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Maggots on BBC *Casualty*: Evaluating the impact of a Television storyline on awareness and public perceptions of Maggot Therapy

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ABSTRACT

Maggot Therapy is an established, effective treatment for chronic infected wounds. Despite its worldwide success, it suffers from poor public regard and acceptance. In 2019, the primetime BBC Medical Drama, *Casualty*, decided to run a Maggot Therapy storyline over four episodes of its recent series (series 33). Our study focusses on an evaluation of the impact of this storyline on changes in public awareness and acceptability of Maggot Therapy. The evaluation comprised an online questionnaire (administered through an independent private research company). Our results showed that exposure to the BBC *Casualty* maggot storyline was associated with a significant increased awareness of Maggot Therapy. Additionally, this resulted in a more positive perception and general acceptability of the treatment, and a decrease in negative responses towards it. Post-wave participants were also more likely to find Maggot Therapy acceptable for their own wound. Our findings suggest that television storylines and narratives are a useful route to raise awareness, inform and educate viewers about important health-related issues. Our study supports the notion that for effective treatments like Maggot Therapy, which often evoke feelings of disgust and reluctance, the persuasive effects of entertainment education could help to transform perception and acceptability.

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Introduction

The use of living, clinical grade maggots (of the species *Lucilia sericata* – the greenbottle fly), is a medical treatment which has been globally revived in recent decades to help treat chronic wounds. Such wounds are slow, stagnant and non-healing, like leg and foot ulcers, and often result from co-morbidities such as diabetes and cardiovascular disorders. To allow chronic wounds to progress and heal, it is accepted that unhealthy, dead and infected tissue must first to be debrided or removed [1]. A vast multitude of dressings and treatments exist to help manage the debridement of chronic wounds and include surgical, enzymatic, autolytic and biological debridement. One such biological treatment for debriding chronic wounds is Maggot Therapy (also known as Larval Therapy).

Maggot Therapy involves the application of tiny, aseptically reared, medicinal maggots onto a necrotic, sloughy or infected wound. Over a 4-day application period, maggots quickly remove dead, infected sloughy tissue from the wound bed. Maggot Therapy is available widely on UK NHS prescription, approved for use in US by FDA, and Health Authorities across several countries worldwide. Additionally, an abundance of published literature, including large clinical trials, supports the view that medicinal maggots work extremely effectively to clear away dead, unhealthy tissue [2-4]. Scientific studies also show that maggots exhibit unique and effective antimicrobial and wound healing properties and can be of great benefit to the wound due to their considerable secondary benefits, which include the ability to destroy antibiotic-resistant strains of bacteria [5,6]. Maggots do not harm living tissue; this selectivity is believed to be due to the inability of their enzymes to digest healthy, living tissue [6]. However, given its efficiency and cost effectiveness , Maggot Therapy has a surprisingly low uptake and is increasingly regarded as an underutilised, last resort clinical treatment for chronic wounds [2,7]. The reasons for this underutilisation may be multifactorial, but effective administration of Maggot Therapy depends on agreement between clinician and patient. Many reports and authors refer to the intrinsic presence of a preconceived cultural dislike of maggots, historically reported as the "Yuck Factor" [8,9]. In addition, there appears to be a lack of public awareness of Maggot Therapy, and its effectiveness as a treatment for chronic wounds [10]. Even when there is an awareness, there is often a lack of positive perception and acceptability [11].

Our research group (SUMRG) has been researching medicinal maggots since 2001 and have published extensively on their scientific properties. We have now extended our research into the public perception of this therapy and in a recent study we showed just how important increased knowledge and a better understanding of Maggot Therapy could be on public perception and acceptability [11].

Maggots on BBC Medical Drama, *Casualty*

In August 2018, producers and script writers of the BAFTA Award-winning BBC Television medical drama *Casualty*, invited authors YN and TH to present their research findings. It was here the authors introduced the concept of Maggot Therapy, and the challenge of public perception and acceptance of this therapy. As a result of this interaction, in October 2018, the producers decided to incorporate a maggot therapy storyline to run through four separate episodes of their forthcoming series (Series 33). Over the next 5-7 months, *Casualty* script writers sought advice and support from SUMRG through regular exchanges to confirm the accuracy and factual content of the maggot storylines, prior to filming. The four *Casualty* episodes featuring Maggot Therapy aired between February 2019 and June 2019.

The BBC programme, *Casualty*, is a long-running, enduring British medical emergency drama that airs at prime time every Saturday evening on BBC One. The programme is primarily set in an Emergency Department (ED) of a fictional hospital and revolves around the professional and personal lives of medical and ancillary staff of this department.

Summary of maggot storyline

The maggot storyline predominantly featured two regular main cast members, the brilliant and eccentric Consultant in the ED, Dylan Keogh, and an enthusiastic student nurse, Jade Lovell.

First maggot episode (series 33, episode 25)

A homeless man arrives into the ED with a wound. The infected wound, being treated by Dylan, is swarming with maggots and makes observers in the vicinity (both healthcare professionals and patients) squeamish and repulsed. However, Consultant Dylan explains how well the maggots are helping to clear the wound, "better than most medics he knows" he says. Seeing the maggots working in the wound, Dylan gets an idea.

Second maggot episode (series 33, episode 28)

The plot focusses around the treatment of a pressure ulcer on the back of a paraplegic patient, Campbell. At first, Campbell refuses treatment, he does not want to go through with Maggot Therapy as he finds the idea of maggots in his wound disgusting. In the same episode, we see that Dylan has set up his own sterile rearing facility for medicinal larvae and he is seen in his lab where he discusses the wonders of maggots and Maggot Therapy with Jade, explaining how maggots work so effectively and efficiently to debride wound ulcers and help treat chronic wounds like pressure ulcers. Back on the ward, Jade then simply explains maggot action to Campbell, how "maggots are like hoovers that suck up the bacteria and dead skin in his wound." By doing so, she successfully manages to convince Campbell to accept the therapy and allow Maggot Therapy treatment for his pressure ulcer.

Third maggot episode (series 33, episode 30)

Jade and Dylan receive a thankyou card and maggot key-ring gift from a grateful Campbell to thank his medical team for using maggots to cure his ulcer, with the words" Maggots are the key to the future!" There are congratulations offered on the success of the maggot trial.

Final maggot episode (series 33, episode 38)

In this episode, a moon-embracing, tree-hugging and willing patient with a serious burn injury on the base of her foot is treated by Maggot Therapy. She remarks on the holistic beauty of nature healing her, but Dylan explains that the therapy works because of its scientific properties.

Entertainment Education

Entertainment Education is considered an approach where drama content is designed and implemented for the purpose of educating as well as entertaining. The idea of this is to promote an increase in audience knowledge, usually about a specific issue [12]. It involves integrating compelling entertaining story lines with educational messages and it is built on the unique persuasive power of entertainment narratives. Research has shown that entertainment education is a particularly effective communication strategy, as one of the mechanisms involved is absorption into the narrative and emotional involvement with a personal character [12]. In the case of *Casualty*, Dylan is a main character, a unique and well-respected Consultant in the Emergency Department. Viewers who have a high level of involvement with a character tend to experience more knowledge gains and the greatest shift in attitude and behaviour and, it has been noted that individual viewers may also identify with fictional characters in entertainments narratives [15,16].

Aim of our study

The study proposed to evaluate the impact of *Casualty* episodes featuring Dylan, Jade and the maggot storyline, on any changes of public awareness and perception of Maggot Therapy. The study design consisted of an independent pre- and post-wave questionnaire using a panel sample of regular *casualty* viewers.

Methods

BBC *Casualty* episodes featuring Maggots/ Maggot Therapy aired between 23rd February and 8th June 2019. Researchers from the private polling company *Opinium* were contracted to undertake a UK wide national research survey. *Opinium* are a private, independent research insight agency who are members of the British Polling Council.

Research method

Opinium conducted the investigation as a two-part poll consisting of a pre-wave survey (prior to airing of maggot-*Casualty* episodes) and a post-wave survey (issued just after the last maggot-*Casualty* episode aired). Testing field dates for the pre-wave survey were 6th February 2019 to 13th February 2019. After the last maggot episode (8th June 2019) was shown, the post-wave survey went live from 12th June and was available until 24th June 2019. For the post-wave survey, *Opinium* researchers re-contacted all the original qualifying pre-wave participants and asked them to complete the post-wave survey.

Survey Questions

Initial questions set for all (both pre-and post-wave) respondents identified standard demographics including age, gender, geographical region and social grade.

Pre-wave survey

After standard demographic questions, the next question was posed to identify if responders would qualify to proceed with the remainder of the survey. Responders were asked to choose

which programmes they regularly watched out of a list of 10 BBC programmes, one of these being BBC *Casualty* (Table 1). Only those responders that were identified as being regular *Casualty* watchers were selected out to proceed to the next step and these became the survey participants. Participants were next asked four questions specifically formulated to uncover their knowledge and opinions of various existing wounds and medical therapies. (Participants were offered questions on a five-point Likert scale response with a mid-point for those who wished to respond neutrally)

The questions asked were:

- How open are you to alternative, non-surgical treatments for chronic wounds?
  For the following three questions, participants were given options of four chronic wound treatments: honey, maggots, hydrosurgery, and enzymatic treatment (all of which were briefly and simply explained intext [Table 4])
- How aware are you of the following non-surgical treatments for chronic wounds?
- In general, how acceptable do you find each of the following non-surgical treatments for chronic wounds?
- If you were given the option of one of the following treatments, how likely is it that you would choose the following non-surgical treatments for chronic wounds?

Post-wave survey

Upon recontact with the original pre-wave participants, the post-wave survey was issued. This consisted of a repeat of the original set of demographic questions and all pre wave questions, plus an additional set of four specific questions directly related to the maggot storylines portrayed in *Casualty*. The additional specific questions asked post-wave participants about their memory of storylines, and whether the portrayal of Maggot Therapy on *Casualty* had specifically changed their perceptions, acceptability or willingness to have the treatment, if needed.

Opinium sent summarised pre-wave and post-wave reports to authors by 27th June 2019. Upon further request, they kindly provided all their raw data in August 2019, enabling authors to undertake detailed statistical analysis for this study.

Data analysis

Analysis of the questionnaire consisted of descriptive statistics based on the results obtained. Statistical analysis was undertaken in EXCEL and SPSS Version 26 for Windows. Any inferential statistical differences between the responses were assessed using a paired samples "t test". Correlations were used to explore the association between responses using the Pearson Correlation Coefficient, r. Statistical significance (P value) was set as $p < 0.05$.

Results

Qualifying participants

The participants included in the online survey carried out by *Opinium* were all viewers of the BBC Television Programme, *Casualty*. Whilst several other shows were also watched to varying degrees (Table 1), 1006 participants regularly watched *Casualty* and therefore these 1006 qualified to take part in the pre-airing (pre-wave) survey. Of these 1006 participants, 622 responded to the post-airing (post-wave) surveys (Table 2). Table 2 shows the results depicting demographic details of participants.

Table 1: BBC Television shows regularly watched by participants of survey

BBC TV shows watched	Total number of survey responders
Casualty	100 %
	1006
Holby City	61 %
	611
Call the Midwife	61 %
	610
Silent Witness	55 %
	555
EastEnders	49 %
	489
Death in Paradise	44 %
	445
Planet Earth	43 %
	436
Luther	39 %
	391
Doctor Who	34 %
	338
Doctors	26 %
	263
None of these	0 %
	0

Table 2: Demographic data for Pre and Post-Wave Participants

	Number of participants	Age			Gender			UK geographical region				Social Grade	
	(N)	18-34	35-54	55+	M	F	Other	England	Scotland	NI	Wales	ABC1	C2DE
Pre wave participants	1006 (100%)	14%	31%	55%	39%	61%	0%	85%	8%	2%	5%	60%	40%
Post wave participants	622 (100%)	8%	27%	65%	40%	60%	0%	85%	8%	2%	5%	58%	42%

Demographic data

From Table 2, it also can be seen that the majority of survey participants fell into the age 55+ category (55% pre-wave and 65% post-wave). There were fewer younger participants for both the pre-wave and post-wave survey (14% and 8% respectively).

Openness to non-surgical treatments

In response to the question "How open are you to alternative, non-surgical treatments for chronic wounds?", there was a very positive response from pre-wave participants. Almost 77% pre-wave participants said they were very open/open to non-surgical treatment (Table 3). This figure did not vary much for post-wave participants, 71.4% of whom were very open/open to non-surgical treatment. No significant difference was found between these two figures ($p = 0.873$; CIs -0.008 (-0.107, 0.091).

Table 3: Participant responses to question: *How open are you to alternative, non-surgical treatments for chronic wounds?* (Figures in parenthesis represent the actual number of participants for each response).

	Very open	Open (after main-stream medical approaches first)	Not sure/ Don't know	Only as a last resort	Never
Pre-wave participants (N=1006)	48.4% (487)	28.2% (284)	9% (91)	9.8% (99)	4.5% (45)
Post-wave participants (N=622)	41.3% (257)	29.1% (181)	11.4% (71)	10.9% (68)	7.2% (45)

Awareness of Maggot Therapy and other non-surgical treatments

For pre-wave participants, awareness of the non-surgical means of treating chronic wounds was highest for Maggot Therapy (53%), second to honey dressings (41.5%) ($p \leq 0.001$; CIs -0.115 (-0.151, -0.080) (Table 4). Pre-wave awareness was lower for other alternative treatments, i.e. hydrosurgery and enzymatic treatment.

For post-wave participants, awareness of other treatments, namely honey, hydrosurgery and enzymatic treatments, did not change significantly from pre-wave awareness. There was, however, a large statistically significant increase in awareness of Maggot Therapy from 53% in pre-wave participants to 75.6% for post-wave participants ($p \leq 0.001$ CIs 0.225 (0.186, 0.264) (Table 4).

Table 4: Participant responses to question: *How aware are you of the following non-surgical treatments for chronic wounds?* (Figures in parenthesis represent the actual number of participants for each response).

	Honey Dressing (dressings that are impregnated with medical grade honey)	Maggot Therapy (placing either free (contained) or 'bagged' clinical grade live maggots onto wound	Hydrosurgery (use of high power pressurised water jet to remove dead tissue)	Enzymatic (use of chemical enzymes to help wound healing)	None of these
Awareness in Pre-wave participants (N=1006)	41.5% (417)	53% (533)	19.6% (197)	18% (181)	29.4% (296)
Awareness in Post- wave participants (N=622)	46.5% (289)	75.6% (470)	22.8% (142)	17% (106)	16.7% (104)

Acceptability of Maggot Therapy and other non-surgical treatments

The general acceptability of various wound treatments for both pre and post-wave participants can also be seen in Table 5. Honey was considered to be the most acceptable treatment in both pre and post-wave responses (79.3% and 81.3% respectively), and acceptability of two of the other potential treatments, hydrosurgery and enzymatic, remained high and similar for both pre and post-wave participants (Table 5). Of note was the result that whilst pre-wave awareness of Maggot Therapy was high, its pre-wave acceptability was the lowest amongst all treatments (Table 5). Pre-wave acceptability of Maggot Therapy was significantly lower (48.8%) than for all other treatments: For example, it was lower than honey (79.3%) ($p \leq 0.001$ CIs -0.878 (-0.963, -0.793), hydrosurgery (70.4%) $p \leq 0.001$ CIs 0.615 (0.529, 0.702), and enzymatic therapy (68.4%) $p \leq 0.001$ CIs 0.658 (0.574, 0.742).

Post-wave acceptability of Maggot Therapy significantly increased from 48.8% to 56.2% ($p \leq 0.001$ CIs 2.571 (2.470, 2.672). Additionally, whilst unacceptability did not change significantly for other wound treatments between pre and post waves, the unacceptability of Maggot Therapy did change, and decreased from 30.9% in pre-wave participants to 23.3% post-wave participants finding it somewhat unacceptable/unacceptable ($p \leq 0.001$ CIs 0.294 (0.188, 0.399) (Table 5).

Table 5: Participant responses to question: In general, how acceptable do you find each of the following non-surgical treatments for chronic wounds? (Figures in parenthesis represent the actual number of participants for each response).
[Data is presented for responses to Acceptable/somewhat acceptable and Somewhat unacceptable/unacceptable. (Data for those respondents who said neither unacceptable of acceptable for each treatment is not included, but makes up the remainder)]

		Honey Dressing (dressings that are impregnated with medical grade honey)	Maggot Therapy (placing either free (contained) or 'bagged' clinical grade live maggots onto wound	Hydrosurgery (use of high-power pressurised water jet to remove dead tissue)	Enzymatic (use of chemical enzymes to help wound healing)
Acceptability in Pre wave participants (N=1006)	Acceptable/ somewhat acceptable	79.3% (798)	48.8% (490)	70.4% (708)	68.4% (684)
	Somewhat unacceptable /unacceptable	3.7% (37)	30.9% (31)	6.9% (69)	6% (60)
Acceptability in Post wave participants (N=622)	Acceptable/ somewhat acceptable	81.3% (5068)	56.2% (349)	70.4% (438)	64.9% (404)
	Somewhat unacceptable /unacceptable	3.1% (19)	23.3% (145)	6.6% (41)	6.6% (41)

Willingness to choose Maggot Therapy and other non-surgical treatments
Considerably more participants in both pre and post-wave surveys were likely to opt for honey, hydrosurgery or enzymatic treatment over Maggot Therapy, if it was offered to them (Table 6). Of pre-wave participants, 39.6% said that they were likely to choose Maggot Therapy but 38.8% said they would be unlikely/very unlikely to choose it.

However, the number of post-wave participants who said they were likely to choose Maggot Therapy increased significantly to 42.9% ($p \leq 0.001$ CIs 0.072 (0.032, 0.111), but more interestingly, the percentage of post-wave participants who said they would be unlikely/very unlikely to choose Maggot Therapy also changed, and decreased significantly from the pre-wave figure of 38.8% to a post-wave value of 30.6% ($p \leq 0.001$ CIs 3.407 (3.298, 3.515) (Table 6).

Table 6: Participant responses to question: If you were given the option of one of the following treatments, how likely is it that you would choose the following non-surgical treatments for chronic wounds? (Figures in parenthesis represent the actual number of participants for each response).
[Data is presented for responses to Very likely/likely and Unlikely/very unlikely. (Data for those respondents who said they were neither likely nor unlikely to accept each treatment is not included, but makes up the remainder)]

		Honey Dressing (dressings that are impregnated with medical grade honey)	Maggot Therapy (placing either free (contained) or 'bagged' clinical grade live maggots onto wound	Hydrosurgery (use of high-power pressurised water jet to remove dead tissue)	Enzymatic (use of chemical enzymes to help wound healing)
Pre-wave participants (N=1006)	Very likely/likely	76.5% (769)	39.6% (398)	64% (643)	62.9% (632)
	Unlikely/very unlikely	6.5% (65)	38.8% (390)	12.1% (122)	9.9% (99)
Post-wave participants (N=622)	Very likely/likely	75.9% (462)	42.9% (267)	62.9% (391)	60% (373)
	Unlikely/very unlikely	4.3% (27)	30.6% (190)	10.1% (63)	9.1% (56)

Specific Post-Wave questions
Memory of maggot storyline
The maggot and Maggot Therapy storyline were remembered by 72.5% of post-wave participants. This was slightly lower than other storylines remembered by viewers (Table 7). For example, other, more dramatic storylines, (Dementia, Depression and Post traumatic Stress Disorder) were remembered by 86.5%, 80.4% and 82.2% of viewers respectively.

Table 7: Additional specific post wave questions

Post wave participant memory of BBC *Casualty* storylines. (Figures in parenthesis represent the actual number of participants for each response).

BBC *Casualty* storylines which featured in maggot episodes	Post wave participants who remembered storyline (N=622)
Maggot therapy treatment	72.5 %
	(451)
Duffy and her dementia diagnosis story line	86.5 %
	(538)
Iain and his depression story line	80.4 %
	(500)
Connie and her post traumatic stress disorder story line	82.2 %
	(511)
None of these	2.6%
	(16)

General perception and acceptability of Maggot Therapy following portrayal on BBC *Casualty*

Response to the final set of questions posed solely to post-wave participants are shown in Table 8 a-c. When asked about their perceptions of Maggot Therapy specifically after watching the Maggots/ Maggot Therapy storyline on BBC *Casualty*, 46.4% of post-wave participants said that their perceptions of Maggot Therapy had become more positive as a result (Table 8a), with only 3.4 % saying that their perception was now more negative ($p \leq 0.001$ CIs 2.529 (2.407, 2.651). However, for 50.2% of post-wave participants, the portrayal of Maggot Therapy on BBC *Casualty* had not changed their perceptions of Maggot Therapy.

Interestingly, when questioned specifically about the general acceptability of Maggot Therapy following its appearance on BBC *Casualty*, 64% of post-wave participants said that they now felt Maggot Therapy was a more acceptable treatment (Table 8b), compared to 13% of participants for whom it was not, ($p \leq 0.001$ CIs 1.601 (1.535, 1.668), and 23% who did not know.

Table 8a: How has portrayal of Maggot Therapy on *Casualty* affected your perception of Maggot Therapy as a treatment?

	Much more positive/More positive	Unchanged	Much more negative/More negative
Perception in Post wave participants (N=622)	46.4% (289)	50.2% (312)	3.4% (21)

Table 8b: Since its appearance on BBC *Casualty*, do you now feel that Maggot Therapy is a more acceptable treatment?

	Yes	No	Don't know
Acceptability in Post wave participants (N=622)	63.7% (396)	12.5% (78)	23.8% (148)

Table 8c Since its appearance on BBC *Casualty*, how likely are you to accept or ask for Maggot therapy for a chronic wound?

[Data is presented for responses to Very likely/likely and Unlikely/very unlikely. Data for those respondents who said they did not know, or were neither likely nor unlikely to accept Maggot Therapy, is also included as it made up a substantial amount of the remainder)]

		Accept Maggot Therapy	Ask for Maggot Therapy
Post wave participants (N=622)	Very likely/ likely	54.5% (339)	34.3% (213)
	Unlikely/very unlikely	19.8% (123)	33.4% (208)
	Neither likely nor unlikely/ Don't know	25.7% (160)	32.3% (201)

Potential uptake of Maggot Therapy for post wave participants own wounds

Our final survey question asked post-wave participants (having seen the appearance and portrayal of Maggot Therapy on BBC *Casualty*), how likely they were to either accept, or request, Maggot Therapy for their own chronic wound, should they need to. Notably, 54.5% of participants said that they would be very likely/likely to accept Maggot Therapy, compared to 19% who said that they would be unlikely/very unlikely to accept it ($p \leq 0.001$ CIs 3.132 (3.026, 3.238). When asked about specifically requesting Maggot Therapy for their own wound, whilst 34.3% of post-wave participants said that they would ask for Maggot Therapy for their wound, there were almost equal numbers of participants who said they would be unlikely/very unlikely to ask for it, or who did not know (Table 8c)

Associations between remembering maggot storyline, perception and acceptability of Maggot Therapy

An analysis of responses from the group of post wave *Casualty* watchers who remembered the storyline about Maggot Therapy, revealed that their general impression of Maggot Therapy appeared to be more positive than those who did not remember it. For example, those participants who remembered the storyline were more positive in their perceptions of Maggot Therapy than the overall sample (54.5% vs 46.4% respectively). A Pearson correlation was run between these two variables and a small but

positive correlation was found between memory and perception ($r = 0.200$; $p \leq 0.001$). Furthermore, there was also a positive association between remembering the maggot storyline and viewing Maggot Therapy as generally acceptable ($r = 0.243$; $p \leq 0.001$).

Discussion

Demographic data

The majority of survey participants fell into the age 55+ category (55% pre-wave participants and 65% post-wave participants were over 55 years old). This may be due to the fact that younger viewers prefer to watch programmes through online streaming, whereas terrestrial BBC Television tends to attract older viewers, as was shown in a recent report by the BBC which stated that the average age of a BBC viewer was 61 years [17]. However, for our study on perception and acceptability of treatments for chronic wounds, this was an ideal age group to capture since older people are much more likely to acquire and suffer from chronic wounds [18].

Interestingly, around three quarters of qualifying participants said they were open to non-surgical, alternative treatments. Recent reports suggest that the use of Complementary and Alternative Medicine (CAM), in many European populations is increasing and a study exploring trends in preferences for CAM showed increasingly positive attitudes towards CAM and a desire for increased access to such approaches/modalities [19,20].

Awareness of Maggot Therapy

Awareness of the use of maggots as a treatment for chronic wounds in pre-wave participants was higher (53%) than it was for all other wound treatments (honey, hydrosurgery and enzymatic). Nonetheless, after the maggot episodes of *Casualty* aired, as expected post-wave participant awareness of Maggot Therapy increased dramatically (75.6%). This was a considerable change in awareness, and resulted in a remarkable impact considering that each maggot episode attracted several million viewers (Episode 25 - 5.2 million viewers; Episode 28 – 4.9 million; Episode 30 – 5.1 million and Episode 38 – 4.8 million [21]), Entertainment education has been shown in the past to be a successful strategy for raising awareness of many different issues [22-23]. More than 40% of regular viewers of primetime TV comedies and dramas report learning something new about a health issue or a disease from these shows with more than 20% taking action on what they have learned [24]. With regards to Maggot Therapy, raising awareness of its existence as a potential treatment is a first step. Indeed, one of the areas of concern highlighted by wound practitioners, is the need to increase patient awareness of Maggot Therapy and its many benefits [10].

Acceptability of Maggot Therapy

Interestingly, for pre wave participants, despite awareness of Maggot Therapy being higher than other treatments, acceptability of the treatment was significantly lower than it was for all other treatments. It has been reported by many authors, that maggots are not regarded as particularly appealing for therapeutic use [24-26]. Indeed, for some individuals the very word "maggot" can entice immediate negative connotations, such as images of rot and decay [27]. However, in our study, the acceptability of Maggot Therapy increased for post-wave participants having watched the portrayal of Maggot Therapy on *Casualty*, and more importantly, the unacceptability of Maggot Therapy significantly decreased too. In addition, after the maggot episodes had aired, there was a significant decrease in the number of participants who said they would be unlikely to choose Maggot Therapy. This is testament to the capability of Entertainment Education to change people's attitudes and is a well-documented occurrence [28,29]. For example, a recent study examined the negative attitude towards breastfeeding in public. The researchers discovered that viewing a prime-time television clip that depicted public breastfeeding not only significantly lessened the extent to which participants believed that breastfeeding was a private activity but also improved attitudes and support for breastfeeding in public. The study concluded that more pro-breastfeeding media messages in entertainment media could help create a climate conducive to breastfeeding success [30].

A series of responses to specific additional post-wave questions obtained a closer understanding of the relationship between the Maggot Therapy storyline and participants own perceptions/ thoughts. Remarkably, 46.4% of post-wave participants stated that their perceptions of Maggot Therapy had become more positive as a result of watching the maggot storyline on *Casualty*, and 63.7% of these post-wave participants stated that they now felt that it was a more acceptable treatment (compared to 12.5% of participants for whom it was still not). This again highlights the change in perceptions and attitudes after viewing the positive outcome of patients and portrayal of Maggot Therapy on *Casualty*. Entertainment media serves as a key resource for health-related information [31], and one of the reasons why entertainment is a powerful vehicle for persuasive messages is because unlike public service announcements or other vertically persuasive formats, entertainment narratives are not generally perceived as having an agenda [32]. The use of TV drama as entertainment education for very serious and important social and public health issues has been seen on many occasions, for example, to highlight the importance of breast cancer screening or to tackle domestic violence [31,32, 34]. The latter paper describes how national and media fervour evoked by the Chinese television drama portraying domestic violence, led to the culmination of the passing of anti-domestic violence legislation in China, reflecting the absolute power of narrative engagement and persuasion.

Relationship between remembering maggot storyline and responses

In the post-wave survey, a large proportion of participants (72.5%) remembered the maggot storyline. This was less than for other more dramatic storylines but may have been due to the fact that we erroneously omitted to mention any specific characters by name. In retrospect, this may have triggered less recall of the Maggot Therapy storyline than for others. Specific questions linking this memory to any changes in perception and acceptability of Maggot Therapy, however, revealed that attitudes in participants who remembered were indeed more positive. This increased positivity was seen in perception, and in general acceptability of Maggot Therapy. However, there was no significant correlation found between participants who remembered the storyline and those who would ask for Maggot Therapy as a treatment for their wounds, although Entertainment Education has been shown not just to change perception of an issue but also to motivate individuals to work to improve their own health and wellbeing [35]. In a report assessing the effects of Entertainment Education on health information, more than 20% regular viewers of primetime TV comedies and dramas reported taking action on what they have learned [24].

Nonetheless, small associations were also found between individuals who remembered the storyline and those that said their perception of Maggot Therapy had become more positive

and their acceptability had increased. This interesting link again reiterates the persuasive nature of Entertainment Education.

With regards to Maggot therapy, any positive change in perception or increase in acceptance would be of great benefit to individuals and their families, and particularly so for patients with chronic wounds. A cultural shift in the perception of maggots could also be pivotal in supporting clinicians who wish to offer Maggot Therapy to their patients. But there is still an uphill struggle due to the dislike and squeamishness exhibited towards this therapy [11]. The positive portrayal of maggots and Maggot Therapy by BBC *Casualty* has been very useful in raising awareness of the treatment and beginning the journey to combat negative perception and poor acceptability. Episodes where there was discussion between Dylan and Jade on how maggot therapy had helped heal patient's chronic wounds, were particularly central to reinforcing positive perceptions and boosting the public image of maggots. Such storylines may help to address negative emotions towards these important medical creatures and perhaps challenge the stigma that they suffer.

Conclusion

The inclusion of Maggot Therapy within the storyline of BBC *Casualty* had a positive effect on public awareness, perception and acceptability of the treatment. This study emphasises the powerful nature of entertainment media education. The inclusion of Maggot Therapy and the appearance of this treatment led to increased awareness and a shift towards a more positive perception of Maggot Therapy with some *Casualty* viewers. Perhaps better communication of knowledge and understanding of the medical benefits of Maggot Therapy could help to further improve public acceptance. Although robust evidence on their medical value is widely apparent, there is still a need to convince people to view these tiny insects a little more favourably.

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