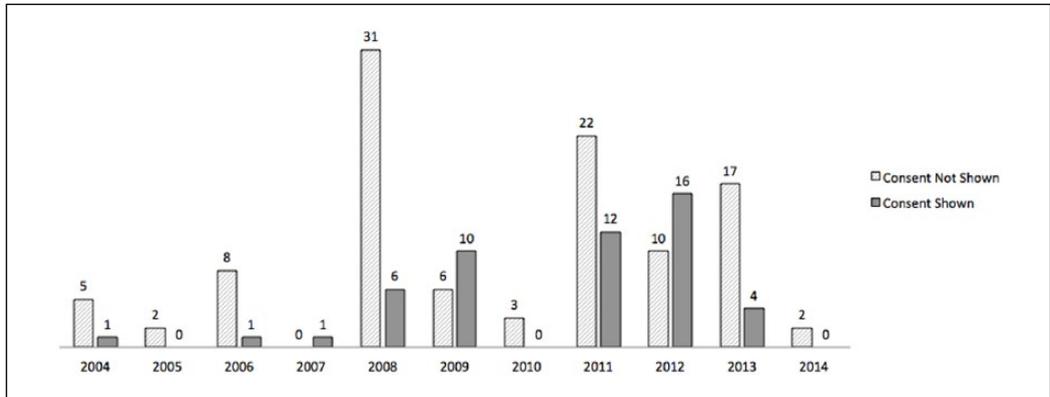


Figure 2. Number of subjects shown receiving informed consent in film/television per year ($N=157$).

the participants ($n=51$). Notably, portrayals of informed consent appeared to significantly increase in the latter half of the sample (Figure 2). Informed consent also had a significantly higher on-screen presence when participation was framed as therapeutic versus non-therapeutic. Specifically, it was shown for 50% of the participants with therapeutic motive ($n=27$) compared to 23% ($n=24$) of all other motives. Part of this was due to plot development. The consent process could be used to enhance the humor and/or foreshadow the side effects that might develop. This was certainly the case in one of the episodes of *Testees* (Season 1, Episode 7) when the two friends experience an adverse reaction and the physician informs them that they signed a “1400-page consent form” and that they cannot sue the company in the case of accidental death. In other words, informed consent does not change the risk of medical research, and rather than being a symbol of empowerment, it too can increase participants’ vulnerability to the research process, the researchers themselves, or profit-seeking pharmaceutical companies.

5. Conclusion

Taken together, do these 65 television shows and films constitute an “assault” on medical research? Peddicord and the ACRO articulated this concern from their informal survey of television and advertising. Clearly, the overwhelming message from our sample emphasizes negative outcomes from clinical research. Additionally, there are few representations of the regulatory system that undergirds the protection of research participants, often making it seem like there are no mechanisms in place to mitigate the risks to human subjects. With that said, however, there was an increasing prevalence of informed consent depicted in these media items, perhaps indicating that over time viewers might be receiving a more nuanced and fair view of the research process. Nonetheless, it is problematic that these media depict participants as disproportionately White, male, and lower or working class as well as financially motivated to enroll in research. These representations are at odds with both the reality of contemporary research participation and the research community’s mission to further enhance the diversity of human subjects (Epstein, 2007).

Despite these problems with how medical research is portrayed in television shows and feature films, these representations do not constitute an “assault” on the clinical trials industry. Rather than simply analyzing the end result of research participation for fictional characters, our study emphasizes the implicit and layered messages about research that television and film can convey. Importantly, negative *outcomes* of fictional medical research are not the same as negative

depictions of such science. STS scholars writing about media representations have long asserted the complex relationship between how science and scientists are depicted and the cultural messages fictional media convey about the institution of science (see Schäfer, 2012). For example, scientist villains on television and in film do not, de facto, send an anti-science message to viewers, and some might even convey a strong *pro*-science message (Orthia, 2010). Villain tropes are especially effective at conveying concerns that the public should have about science. Jones (2001) found that films from 1945 to 1970 provided an outlet for the public to engage post-war anxieties about the use and control of science, scientists' lack of concern for the consequences of their work, and scientists' lack of objectivity.

Returning to our sample, these popular media have similarly found inventive (even if highly fictionalized) portrayals of important areas of concern in the research enterprise. There are real risks to research participants who enroll in medical studies as well as high rates of scientific failure (Fisher, 2015; Fisher et al., 2015). Together, these fictional portrayals communicate well that medical research is not about finding a magic bullet cure or accessing an easy source of income. These representations also raise awareness about the conflicts of interest that are part of the scientific process from pharmaceutical companies' commitment to their own profits to researchers' deep investment in specific outcomes of their clinical studies (Angell, 2004; Biddle, 2007; Light et al., 2013). Through such stories, the media provide a deeper way than traditional research recruitment mechanisms to engage multiple publics about what it means to be a research participant and what risks are attendant in that participation. In other words, the "negative" story that entertainment media are telling about medical research might provide a more truthful representation of the associated risks as well as the lack of clear benefits of research. These are themes that an informed public and anyone considering participating in medical research should engage.

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Notes

1. Association of Clinical Research Organizations (ACRO) is the trade and lobbying organization representing companies that are part of the clinical trials industry, those companies that are hired by the pharmaceutical industry to support the clinical development stage of testing investigational drugs. For more information on this industry, see Fisher (2009).
2. In our count of research participants, we included each representation of the same character depicted in multiple television episodes as a distinct subject. For example, in two episodes of *Grey's Anatomy*, a single biracial female character is portrayed. Because this character spans two distinct episodes, we counted her twice. Three additional television series depict the same subject across multiple episodes: *Tasteless*, *The Big C*, and *Fringe*. We count characters from each episode because not all viewers necessarily watch each episode and typically the focus of the action differed from episode to episode.
3. The transwoman character appeared in the film *Dallas Buyers Club*.
4. The non-White characters were split almost evenly between the television shows ($n=12$) and films ($n=9$) in our sample.
5. This storyline is the primary source of comedy in the episode. Thus, not surprisingly, Alan goes on to develop many side effects from the investigational drug, including turning red, getting boils on his face, and losing his hair in patches. He also relates to other characters that he can see his heart beating through his shirt, has had fainting spells, and that his feces look like charcoal briquettes. Looking comically terrible in one scene, he turns to his brother and says, "I don't think I'm in the control group."
6. Due to the overwhelming majority of White characters depicted (87%), it was difficult to determine whether the representation of the 21 non-White characters in our sample was meaningfully different than their White counterparts.

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