

Exposure to fictional medical television and health: a systematic review

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Received on March 2, 2016; accepted on January 26, 2017

Abstract

Fictional medical television programs have long been a staple of television programming, and they remain popular today. We aimed to examine published literature assessing the influence of medical television programs on health outcomes. We conducted systematic literature searches in PubMed, PsychINFO and CINAHL. Selected studies had to be scholarly research, to involve exposure to fictionalized medical television programming, and to assess associations between exposures and outcomes. Of 3541 unique studies identified, nineteen met selection criteria. The most commonly studied programs were *ER* (73%), *Grey's Anatomy* (58%) and *House M.D.* (37%). Outcomes included knowledge, perceptions and behaviors related to topics as diverse as organ donation, cancer screening, sexually transmitted infections, and heart disease. Viewing fictional medical television programs had a negative influence on viewers' health-related knowledge, perceptions and/or behavior in 11% of studies, a positive influence in 32% of studies, and mixed influence in 58%. While most studies (58%) were characterized as having fair quality in terms of rigor of study design, 21% were classified as good and 21% were classified as poor. As such, medical television can affect health education and outcomes. Future work should utilize randomization, more longitudinal

assessments, and more direct assessments of health education and behavioral outcomes.

Introduction

Fictional medical programs have long been a staple of television drama. In the 1960s and 1970s, television doctor heroes such as Dr. Kildare and Marcus Welby populated the airwaves. On these programs, the primary focus was on the patient's story, and the doctors generally could do no wrong [1]. However, the 1994 premieres of *ER* and *Chicago Hope* ushered in a new era of fictional medical programming. These programs—in particular *ER*—prided themselves on techniques such as using medical jargon, increasing accuracy as much as possible without sacrificing entertainment value, and hiring physicians and other medical professionals to serve on the writing staff [2].

At its peak in 1998, *ER* attracted over 47 million viewers per week, and its success has been followed by other highly popular programs [3]. Although some of these programs are no longer on the air, their accessibility on services such as Netflix—which has over 62 million subscribers—ensures that they continue to reach a vast audience [4]. Furthermore, according to ratings estimates from Nielson, in 2015 *Grey's Anatomy* was Thursday night's most watched program in adults 18–34, and the premiere episode of *Code Black*, a new

medical drama that began in the fall of 2015, won its timeslot for overall viewers [5, 6]. Thus, this type of programming is likely to remain popular for the foreseeable future. There is hence value in examining the influence of this large exposure on viewers' knowledge, perceptions and behaviors related to health. Better understanding of these associations may help researchers and practitioners to maximally leverage this large exposure to improve health education and public health.

Cultivation theory, which is widely accepted by communication scholars, suggests that exposure to media, and to television in particular, substantially 'cultivates' viewers' perceptions of reality over time [7]. With regard to fictional medical television programming, cultivation theory suggests that viewing these programs could influence public perception of real-life outcomes such as the behavior of health care professionals, the set up of health care settings (e.g. hospitals), and the impact of medical interventions on disease progression. For example, one study found that on television 75% of patients receiving cardiopulmonary resuscitation (CPR) were revived, which is more than ten times higher than real-life survival rates [8]. Thus, viewers of these programs may have a perception that CPR is more effective than it is in reality. Other studies have similarly assessed discrepancies between patient demographics and disease prevalence on television as compared with real life, and the potential for these inaccuracies to shape viewer's perception of health and health care [9, 10]. Cultivation theory also suggests that these misperceptions may subsequently affect health communication, expectations and outcomes. For example, individuals and their families who end up with poor outcomes after cardiac arrest may be unpleasantly surprised because they have based their expectations on television outcomes [9].

Researchers have also been interested in whether viewers retain medical information portrayed by medical television programs. Entertainment education theory postulates that viewers retain messages presented in fictional television by transporting them into a storyline and involving them with characters, and that they are then likely to emulate behavior that they have observed on screen and consider to be

desirable [11]. Thus, researchers have examined the impact that specific storylines on fictional medical television programs have on viewers' health-related knowledge, perceptions and/or behavior. There have also been related case reports of interest, such as the recent story of an Israeli woman who diagnosed her own breast cancer and proactively sought out treatment after seeing a storyline about breast cancer on an episode of *Grey's Anatomy* [12].

However, to our knowledge, there has never been a formal, rigorous systematic review of the literature assessing the ability of medical television programs to affect important public health outcomes such as viewers' health-related knowledge, perceptions and/or behavior. Considering the continuing availability of medical television programming and its potential for continued influence, this is an important gap in the literature. Therefore, we conducted such a systematic review in order to synthesize extant research, make recommendations for future study, and explore opportunities to creatively leverage the infrastructure around these programs.

Materials and methods

We designed and reported this study using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) [13], which was developed to guide authors in comprehensive, evidence-based systematic reviews and meta-analyses.

Selection criteria

We created a comprehensive research protocol (Supplementary Appendix AI). Selected studies were required (i) to be scholarly, peer-reviewed research, (ii) to involve an exposure to fictionalized United States (U.S.) medical television programming premiering in 1994 or later by individuals that are not students in a formal health professional training program and (iii) to assess associations between exposure and viewers' knowledge, perceptions and/or behaviors. We included all studies that met inclusion criteria published prior to February 2015. To be considered scholarly research, manuscripts were required to report an original

research study published in a peer-reviewed journal in medicine, public health, the social sciences, or related fields. Although including grey literature such as conference presentations and dissertations may have yielded more results, it was central to our research question that we focus on peer-reviewed journals. We made this choice because it was explicitly important to our research aims to identify what has been published in the peer-reviewed literature and subsequently to identify holes in what has been published in that literature on this topic. We defined fictional television programming according to the Academy of Television Arts & Sciences Emmy awards definition of a primetime television drama or comedy series [14]. In order to be deemed as medical programming, at least half of the on-air time had to be placed in a health-care setting, and at least half of the main characters had to be professionals (such as physicians, physician assistants, or nurses), administrators, and/or ancillary staff specifically in the health care field. We focused on programs premiering in 1994 or later in light of the identification of this year as a turning point in fictional medical television. Specifically, in *Playing Doctor: Television, Storytelling and Medical Power*, author Joseph Turow points to the 1994 premieres of *ER* and *Chicago Hope* as ushering in a new era of fictional medical programming in which the focus was on the lives of the doctors and nurses, and where these individuals were portrayed as human beings with flaws [1]. Furthermore, programming premiering prior to that was less relevant to our goals of making recommendations for future research in this area and exploring opportunities to creatively leverage the infrastructure around these programs. Finally, included studies were required to assess the association between program exposure and viewers' knowledge (e.g. acquisition of facts), perceptions (e.g. attitudes and beliefs) and/or behaviors. Therefore, we excluded studies that were only content analyses. For example, a Jain and Slater study that examined depiction of patient-provider communication in medical television programs was not included because it did not assess the impact of these exposures on viewers [15]. We only included

studies published in English. However, selection was not limited by sample size, demographic characteristics of participants, or study location.

Identification and selection of studies

We conducted searches in PubMed, which includes MEDLINE, PsychINFO (OvidSP) and CINAHL (EBSCOHost) in February 2015. A professional research librarian developed search strategies specific to each of these databases. Search strategies were designed to be broad and tailored to the idiosyncrasies of each particular database (Supplementary Appendix AII). All searches included comprehensive lists of search terms related to entertainment education, prime-time television, medical television and titles of particular medical programs (e.g. *Grey's Anatomy* and *Nurse Jackie*). We hand-searched reference lists of included studies to identify additional relevant articles. We also contacted authors of all included studies to inquire whether they knew of any unpublished or in-press studies that met our selection criteria.

Four researchers independently screened all article titles and abstracts to generate a set of articles for which there was any possibility for selection [16]. Then, two researchers independently assessed the full texts of these studies for eligibility. During this process, these researchers used structured abstraction forms that enabled subsequent comparison of independent assessments with inter-rater reliability statistics. Inter-rater reliability was excellent (96.3% agreement, Cohen's $\kappa = 0.86$). To minimize risk of reviewer bias, only after independently screening articles did reviewers meet to discuss any differences. After adjudication, we easily achieved consensus in 100% of cases. We assigned each article a primary reason for exclusion.

Data extraction

We developed structured spreadsheets to facilitate complete and accurate data collection. Researchers abstracted (i) study background information, such as year of study and location of study; (ii) participant-related information, such as sample size and participant demographics; (iii) exposure-related

information, such as program names and total number of episodes/clips studied; (iv) outcome-related information such as frequency of assessments, timing of assessments and main outcome measures; and (v) quality-related information such as if participants were randomly selected, whether outcome measures were clearly stated and validated, and whether the study was longitudinal versus cross sectional (Supplementary Appendix AI).

We created multiple relevant variables based upon the primary information collected in these five categories. For example, we classified studies into subgroups based on whether or not they focused on a specific health topic or assessed overall perception of health and the health care system. We also focused on whether the main outcome measure was viewer knowledge, perceptions and/or behavior. These procedures were followed to facilitate synthesis of data and reporting of results (Supplementary Appendix AI).

Data analyses

Because of the wide variety of outcomes assessed and the lack of standard measurements for the outcomes that different studies had in common, we could not perform meta-analyses to quantitatively combine data. Instead, we qualitatively described the data using standard methods of systematic review described by PRISMA (Supplementary Appendix AIII) [13].

Because few measures exist for assessing bias when examining studies with such heterogeneous outcome measures, we used two established methods for assessing bias at the study level [16]. First, to determine if respondents consisted of a random of convenience sample, we used participant recruitment methods as part of our assessment of study quality. Second, to minimize the chance of publication bias (i.e. the systematic omission of certain studies that have been conducted from the peer-reviewed literature, usually because of negative results), we contacted authors of all included studies to determine if they knew of any studies that were unpublished that may meet selection criteria.

Results

Study identification and selection

Of 4044 potentially relevant published articles culled in initial searches, 3541 represented unique studies. Of these, we eliminated 3406 based on initial assessment of titles, abstracts and other relevant meta-data with four reviewers. The initial assessment was conducted to provide an initial screening to narrow the field of studies to those—based on the title, abstract and other meta-data—with any likelihood of ultimately meeting selection criteria. The remaining 135 full-text articles were assessed using a far more detailed review of the complete manuscript. This is standard procedure for systematic reviews [16]. Of these, 19 (14%) met selection criteria (Fig. 1). No authors of the nineteen included studies knew of any additional unpublished or in-press studies that met criteria.

Population characteristics

One study had adolescent participants [17], and the remaining eighteen had adult (18+) participants (Table I). Seven studies (37%) enrolled students from college undergraduate courses [18–24], and no studies assessed participants aged 65 or above. For studies that reported the mean age of participants, the mean age was 29 years (SD = 11.7). The number of participants per study ranged from 35 to 11 555, with a mean of 1659 (Standard Deviation [SD] = 3000) and a median of 496 (Interquartile range = 183–600). The percent of female participants ranged from 41 to 79% (mean = 62%, SD = 11%), excluding two studies that involved only one sex [25, 26]. Of the thirteen studies (68%) that reported participant race/ethnicity, all but one [27] had a majority of Caucasian participants.

Exposure characteristics

The most commonly assessed programs were *ER* (73%), *Grey's Anatomy* (58%) and *House M.D.* (37%) (Table I). Six studies (32%) examined the impact of fictional medical programs on viewers' overall perception of health and the health care system [19–22, 29, 31]. The remaining thirteen

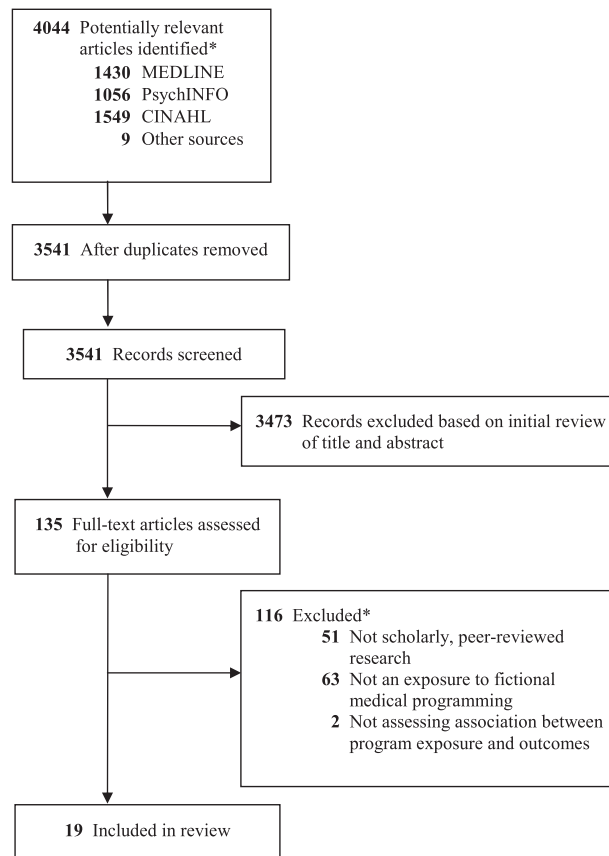


Fig. 1. Study selection. Of the 3541 unique articles retrieved using the defined search strategy, 19 remained after the exclusion process. *Although many articles did not meet inclusion criteria for more than one reason, each article was assigned a primary reason for exclusion. These numbers represent articles excluded for the primary reasons listed.

studies (68%) focused on a specific health topic. Of these studies, the most common health topics assessed were organ donation (31%) [23, 27, 28, 30], cancer (23%) [10, 25, 32] and sexually transmitted infections (23%) [26, 28, 33].

Eight studies (42%) used overall regular viewing habits as the exposure [10, 19–21, 27–29, 31], and seven studies (37%) asked participants whether or not they saw specific episode(s) as the exposure [22, 23, 25, 26, 30, 32, 34]. Three (16%) studies exposed respondents to a specific clip or episode in a classroom setting [17, 18, 24], and one study (5%) used both regular viewing habits and viewership of specific episodes to define the exposure [33].

Outcome characteristics

The majority of studies (79%) involved a one-time survey as the assessment tool (Table II). Four studies (21%) examining knowledge utilized a longitudinal study design to measure viewer knowledge of a health topic both before and after exposure [25, 32–34]; only one of these used a delayed follow-up assessment [33].

Each study was classified according to whether it assessed participants' knowledge (e.g. acquisition of facts), perceptions (e.g. attitudes and beliefs) and/or behavior (Table II). One study (5%) assessed only participants' knowledge [17], seven studies (38%) assessed perception [10, 21, 22, 24, 26, 28, 29], two

Table 1. Study characteristics of studies examining impact of fictional medical shows on viewers

Reference	N ^a	Participant race/ethnicity	Age (mean, Y)	% female	Program(s)	Exposure details	Health topic
Asbeek-Brusee <i>et al.</i> 2015 [28]	525	NR	44.3	48.6	<i>ER, Strong Medicine, House M.D., Grey's Anatomy, Private Practice</i>	Regular viewing habits. Percent that had watched each show: <i>House M.D.</i> (80), <i>ER</i> (49), <i>Grey's Anatomy</i> (43), <i>Private Practice</i> (19), <i>Strong Medicine</i> (16)	Organ Donation, Abortion, Sexually Transmitted Infections
Hetsroni [29]	281	78% white, 8% African-American and Latino	39	54	<i>ER, House M.D., Grey's Anatomy</i>	Regular viewing habits. Average time viewing TV/week: 16.2h; Average time/week spent watching medical dramas: 55min	None Specified
Quick <i>et al.</i> [27]	600	33% Latino, 33% African-American, 33% Caucasian	21	58	<i>Grey's Anatomy</i>	Regular viewing habits. No significant difference of viewer-ship between the ethnic groups	Organ Donation
Kim <i>et al.</i> [18]	163	NR	21.8	72	<i>ER</i>	4.5 min clip either with health message, without health message, or control	Alcohol
Lee and Taylor [19]	253	NR	20.9	67.6	<i>ER, House M.D., Grey's Anatomy</i>	Regular viewing habits. All students had watched at least one episode of one show	None Specified
Chung [11]	11 555	72.7% non-Hispanic white, 8.5% black, 12.9% Hispanic	48.1	52.8	<i>ER, Strong Medicine, House M.D., Grey's Anatomy</i>	Regular viewing habits. Minimum average viewing of episodes/month was 6.9	Cancer and Heart Disease
Stinson and Heischmidt [20]	176	87% Caucasian, 10% African-American, 1% Asian, 2% Other	68% 18–19, 19% 20–21, 6% 22–25, 7% 26+ ^b	65	<i>ER, Scrubs, House M.D., Grey's Anatomy, Private Practice</i>	Regular viewing habits. Average minutes viewed over past 6 weeks: <i>House M.D.</i> : 79.8, <i>Grey's Anatomy</i> : 71.9, <i>Scrubs</i> : 58.8, <i>ER</i> : 57.6, <i>Private Practice</i> : 31.7	None Specified
Cho <i>et al.</i> [21]	496	80.4% white, 3.7% African-American, 2.5% Hispanic, 10.6% Asian/Pacific Islander	20	40.9	<i>ER, House M.D., Grey's Anatomy,</i>	Regular viewing habits. Percent who had seen at least one episode of each show: <i>ER</i> (81), <i>House M.D.</i> (73), <i>Grey's Anatomy</i> (41), 29% had watched an episode of all three	None specified

(continued)

Table 1. Continued

Reference	N ^a	Participant race/ethnicity	Age (mean, Y)	% female	Program(s)	Exposure details	Health topic
Primack <i>et al.</i> [17]	55	73% White, 27% Black	14.6	49	<i>ER</i>	Shown 3 clips from 7th season episode of <i>ER</i>	Heart Disease
Marcus <i>et al.</i> [32]	547	NR	NR	NR	<i>ER</i>	Regular viewing habits of specific episode, 336 viewed <i>ER</i> episode on cancer patient navigators, 211 unexposed	Cancer
Quick [22]	269	95.5% White, 1.1% African-American, 3.4% Other	20.72	65.1	<i>Grey's Anatomy</i>	Regular viewing habits of seasons 2 and 3. Mean number of episodes viewed = 12.8 (SD 14.3). 78 participants had seen all 32 episodes and 95 had not seen a single episode	None Specified
Morgan <i>et al.</i> [30]	6052	81.5% Caucasian, 4.9% Asian-American, 4.4% Other, 3.6% Hispanic, 2.7% African-American	29.01	79.1	<i>House M.D.</i> , <i>Grey's Anatomy</i> (plus two non-medical shows)	Regular viewing habits of specific episodes, 340/354 viewed both episodes of <i>Grey's Anatomy</i> , 3541/5034 viewed both episodes of <i>House M.D.</i>	Organ Donation
Quick [23]	269	95.5% White, 1.1% African-American, 3.4% Other	20.72	65.1	<i>Grey's Anatomy</i>	Regular viewing habits. Compared 78 loyal viewers (seen all episodes with Season 2 and 3 storyline about organ donation) and 95 non-viewers (no episodes viewed)	Organ Donation
Hether <i>et al.</i> [25]	599	92% Caucasian, 4% African-American, 2% Hispanic, 1% Asian-American, 1% Other	43	100	<i>ER</i> , <i>Grey's Anatomy</i>	Regular viewing habits of specific episodes, 18% had seen both <i>ER</i> episodes, 18% had seen <i>Grey's Anatomy</i> episode, 7% saw all 3 episodes, 61% did not see any episode.	Cancer
Valente <i>et al.</i> [34]	5465	Email recruitment: 88.1% White, 3.8% African American, 2.8% Hispanic; Web recruitment: 86.2% White, 3.3% African American, 2.7% Hispanic; Mail	Email: 26.5% 25–34; Web: 32% 25–34; Mail: 18.4% 25–34 ^b	Email: 67.4, Web: 81.1, Mail: 54.5	<i>ER</i>	Regular viewing habits. Asked about specific episode	Obesity and Healthy Eating

(continued)

Table 1. *Continued*

Reference	N ^a	Participant race/ethnicity	Age (mean, Y)	% female	Program(s)	Exposure details	Health topic
Whittier <i>et al.</i> [26]	501	recruitment: 56.9% White, 19.5% African-American, 17.6% Hispanic 88% white, 12.5% Hispanic	35	0	ER	Regular viewing habits and viewership of specific episode. 58% reported regular viewership of ER and 57% had seen the storyline about syphilis in MSM	Sexually Transmitted Infection
Miller and Wheeler-Scruggs [24]	35	NR	18–40 ^b	NR	<i>Gideon's Crossing</i>	Random assignment to watch a neutral clip (17 students) or to watch a <i>Gideon's Crossing</i> storyline about cochlear implants (18 students)	Pediatric Cochlear Implant
Brodie <i>et al.</i> [33]	3500	86% white, 11% black, 3% Other	28% 18–29, 49% 30–49, 23% 50+ ^b	64	ER	Regular viewing habits and viewership of specific episodes. Also looked specifically at episodes with storyline that on emergency contraception and storyline on HPV.	Emergency contraception; Sexually Transmitted Infection
Davin [31]	183	'Wide range'	13–84 ^b	74	ER	Regular viewing habits	None Specified

NR, not reported; Y, years.

^aThe number of participants analyzed.

^bMean age was not reported for Stinson and Heischmidt [20], Valente *et al.* [34], Miller and Wheeler-Scruggs [24], Brodie *et al.* [33] and Davin [31]; thus age ranges are presented instead.

Table II. Study outcomes from studies examining impact of fictional medical shows on viewers

Reference	Assessment Tools and Timing	Outcome Measure(s) ^a	Main Findings
Asbeek-Brusee <i>et al.</i> [28]	One time online survey	P – Perception of health storylines	Judgements concerning negatively framed storylines about sexually transmitted infections and organ donation were more negative than judgements of neutral or positively framed storylines. Judgements about a neutral abortion storyline were more positive compared with judgements of a storyline in which abortion was encouraged or discouraged
Hetsroni [29]	One time random digit telephone survey	P – Effect of viewership on estimates of prevalence of health events	Medical dramas exaggerate occurrence of certain medical events, such as mortality rate during hospitalization. Respondents did not have a very good knowledge of medical reality. Total viewing time, but not viewing medical dramas, associated with higher estimates of health concerns. Demographic variables not strong in shaping health estimates
Quick <i>et al.</i> [27]	One time random digit telephone survey	K, P – Effect of viewership on different ethnic groups' knowledge and perception about organ donation	For overall sample and each ethnic group viewing positively associated with perceived realism. African-Americans perceived the program to be more realistic than the other two groups. As perceived realism increased, organ donation knowledge decreased and barriers to donation increased
Kim <i>et al.</i> [18]	Post-exposure decoy test, word-fragment completion test to assess implicit memory and survey	K, P – Memory of entertainment education message, attitude towards and intention to binge drink	Anti-alcohol message successfully elicited implicit memory. Participants assigned to health message reported significantly more negative attitudes towards binge drinking and lower intention to binge drink. No significant difference in attitudes in those with high levels of past experience and involvement with binge drinking
Lee and Taylor [19]	One time online survey	K, P, B – Motives for watching TV dramas, and which motives are associated with using health information from the shows	Social interaction, entertainment and relaxation predicted medical drama viewing. Health information motive predicted information use
Chung [11]	Data from Annenberg National Health Communication Online Survey Jan 2007–Dec 2009	P – Influence of medical dramas on perception of certain illnesses and their prevalence	Heavy viewers less likely to select chronic illnesses such as cancer and heart disease as important issues facing society. Medical drama watching was a significant, positive predictor of fatalistic beliefs about cancer, but not significantly related to diabetes, mental health, or HIV/AIDS
Stinson and Heischmidt [20]	One time paper survey	P, B – Effect of viewership on patient perception of	

(continued)

Table II. *Continued*

Reference	Assessment Tools and Timing	Outcome Measure(s) ^a	Main Findings
Cho <i>et al.</i> [21]	One time survey	physicians and patient-physician interaction P – Relationship between exposure and perceptions of physicians, and if perceived realism moderates the effect	More positive perception of physicians linked to exposure to prime time shows. 11% had asked personal physician about something they say on TV Three dimensions of realism were distinguished: perceived plausibility, typicality and narrative consistency. For all three dramas narrative consistency predicted positive perceptions about physicians, but no significant relationships between perceived plausibility, typicality and physician perception
Primack <i>et al.</i> [17]	Post course survey	K – Enjoyment of curriculum and knowledge gained about topic	91% enjoyed the curriculum, 3.6% did not enjoy it and 5.4% had a mixed impression. Average of 2.9 examples of medical content/participant in survey answers, and 92.3% of medical statements were true
Marcus <i>et al.</i> [32]	Online survey pre and post episode. Post episode included viewers and non-viewers. Pre and post episode groups not the same	K, P, B – Changes in attitudes and beliefs about cancer, knowledge of the role of the patient navigator, and likelihood of behaviors such as obtaining breast cancer screening	Greater % of exposed group (but not significant difference) identified cutting into cancer myth as false and correctly identified role of patient navigator. Exposed group significantly more likely to get screened or recommend screening for breast cancer. Clips were shown to Congress and used to help with passage of the Patient Navigator Act
Quick [22]	One time paper survey	P – Relationship between viewership and perception of credibility. Effect of perceived credibility on perceived courageousness of real-world doctors and patient satisfaction	Positive association between viewing <i>Grey's Anatomy</i> and perception of credibility of show. Positive association between perception of show credibility and perception that real world doctors are courageous. Positive association between perceiving real-world doctor courageousness and patient satisfaction
Morgan <i>et al.</i> [31]	Online survey post air date of episodes	K, P, B – Perception of organ donation plotlines on shows and effect of shows on perception of organ donation, knowledge, discussion with others, deciding to become an organ donor, and urging others to become donors	Perceived accuracy, learning and emotional involvement with show significantly predicted learning and motivation to become an organ donor. Knowledge and beliefs about organ donation were significantly correlated with the content presented in the storylines. Current organ donors were significantly likely to urge others to become an organ donor based on the content of some programs
Quick [23]	One time paper survey	P, B – Relationship between being a loyal viewer to belief in certain organ donation	Loyal viewers less likely to believe the purchase myth (rich and famous can buy their way to the top of the transplant list) and more likely to talk about organ donation with

(continued)

Table II. Continued

Reference	Assessment Tools and Timing	Outcome Measure(s) ^a	Main Findings
Hether <i>et al.</i> [25]	Email survey before both storylines aired, after <i>ER</i> storyline aired, and after both had aired	myths and discussion with family members K, P, B – Attitudes towards BRCA gene screening, knowledge of BRCA mutation, intention to be screened, and likelihood of behaviors such as scheduling a breast cancer screening and talking to someone about breast cancer	family than non-viewers. No difference between loyal viewers and non-viewers for relationship myth (certain patients receive transplants faster because of their relationship with medical professionals) or overall organ donation attitudes Exposure to <i>ER</i> associated with more positive attitudes about screening. With each <i>ER</i> episode viewed 50% more likely to have heard of the BRCA gene. <i>Grey's Anatomy</i> viewers 2x as likely to have heard of BRCA gene, and more likely to know BRCA gene is associated with risk for ovarian cancer. With each episode viewed of both shows 33% more likely to be aware of the BRCA gene. With each episode viewed respondents >50% more likely to agree that BRCA mutation increases risk of breast cancer. Exposure to shows individually not associated with behavior change, but combined exposure significantly associated with scheduling breast cancer screening Modest increase in knowledge of '5 a day' between baseline and follow up. Exposure associated with self-reported behavior change (odds ratio = 1.65). Magnitude of association between exposure and self-reported behavior change was higher for African-Americans than whole sample
Valente <i>et al.</i> [34]	Email solicitation pre and post episode. Website solicitation from date of airing of first episode to one month later. Mail solicitation post storyline	K, P, B – Nutrition attitudes, increased knowledge of '5 a day', and self-reported behavior change such as consumption of fruits and vegetables and visiting a health professional	Exposed group reported significantly greater intentions to be tested and advise others to be tested. Exposure to episode was the sole significant predictor of intention to get tested. Exposure to episode and education were significant predictors of intentions to tell others to get screened Exposed group's overall beliefs were not different than control, but less variance on individual items in the exposed group as opposed to control group One week after viewing episodes, awareness of emergency contraception increased 17% and awareness of birth control pills for emergency contraception increased by 23%. 20% of those who knew about emergency contraception said they learned about it from <i>ER</i> . At 2 month follow up
Whittier <i>et al.</i> [26]	Survey one week post episode. Recruitment via online homosexual chat rooms in 8 major cities	P – Intention to be tested, intention to practice safer sex, and intention to tell others to be tested	
Miller and Wheeler-Scruggs [24]	Post-viewing 10 item attitude survey	P – Beliefs on cochlear implant	
Brodie <i>et al.</i> [33]	Series of cross sectional telephone surveys of regular <i>ER</i> viewers. 10 total surveys pre, post episode and follow up	K, B – Knowledge of emergency contraception and HPV. Self-reported behavior such as discussion with friends and family and contacting a	

(continued)

Table II. Continued

Reference	Assessment Tools and Timing	Outcome Measure(s) ^a	Main Findings
Davin [31]	One-time survey. Qualitative analysis based on grounded theory principles	doctor about health problem on the show K, P, B – Reasons for watching ER, what viewers learned from watching, and intention to seek medical care	awareness was back to pre-episode levels. Exposure to storyline on HPV showed increased knowledge one week after storyline, but not sustained at one month. 52–55% said they learned about health issues from the show. 33% used information from the show to make health-care decisions and 14% contacted a doctor about health problem because of show Respondents perceived medical dramas as educational. Learned physiology, disease, procedures; warned against risky behaviors. Identification with characters raises emotional responses to health messages. Some might visit a doctor if they had symptoms seen on TV

^aAbbreviations: K, knowledge; P, perceptions; B, behaviour.

(10%) assessed perception and knowledge [18, 27], two (10%) assessed perception and behavior [20, 23], one (5%) assessed knowledge and behavior [33], and six (32%) assessed knowledge, perception and behavior [19, 25, 30–32].

Five studies (50%) examining knowledge reported that participants learned correct health information from the exposure [17–19, 30, 31], one (10%) reported that viewers learned incorrect information [27], and the remaining four studies (40%) reported that viewers learned some, but not all, of the intended information [25, 32–34]. One study utilized a delayed follow up assessment, and found that viewers possessed increased knowledge of the health topic immediately post-episode; however, participants did not retain knowledge at two-month follow up [33].

Eight studies (47%) that assessed perception reported a positive influence of exposure on perception of the topic evaluated [18, 22, 25, 26, 30–32,34], one study (6%) reported a negative influence [27], two studies (12%) reported no influence [19, 24] and the remaining six (35%) reported mixed findings (Table III) [10, 20, 21, 23, 28, 29].

Of the nine studies that included an assessment of behavior, all utilized self-reported behavior as the outcome measure. Five studies assessed the behavior of consulting a health professional or scheduling a medical appointment related to a health topic on a television program [25, 31–34]. Four studies assessed the behavior of discussing a health topic on a program with a friend or family member [23, 25, 30, 32]. Seven (78%) reported a positive association between viewership and the health behavior being assessed [20, 23, 25, 30–33], meaning that viewing the episode resulted in positive health behavior change (e.g. consulting a health professional to get blood pressure checked after watching an episode of *ER* that discussed the dangers of hypertension). The remaining two (11%) reported both a positive and neutral association [19, 34] (Table III). Two studies that assessed perception and/or knowledge also asked about behavioral intentions (i.e. the likelihood of getting screened for a disease or visiting a doctor). However, these studies did not ask about actual behavior change [26, 31].

Table III. Overall influence of fictional medical television shows on viewer knowledge, perceptions and/or behaviour

Reference	Knowledge	Perceptions	Behaviour
Asbeek-Brusee <i>et al.</i> 2015	NS	+, -, 0	NS
Hetsroni [29]	NS	-, 0	NS
Quick <i>et al.</i> [27]	-		NS
Kim <i>et al.</i> [18]	+	+	NS
Lee and Taylor [19]	+	0	+, 0
Chung [11]	NS	-, 0	NS
Stinson and Heischmidt [20]	NS	+, -	+
Cho <i>et al.</i> [21]	NS	+, 0	NS
Primack <i>et al.</i> [17]	+	NS	NS
Marcus <i>et al.</i> [32]	+, 0	+	+
Quick [22]	NS	+	NS
Morgan <i>et al.</i> [31]	+	+	+
Quick [23]	NS	+, 0	+
Hether <i>et al.</i> [25]	+, 0	+	+
Valente <i>et al.</i> [34]	+, 0	+	+, 0
Whittier <i>et al.</i> [26]	NS	+	NS
Miller and Wheeler-Scruggs [24]	NS	0	NS
Brodie <i>et al.</i> [33]	+, 0	NS	+
Davin [31]	+	+	+

+, positive; -, negative; 0, neutral; NS, not studied.

Quality characteristics

We assessed several objective quality characteristics. These measures were study design type (e.g. cross sectional versus longitudinal), study population (including sample size and whether the sample was representative versus self-selected), the presence of a control group, and whether or not studies used a clearly defined outcome measure. Based on these measures, studies were assigned a quality score, with a score of 4–5 corresponding to ‘good’, 2–3 corresponding to ‘fair,’ and 0–1 corresponding to ‘poor.’ Four studies (21%) received a rating of good [25, 32–34], eleven studies (58%) received a rating of fair [10, 18, 20–24, 26–29], and four studies (21%) received a rating of poor [17, 19, 30, 31].

Discussion

Despite a broad search and flexible selection criteria (e.g. included studies did not need to randomized controlled trials), there were relatively few peer-reviewed studies that examined the influence of

fictional medical television programs on viewers. Available studies suggest that programs can impact individuals’ knowledge about specific health topics, perceptions of healthcare and healthcare workers, and health behaviors.

Our finding that there have been relatively few peer-reviewed studies in this area is notable considering the potential value of such studies. With millions of viewers tuning in each week, it is important to further research the influence of this programming and its potential use in shaping health knowledge, perceptions and behaviors. These programs also offer an opportunity to leverage the mass expanse of material already developed instead of developing brand new health-oriented programming. Modern platforms such as web-based surveys offer the opportunity to conduct research with large, nationally representative samples exposed to such programming.

Our review identified several gaps in the existing literature that could be targets for future research. First, existing studies were limited in terms of population studied. Of the nineteen selected studies, more

than one-third enrolled only undergraduate college students. Given health disparities and the fact that older individuals are more frequent consumers of health care [35], it would be valuable for researchers to examine the influence of fictional medical television on more diverse and older populations. It would also be valuable for researchers to examine the influence of fictional medical television in older populations given that half of broadcast television viewers are 54+, and in 2012 the median age audience for *Grey's Anatomy* was 50 [36, 37].

Second, our review found that peer-reviewed research to date has been limited in scope to certain health topics. The majority of studies focusing on specific health topics assessed organ donation [23, 27, 28, 30], cancer [10, 25, 32] and sexually transmitted infections [26, 28, 33]. While these are important health topics, it would be useful to study the impact of fictional medical television other leading causes of morbidity and mortality, such as drug and alcohol use, tobacco use, obesity and heart disease.

Third, although several studies assessed behavior change, all behavior change was self-reported, and no studies examined the long-term effect of behavior change. One study identified in this review assessed change in preventative health behavior that might lead to lower utilization of health care services, and this study found a positive association between viewing the health promotion storyline and healthier eating and more exercise behaviors [34]. However, it may also be that misinterpretation of events in a medical program may lead individuals may seek out unnecessary consultation from health care providers, potentially increasing morbidity and costs. Thus, it would be valuable for future research to examine the potential influence of fictional medical programs on the utilization of health care services and the impact on health care costs.

Fourth, three studies in our review [20, 21, 22] suggest that fictional medical programming influences real patients' experiences of health care workers and the health care system, but more work is needed in this area. Quick found a positive association between believing the show *Grey's Anatomy* to be credible and the perception that real world

doctors are courageous [22]. However, Stinson and Heischmidt found exposure to medical television negatively predicted perception of personal physician character [20]. Thus, more research is needed to better assess this relationship and the degree of influence.

It would also be valuable for future studies to utilize more rigorous study design. To assess study quality, we evaluated study design type, study population, the presence of a control group, and whether studies used a clearly defined outcome measure. One way to improve study quality would be for researchers to utilize a longitudinal study design. Only four studies assessing viewer knowledge of a specific health topic were conducted longitudinally, and only one study utilized a delayed follow up assessment to measure the retention of knowledge [33]. This is perhaps due to logistic challenges. However, pre- and post-tests are often logistically feasible and would improve the ability to capture the change from before to after exposure. Another way to improve study quality would be to utilize a randomized control trial (RCT) to allow for intervention versus control comparisons. Only two studies in our review utilized an RCT design [18, 24]. It is understood that this design may be challenging due to the nature of synchronous television exposure. However, use of Web-based technology could help facilitate assignment of individuals who have not seen a given program to either control or intervention groups. If researchers wish to provide the medical television exposure to all participants, the use of a crossover design—with some participants receiving the exposure initially and others at a later time—may be useful.

Overall, our results suggest that fictional medical programs do influence viewer knowledge, perceptions and behaviors. Thus, it may be valuable for medical and public health professionals to work with fictional medical television writers, producers and directors to ensure that programs are as accurate as possible while maintaining their entertainment value. Furthermore, there may be opportunities for health professionals to work with these programs to augment current public health and health education campaigns. For example, in 2014 the CDC spent

\$2.1 million on national tobacco education campaigns [38], but working with existing medical television programs to incorporate anti-smoking plotlines into episodes could provide additional education to millions of viewers at little to no additional cost.

Limitations

Interpretation of selection criteria can be subjective. Therefore, we attempted to minimize this bias by carefully defining our selection criteria with specific protocols and examples (Supplementary Appendix AI) and by having selection criteria applied by independently-working researchers. It was a necessary limitation of our methodology that we did not include grey literature. While this may have resulted in certain studies being overlooked, it was central to our research question that we focus the highest quality published research. While it was our assumption that high-quality conference presentations would also have been subsequently published in peer-reviewed journals, we recognize that this might not always be the case. Our study was also limited in that we only examined programs originating in the U.S. in the past twenty years. Although we examined earlier research and concluded there was not something substantial to be added, it is possible that our time frame excluded relevant prior research. We also designed our search to be as broad and flexible as possible as opposed to searching with key words related to a specific condition. However, it may be valuable for future researchers to explore this topic with search terms specific to certain disease states. In addition, we did not examine fictional medical programs from other countries. Our scope was also limited to shows that feature health professionals in a professional setting. Thus, we did not include programs such as *Frasier* that feature medical professional characters mostly outside of an office or hospital setting. These restrictions were put in place because we wished to focus on programs that take place in a medical setting, but it is important to keep in mind that a wider variety of programming might be interesting to study in the future. It should also be noted that many included studies used

convenience instead of random samples. It would be valuable for future studies to use more random sampling instead of convenience sampling. This is because recruitment advertisements for studies involving medical television are likely to attract viewers who may have more favorable views of medical television. Thus, to truly understand how medical drama viewing affects viewers, it is likely more telling to assess random samples of individuals. Finally, it was not possible to utilize formal techniques of meta-analysis because of the wide diversity we found in terms of study design and outcome measures. However, future research could use standardized measures based on our findings so that there will be sufficient data for meta-analyses.

Conclusions

Despite these limitations, this systematic review suggests that fictional medical television does seem to influence viewers' health-related knowledge, perceptions and/or behavior. Given this potential, the use of fictional medical television programs to educate viewers about important health topics has been underutilized to date. Because existing studies have been limited in terms of scope and study quality, it will be valuable for future research to utilize more rigorous study design and to more directly assess the impact of these experiences on long-term knowledge acquisition and the utilization of health care services.

Conflict of interest statement

None declared.

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