

# An exploration of public perceptions and attitudes towards maggot therapy

**Objective:** The aim of the study was to explore public opinion and perceptions of maggot therapy (larval therapy), a treatment option for hard-to-heal wounds.

**Method:** The study used a mixed-method approach to obtain quantitative and qualitative data. A focus group was convened to explore opinions and views of maggot therapy with a small group of members of the public. Analysis of emerging themes from the focus group was used to design an anonymised web-based survey, which was made available online to members of the public through email and social media.

**Results:** The focus group participants identified four key themes concerning the acceptability of maggot therapy. The subsequent online survey was completed by 412 participants, analysis of which revealed some worries and fears. Only 36% of survey participants agreed that they would accept maggot therapy as a first choice for a

hypothetical painful wound, although this number increased with wound severity. The most predominant concerns regarding maggot therapy were sensation and a feeling of disgust associated with the therapy. However, participants could see some benefits to maggot therapy.

**Conclusion:** Our study showed that public perception of maggot therapy is varied. Survey participants expressed worries and fears associated with its use. However, positive relationships existed between knowledge scores and potential acceptability of maggot therapy, suggesting that information dissemination and education may be an important factor in public perception and acceptability of maggot therapy.

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chronic • hard-to-heal • larval therapy • maggots • maggot therapy • public perception • wound • wound care • wound dressing • wound healing

**H**ard-to-heal (chronic) wounds are slow or non-healing wounds, for example leg ulcers, which often result from comorbidities such as diabetes and cardiovascular disorders, imposing a significant burden on the individual, families and healthcare systems.<sup>1</sup> For example, in Wales (UK), the prevalence of hard-to-heal wounds is currently estimated at 6% of the population with a concurrent cost of 5.5% of the UK National Health Service (NHS) budget (£303 million).<sup>2</sup> Complications of hard-to-heal wounds can be extremely severe and include infections such as cellulitis, gangrene, haemorrhage and lower-extremity amputations.<sup>3</sup> Wounds are managed by a range of healthcare practitioners, and in the UK, hard-to-heal wound care is predominantly nurse-led. To allow hard-to-heal wounds to progress and heal, it is accepted that unhealthy, dead and infected tissue must first be removed.<sup>4</sup> A multitude of dressings and treatments exist to help manage the debridement of hard-to-heal wounds and include surgical, enzymatic, autolytic and biological debridement.<sup>5</sup>

Another treatment for debriding hard-to-heal wounds is maggot therapy (larval therapy) which involves the application of living, aseptically-reared, clinical grade medicinal maggots onto a necrotic, sloughy or infected wound. Although evidence exists of ancient tribes and traditional cultures using maggots to help heal wounds, the modern use of maggot therapy began in the 1930s, with over 300 hospitals in the US and Canada using it to help treat hard-to-heal and infected wounds.<sup>6</sup> At that time, use of maggot therapy never quite reached Britain and Europe, and there were strong debates about its acceptability in the UK.<sup>7</sup> In the British journal *Medical Annual*,<sup>8</sup> it was argued that the treatment would never be used in the UK because 'the word maggot was repulsive, and neither the profession nor the public would favour the method.'

In the 1940s, antibiotics became industrially mass produced and readily available, and the use of maggot therapy disappeared altogether. However, we now find ourselves on the verge of a catastrophic global antibiotic resistance,<sup>9</sup> with a worldwide rise in patients with antibiotic-resistant wound infections.<sup>10</sup> This, coupled with the increased burden of hard-to-heal wounds in the UK and worldwide, has led to a progressive reemergence of maggot therapy as a viable wound treatment.<sup>11</sup> Maggots are now available on NHS prescription and the US Food and Drug Administration (FDA) has approved it for use in the US and several other countries.

Published literature, including clinical trials, supports the view that medicinal maggots work quickly and

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selectively to clear dead tissue.<sup>12–14</sup> Studies also show that maggots exhibit unique and effective antimicrobial and wound healing properties.<sup>15</sup> A hard-to-heal wound typically costs £2333 and takes, on average, 89 days to debride, while a wound debrided by maggot therapy costs £209 and initial treatment takes five days.<sup>16</sup> However, despite its debriding efficiency and cost-effectiveness,<sup>17</sup> maggot therapy has a surprisingly low uptake and is increasingly regarded as an extremely effective yet underutilised clinical treatment for hard-to-heal wounds.<sup>14</sup> The reasons for this underutilisation may be multifactorial, but effective administration of maggot therapy depends on agreement between the clinician and patient. Some reports refer to the intrinsic presence of a preconceived cultural dislike of maggots, historically reported as the 'yuk factor'.<sup>18,19</sup> Here, we report results of our investigation into public opinion and perceptions of maggot therapy, with the aim of identifying emerging key themes which may be associated with the idea of maggot therapy, and perhaps, therefore, its potential use and uptake as a wound treatment.

## Method

### Research design

The research study used a mixed-method approach to obtain quantitative and qualitative data on public perception and opinion of maggot therapy. The design consisted of two stages.

**Stage one:** implemented through a focus group conducted with 10 members of the public. The discussion was guided by four key questions:

- Participant's awareness of maggot therapy
- Participant's reactions to the concept of maggot therapy
- Participant's knowledge of maggot therapy
- Participant's own willingness to accept maggot therapy if ever needed.

The focus group lasted for about one hour and field notes were taken (by author SW). A graphic record of the focus group findings was also captured.

Qualitative data obtained from the focus group were used to identify emerging key areas and themes which were noted for further exploration in Stage two.

**Stage two:** implemented as an online survey designed from themes identified in stage one. The survey consisted of 22 questions. The design of the survey included two types of responses:

- Dichotomous questions asked about participant knowledge ('Yes'/'No' responses only)
- Responses to questions which sought participant opinion and perception using a five-point Likert scale (1='strongly agree', 2='agree', 3='neither agree nor disagree', 4='disagree' and 5='strongly disagree').

Additionally, data were collected to measure sex, age, geographical location, academic qualification, profession, and prior personal experience of maggot therapy.

### Participant recruitment

Participation was open to any adult who met the inclusion criteria: aged 18+ years; ability to complete the study in the English language; and ability to give consent. Exclusion criterion was solely any prior personal experience of maggot therapy (to eliminate the introduction of any bias).

### Stage one

Email invitations for participants to attend the focus group discussion were sent to community groups and employees of local businesses, with an additional open invitation to invite their family and friends. The general theme for the focus group was stated as 'Maggot Therapy'. No other information given but details of the exclusion criteria were provided. Responding participants who met the inclusion criteria were invited to attend the focus group at the set date and time. A free lunch was provided.

### Stage two

The online survey was advertised publicly using study adverts in the local community, university all-staff emails, and social media (Twitter and Facebook). An information sheet on maggot therapy was displayed electronically for online participants before they undertook the survey (available from the authors on request).

The research was conducted between December 2015 and January 2017.

### Data collection and analysis

**Stage one:** a qualitative descriptive approach was used to identify the main themes that emerged from the focus group, using field notes and an artist illustration technique.<sup>20</sup> Participant responses were coded and key themes and sub-themes identified. A random sample of themes were selected for confirmation of themes by two independent coders. Agreement was found in >90% of cases. The themes that emerged were used to develop the survey in Stage two.

**Stage two:** responses from the survey were analysed using SPSS version 22 (IBM Corp., US). Statistical t-tests were used to compare responses for participant's sex, while Pearson's correlation coefficient (r) was used to explore the association between responses and participant demographics.

### Knowledge and barrier scores

A knowledge score was calculated by adding up the total number of statements presented that were already known by participants. The knowledge score ranged from 0–8 statements known. A barrier score was also calculated on responses to statements about barriers to maggot therapy. The overall perceived barrier score was computed by adding a score to each barrier item, where 1='strongly agree' and 5='strongly disagree'. A lower score indicated greater number of perceived barriers.

### Regression analyses

A series of linear regression analyses, placing choice to use maggot therapy in different scenarios as the outcome variable, and barriers, benefits and knowledge as the predictor variables was conducted.

Finally, a content analysis approach was used to categorise the open box (qualitative) responses, which some participants provided.

### Ethical considerations

Ethical approval was obtained through the College of Human and Health Sciences, Swansea University Research Ethics Committee for the survey and focus group. The study adhered to all aspects of the Declaration of Helsinki 1964.

### Results

#### Stage one

A total of 10 members of the public (who met the inclusion criteria) attended and took part in the maggot therapy focus group discussion. There were six female participants and four male participants, aged between 30–70 years. At the start of the focus group, emotions and attitudes were mixed when participants were asked for their thoughts on maggot therapy. Only 20% of the group were wholly positive and accepting

about the idea of maggot therapy, 10% were unsure, but the majority (70%) were very reluctant. The latter group of participants, in particular, expressed concerns and fears surrounding the use of maggot therapy. However, a perceived benefit was the natural quality of the therapy, and several participants stated that they would be guided by the opinion of their health practitioner.

Overall, participants of the focus group identified and described several ideas, concerns, perceived barriers and benefits, which were noted and captured by a real-time graphic recording artist. A visual representation of the discussion was produced that brought together some study information to facilitate discussion, and generated participants' thoughts and opinions (Fig 1).

From field notes, four main themes emerged from the discussion:

- Acceptance of the therapy would depend on wound severity and level of desperation for the wound to heal
- Key barriers were identified, such as fear of sensation and general dislike/fear of insects and 'creepy crawlies'. In addition, a negative association of maggots with death and decay was evident, and participants identified a fear of maggots escaping or turning into flies during treatment
- Lack of awareness of maggot therapy benefits
- Lack of knowledge about maggot therapy.

As the discussion concluded, all participants felt that more education and information was needed to ensure a better understanding of how maggot therapy works, and that if patients and the public were made more aware of the benefits of this type of therapy, this may help address fears and anxieties that they associated with maggots and maggot therapy.

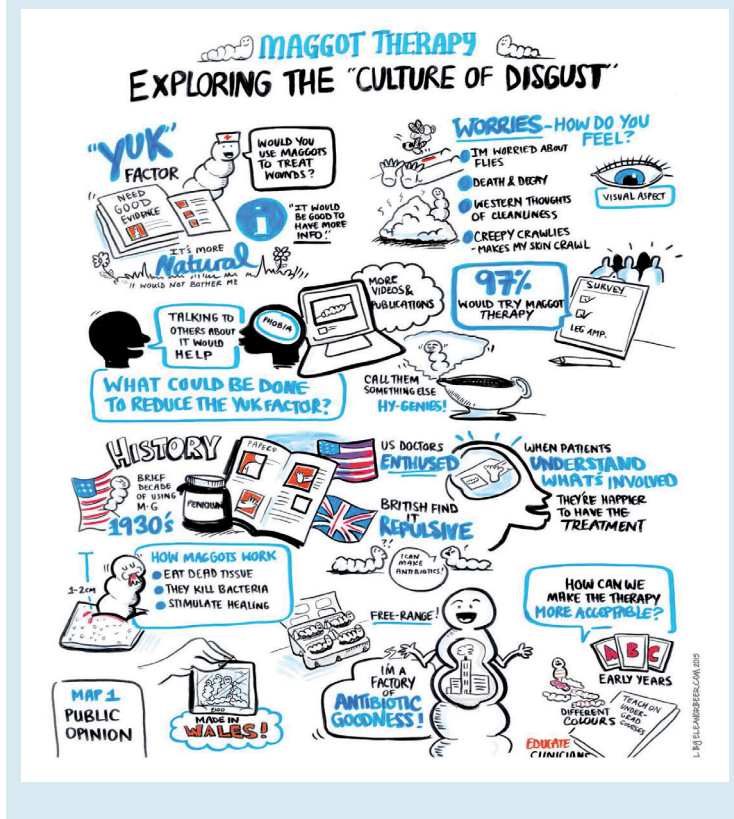
#### Stage two

The findings and core themes which emerged from Stage one determined the development of questions and scenarios that formed the public online survey. These were grouped into four categories based on the key themes identified from Stage one:

- Participant willingness to try maggot therapy
- Participant perception of barriers to maggot therapy
- Participant perception of benefits of maggot therapy
- Participant knowledge of maggot therapy.

A total of 413 people (adults) completed the survey, of whom 412 (99.8%) successfully met the inclusion criteria (one respondent had previously received maggot therapy treatment for an infection following a leg amputation, and thus was excluded from the survey sample). Of the participants, 38 (9.2%) knew someone who was offered maggot therapy and accepted it, and a further seven (1.7%) participants knew someone who had declined it. A participant suggested to their health professional that they had maggot therapy and the professional accepted (the participant noted above who was excluded from the study), whereas three participants suggested it to their health professionals and had their request declined.

**Fig 1.** Graphic recording of discussions (study information and participant thoughts and opinions) from the Stage one focus group ]



Of the 412 participants, 139 (33.7%) were male and 273 (66.3%) female. Participants ranged across all age brackets (92.7% were aged 18–59 years). Responses were obtained from participants in the UK, US, Canada, South Africa, Australia and New Zealand. Of the participants, 370 (89.8%) had heard of maggots being used to treat wounds. With regards to academic qualifications, 354 (86.0%) of participants had a degree or above. Most participants were university employees.

**Participant willingness to agree to maggot therapy**

Participants were asked to imagine a series of scenarios (Table 1) in which they might receive maggot therapy and to consider how strongly they would agree to have the treatment. Results are shown as the percentage of participants who either ‘strongly agreed’/‘agreed’, ‘strongly disagreed’/‘disagreed’ or were ‘unsure’.

Scenario one was the use of maggot therapy as a first treatment for a painful wound. Given this scenario, 36.2% participants ‘strongly agreed’/‘agreed’ they would be willing to have the therapy and 63.8% ‘did not agree’ or were ‘unsure’. The percentage of participants who ‘strongly agreed’/‘agreed’ was deemed low considering how many participants had heard of maggot therapy (36.2% and 89.7%, respectively).

For scenario two—a painful wound that hadn’t healed in one month—a greater number of participants (80.4%) ‘strongly agreed’/‘agreed’ they would be willing to accept maggot therapy.

For scenario three (a painful wound that hadn’t healed in six months) and scenario four (which involved a limb amputation), 92.9% and 91.6% participants, respectively, ‘strongly agreed’/‘agreed’ they would be willing to accept maggot therapy (Table 1). The data revealed a steady increase in the number of participants who felt they would be more willing to try maggot therapy as the hypothetical severity of their wound increased.

**Participant perception of barriers towards maggot therapy**

Participants were asked how strongly they agreed or disagreed with a series of statements regarding barriers

towards maggot therapy. The percentage of participants who ‘strongly agreed’/‘agreed’ and ‘strongly disagreed’/‘disagreed’ is shown in Table 2. Interestingly, no statement was shown to be an overwhelming barrier for the majority of participants, with ‘worry about the sensation of maggot therapy’ having the highest percentage strongly agreeing/agreeing (52.8%). Almost 41.0% of participants ‘strongly agreed’/‘agreed’ that the thought of maggot therapy ‘made their skin crawl’ and 35.5% of participants ‘strongly agreed’/‘agreed’ that maggots were ‘disgusting’. Only 3.3% of participants ‘strongly agreed’/‘agreed’ that the idea of maggot therapy was ‘stupid’, and only 2.5% felt that it ‘would not work’. With regards to pain and limb amputation, very few participants ‘strongly agreed’/‘agreed’ that they would prefer this to maggot therapy (1% and 0.8%, respectively) (Table 2).

Significant differences appeared in perceived barriers by sex. Women (n=273, 66.3%) were more likely to perceive disgust and have negative feelings towards maggot therapy than men. Women were more likely:

- To worry about the sensation (t=3.260; p=0.001)
- To perceive maggots as ‘disgusting’ (t=4.345; p<0.001)
- To associate maggots with death (t=2.390; p=0.017)
- To think that it would make their skin crawl (t=6.421; p<0.001)
- To think that it would make them feel ill (t=4.796; p<0.001).

The association between perceived barriers and readiness to accept maggot therapy was examined using Pearson’s correlation coefficient. All barriers significantly predicted each choice. The greater the perceived barrier, the less likely an individual would be to consider maggot therapy as a treatment (Table 3). As so many barriers predicted choice, a series of regression analyses was performed to explore which attitudes predicted the choice made. The following barriers remained significant: For maggot therapy as a first choice of treatment:

- I would prefer to take medication (p<0.001)
- I prefer conventional treatment (p<0.001)
- I don’t think they would work (p=0.022).

For maggot therapy after having a painful wound for

**Table 1. Willingness of questionnaire participants to try maggot therapy in different scenarios (n=412)**

Scenario	Percentage participants who ‘strongly agree’/ ‘agree’	Percentage participants who ‘strongly disagree’/‘disagree’	Percentage participants who were ‘unsure’ (neither agree nor disagree)
I would try maggot therapy as a first treatment for a painful wound	36.2	31.0	32.8
If I had a painful wound that hadn’t healed in one month, I would try maggot therapy	80.4	6.6	13.0
If I had a painful wound that hadn’t healed in six months, I would try maggot therapy	92.9	2.2	4.9
If I was told I needed to have a limb amputated I would try maggot therapy	91.6	1.7	6.7

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**Table 2. Willingness of questionnaire participants perceiving barriers to maggots and maggot therapy (n=412)**

Barrier	Percentage participants who 'strongly agree'/'agree', n=412	Percentage participants who 'strongly disagree'/'disagree', n=412	Percentage participants who were 'unsure' (neither agree nor disagree), n=412
I would prefer other conventional dressings	39.8	17.9	42.3
I don't think they would work	2.5	86.3	11.2
I think the idea is stupid	3.3	92.5	4.2
I worry about the sensation	52.8	32.3	14.9
I worry it would hurt	24.1	59.9	16
They are disgusting	35.5	42.3	22.2
I worry they are unclean	15.0	70.5	14.5
I worry they would turn into flies	20.1	77.8	2.1
I associate maggots with death	25.1	56.2	18.7
The thought makes me feel ill	27.6	51.9	20.5
The thought makes my skin crawl	40.8	43.5	15.7
I would prefer to have a limb amputated	1.0	91.0	8.0
I would prefer to take medication	34.2	33.2	32.6

**Table 3. Associations between perceived barrier to maggot therapy (MT) and likelihood of accepting MT in each scenario described in Table 1 (using Pearson's correlations). All barriers significantly predicted each choice. The greater the perceived barrier, the less likely a participant would consider having MT as a treatment**

Barrier	MT as a first choice with a painful hard-to-heal wound	MT after 1 month with a painful hard-to-heal wound	MT after six months with a painful hard-to-heal wound	MT if a limb amputation was needed
I would prefer other conventional dressings	-0.565, p<0.001	-0.496, p<0.001	-0.379, p<0.001	-0.301, p<0.001
I don't think they would work	-0.342, p<0.001	-0.367, p<0.001	-0.378, p<0.001	-0.295, p<0.001
I think the idea is stupid	-0.246, p<0.001	-0.362, p<0.001	-0.405, p<0.001	-0.307, p<0.001
I worry about the sensation	-0.349, p<0.001	-0.325, p<0.001	-0.261, p<0.001	-0.174, p<0.001
I worry it would hurt	-0.241, p<0.001	-0.253, p<0.001	-0.182, p<0.001	-0.105, p=0.019
They are disgusting	-0.407, p<0.001	-0.409, p<0.001	-0.414, p<0.001	-0.278, p<0.001
I worry they are unclean	-0.340, p<0.001	-0.389, p<0.001	-0.340, p<0.001	-0.194, p<0.001
I worry they would turn into flies	-0.310, p<0.001	-0.316, p<0.001	-0.300, p<0.001	-0.149, p<0.001
I associate maggots with death	-0.244, p<0.001	-0.270, p<0.001	-0.205, p<0.001	-0.157, p<0.001
The thought makes me feel ill	-0.478, p<0.001	-0.468, p<0.001	-0.458, p<0.001	-0.297, p<0.001
The thought makes my skin crawl	-0.460, p<0.001	-0.378, p<0.001	-0.351, p<0.001	-0.222, p<0.001
I would prefer to have a limb amputated	-0.132, p=.004	-0.327, p<0.001	-0.484, p<0.001	-0.466, p<0.001
I would prefer to take medication	-0.573, p<0.001	-0.453, p<0.001	-0.341, p<0.001	-0.246, p<0.001

one month:

- I prefer conventional dressings (p<0.001)
- The thought of maggot therapy makes me feel ill (p=0.002).

For maggot therapy after having a painful wound for six months:

- The thought of maggot therapy makes me feel ill (p<0.001)

- I think the idea is stupid (p=0.008)

- I prefer conventional dressings (p=0.009)
- I associate maggots with death (p=0.021)
- They are disgusting (p=0.025)
- I worry it would hurt (p=0.038).

For maggot therapy if needed a limb amputated:

- I would prefer to have a limb amputated (p<0.001)

**Table 4. Percentage of participants perceiving benefits to maggot therapy (n=412)**

Benefit	Percentage participants who 'strongly agree'/'agree', n=412	Percentage participants who 'strongly disagree'/'disagree', n=412	Percentage participants who were 'unsure' (neither agree nor disagree), n=412
I like alternative (non-conventional) treatments	31.1	5.9	63.0
It is a short treatment	69.8	5.9	24.3
It has been shown to work	90.0	1.3	8.7
I trust treatments offered by the medical profession	71.0	7.2	21.8
I believe nature has the answer	47.3	14.2	38.5
It is better than wound pain	91.2	2.0	6.8
I know someone who had a positive experience with maggot treatment	16.0	38.5	45.5

- I prefer conventional dressings (p=0.012)
- I think the idea is stupid (p=0.040) (Table 3).

**Participant awareness of benefits of maggot therapy**

Participants were invited to reflect on a series of statements examining the perceived benefits of maggot therapy. The percentage of participants who 'strongly agreed'/'agreed' and 'strongly disagreed'/'disagreed' with each benefit is shown in Table 4. Results are shown as the percentage of participants who either 'strongly agreed'/'agreed', 'strongly disagreed'/'disagreed' or were 'unsure'. The greatest benefits were perceived to be:

- Maggot therapy was better than wound pain (91.2% participants 'strongly agreed'/'agreed')
- The efficacy of maggot therapy (90% participants 'strongly agreed'/'agreed')
- The short time period of treatment (69.8% participants 'strongly agreed'/'agreed').

A high percentage of participants (71%) 'strongly agreed'/'agreed' that they had a trust in treatments

offered by the medical profession (Table 4).

Significant differences appeared in perceived benefits by sex. Women (n=273) were significantly more likely than men to perceive the following benefits:

- Like alternative (non-conventional) treatments (t=5.556, p<0.001)
- It is a short treatment (t=2.785, p<0.001)
- Believe nature has the answer (t=3.998, p<0.001).

**Participant knowledge of how maggot therapy works**

Participants were given a series of facts about the maggot therapy process and asked whether they were aware or had heard of any of them. The percentage of participants who had heard of each fact is shown in Table 5. The fact that appeared to be the most well-known was that the maggots used in maggot therapy could not eat healthy tissue (86.4% participants knew this) and the least well-known fact was that it was only baby maggots which were used for maggot therapy (17.6% participants knew this). Less than one-third (30.2%) of participants knew about the short duration (3–7 days) of maggot therapy.

**Table 5. Percentage of participants with knowledge of each factor (n=412)**

Factor	Percentage participants with knowledge
Maggots (used in MT) do not eat healthy tissue	86.4
Maggots (used in MT) are clean and infection-free	78.9
Special maggots are grown for this purpose	65.9
Maggots are kept in a small bag	44.7
Maggots cannot escape (from bags)	49.5
Treatment would take 3–7 days	30.2
Only baby maggots are used	17.6
The treatment does not hurt	64.9
MT—maggot therapy	

**Knowledge scores and relationship of knowledge to acceptance of maggot therapy**

A knowledge score was calculated by adding up the total number of statements presented that were already known by participants (Table 5). The knowledge score ranged from 0–8 statements known. The mean knowledge score of participants was 4.36±2.28. No significant difference in knowledge score was found for sex, and no significant association was found between age and knowledge. The greater an individual's knowledge score, however, the more likely they would be to 'strongly agree'/'agree' to the use of maggot therapy as a first treatment for a painful wound (Pearson's r = -0.263, p<0.001). Additionally, an overall perceived barrier score was computed by adding a score to each barrier item from Table 2. A lower score indicated

**Table 6. Sample of participants' positive comments regarding maggot therapy**

Comments
'I am extremely concerned about the increase of medication resistant strains of infections and think that maggot therapy can play an important role in the prevention of this happening'
'The main problem is educating the GPs and nurses that the option of maggot treatment can be offered. I don't know anybody who has ever been offered maggot treatment and if the GPs and nurses would advocate it more strongly, patients would be more inclined to use it. Most patients will rely on what the doctor recommends'
'You would be mad not to take the chance of this therapy. It works'
'An excellent form of treatment!'
'An excellent alternative to conventional medicine, possibly a cheaper option also'
'I learned new information about the treatment, and found my attitudes were changing by the end of the survey. Taking the survey has meant I would be more inclined to consider this treatment if I ever needed it'
'Knowing (now) that they are babies and enclosed in a bag is the most reassuring aspect for me'
'I would have no problems trying the treatment should it be recommended by a health professional'
'If a doctor tells me I need a limb amputated, it's coming off. If they say that maggots is an alternative then of course I'd give them a go'

a greater perceived barrier (as 1='strongly agree' and 5='strongly disagree'). Analysis of the relationship between knowledge and perceived barriers indicated that the greater an individual's knowledge score, the lower their perceived barriers (Pearson's  $r=0.489$ ,  $p<0.001$ ).

#### Open-ended survey responses

Participants were invited to make any further comments in an open box at the end of the survey. A total of 75 (18.2%) participants provided comments and of these, 26 (34.7%) were considered general comments on the survey, research, expressions of interest in the topic etc., and were not analysed further. Of the remaining 49 (65.3%) comments, 21 (42.9%) were positive towards maggot therapy, with comments such as: 'An excellent form of treatment!', and 'You would be mad not to take the chance of this therapy' (Table 6). Interestingly, three participants saw the positivity only if a doctor or healthcare practitioner recommended the therapy, for example: 'I would have no problems trying the treatment should it be recommended by a health professional'. Other comments indicated that a better knowledge of maggot therapy may help with participant acceptability of the treatment, for example: 'Knowing (now) that they are babies and enclosed in a bag is the most reassuring aspect for me!', and 'I learned new information about the treatment, and found my attitudes were changing by the end of the survey. Taking the survey has meant I would be more inclined to consider this treatment if I ever needed it' (Table 6).

However, 28 (57.1%) comments made by participants were considered negative. These specifically reflected participants' worries, fears and concerns, and were grouped into themes Table 7 (a–h). Samples of comments under each theme are presented. Interestingly, some of the major theme groups identified were similar to those that had emerged previously in

the Stage one focus group (Fig 1). The greatest number of negative comments (9/28) fell under the theme of preconceived/cultural conceptions, for example: 'I just think it's ingrained to associate maggots with death and difficult to change that feeling' (Table 7 (a)). This was followed by negative feelings associated with the disgust 'skin-crawling' element (5/28), such as: 'They make me shudder at the very thought—that skin crawling sensation', and 'I know I should really like the idea but my skin is crawling!' (Table 7 (b)).

Some participants (5/28) mentioned that the term maggot itself was a negative concept and these participants suggested removing the word 'maggot' from maggot therapy (Table 7 (c)). Comments were also made to indicate that the visibility of maggots applied was important (3/28), for example: 'I don't want to see them...', and 'My "disgust factor" would be lower the smaller the maggots are' (Table 7 (d)). A few comments reflected participants' phobia of insects (3/28) (Table 7 (e)), and fears of the maggots themselves (2/28): 'I'm worried they could somehow get inside me!' (Table 7 (f)). Of the comments, one reflected a concern about what others may think of participants if they agreed to maggot therapy: 'I think I'd worry about being stigmatised by others during the treatment' (Table 7 (g)), and one participant noted that maggot therapy, as with other alternative treatments, was not considered to be the best treatment, for example: 'I also don't like that it is seen as an alternative treatment. Alternative in my mind is breaking or going against convention and perhaps a less powerful treatment' (Table 7 (h)).

#### Discussion

Following an exploration of ideas from a small public focus group, we developed a public online survey on perceptions of maggot therapy. Our study examined the views and opinions of 412 members of the public to better understand the thoughts and perceptions

**Table 7. Participants' fears and concerns from open-ended responses. Examples of responses are given under theme groups (a–h). The total number of participant fears and concerns was 28. Data in parentheses indicate number of comments for each theme group**

<b>a. Prior negative/cultural associations (9/28)</b>
'I associate maggots with fishing—as bait. Seeing my grandfather/father/brothers hooking a live maggot is the memory that makes my skin crawl, and the smell as the tub was opened'
'I just think it's ingrained to associate maggots with death and difficult to change that feeling'
'I have a cultural aversion to maggots. But would be willing to try if the need ever arises...but I think there would have to be a real need'
<b>b. Sensation of skin crawling (5/28)</b>
'They really do make my skin crawl'
'They make me shudder at the very thought—that skin crawling sensation'
'I know I should really like the idea but my skin is crawling!'
<b>c. Dislike of term 'maggot' in maggot therapy (5/28)</b>
'DO NOT use the word maggots. Maggots are familiar from everyday life, dustbins etc. as filth. Call them something slightly cute but explanatory: e.g. hygenies'
'Maggot therapy' is off-putting. Perhaps if it was referred to as something else e.g. biotherapy then it wouldn't have such a negative reaction'
<b>d. Dislike of the sight of maggots (3/28)</b>
'I don't want to see them...'
'My 'disgust factor'' would be lower the smaller the maggots are'
<b>e. Phobia of insects (3/28)</b>
'I love the idea but am somewhat phobic about insects/creepy crawlies and worry I would not cope well'
'I worry that I wouldn't be able to get past the idea of bugs running about all over me eating my flesh'
'I can fully see the benefits of maggot therapy however the thought is terrifying but no different I suppose to a phobia of spiders'
<b>f. Fears of embedding in the skin (2/28)</b>
'My concern would be making sure the number of maggots introduced to the wound was the same number as were removed. The thought of one burrowing into the wound and staying there is very disconcerting'
'I'm worried they could somehow get inside me!'
<b>g. Worry about stigma (1/28)</b>
'I think I'd worry about being stigmatised by others during the treatment'
<b>h. Dislike of alternative treatments (1/28)</b>
'I also don't like that it is seen as an alternative treatment. Alternative in my mind is breaking or going against convention and perhaps a less powerful treatment'

regarding the use of maggot therapy to treat hard-to-heal wounds. Interestingly, while almost 90% of participants in our study had heard of maggot therapy, just over one-third of these said they would only initially accept maggot therapy if it was offered as a first treatment for a painful wound. So, even though awareness of maggot therapy was very high among our participants, this was not reflected by a corresponding high acceptability of maggot therapy. Although the majority of participants agreed that treatment of hard-to-heal wounds with maggots could work, and that the idea of maggot therapy was not 'stupid', when presented with hypothetical clinical scenarios, only 36% of people

surveyed said they would agree to maggot therapy as a first treatment for a painful wound. However, there was a proportion of participants (one-third) who did not reject the idea outright, but said they were 'unsure'. This demonstrates the huge potential to sensitise and inform these participants further, and so armed with more knowledge and evidence perhaps they could be persuaded to be more accepting of the idea of maggot therapy. Indeed, participants became increasingly more likely to agree to accept maggot therapy if their hypothetical wound had been hard-to-heal for some time, or if their only other option was amputation, suggesting that maggot therapy became more acceptable



when the severity of the wound increased, and perhaps the level of desperation for their wound to heal became more pronounced. This reflects the current clinical situation where maggot therapy is almost always considered as a last resort for the treatment of hard-to-heal wounds.<sup>21</sup>

#### Perceived barriers towards maggot therapy

Participants identified with some of the potential concerns and anxieties that could be associated with maggot therapy. Over half of our study participants felt worried about the sensation of maggots during the therapy. While worrying about the sensation of maggot therapy appeared to be a significant barrier for our study participants, studies report that patients describe the sensation of maggots on their wounds as 'tickly' and state that often the thought (of maggot therapy) is much worse than the actual sensation experienced.<sup>22</sup> However, for between 5–30% of patients (often those with ischaemic tissue), there may be some pain associated with maggot therapy,<sup>14</sup> although this is usually lessened with the administration of mild pain relief.<sup>23,24</sup>

#### The perception of disgust

In our survey, 40% of participants said that the thought of maggot therapy 'made their skin crawl' and more than one-third of participants felt that maggots were disgusting. Disgust is a universal physiological reaction of all human beings. Curtis et al.,<sup>25</sup> suggested that the sensation of disgust has evolved primarily for protection. Several things such as bodily secretions, wounds, corpses, decaying meat or rubbish, and certain living creatures like flies, maggots and rats are considered revolting. Remarkably, a recent study of >500 patients with hard-to-heal ulcers found that 60% of patients considered images of maggots to be more repulsive than images of gangrenous wounds.<sup>26</sup> In addition, a number of our survey participants mentioned the negative sensation associated with maggot therapy which they described as 'making their skin crawl'. This presented as a worry in the perceived barriers in our survey. Repulsion, fear or disgust is a common response associated with maggots, and in a study by Spilsbury et al.,<sup>27</sup> it was reported that a major reason for patients refusing maggot therapy was 'the thought of maggots', and it made them 'feel sick'. Reports suggest that disgust is a multifaceted emotion, a product of culture, socialisation and early learning,<sup>28</sup> and it is widely accepted that its evolutionary origin was to prevent the ingestion of harmful substances.<sup>29</sup> Researchers believe that disgust is associated with a heightened risk perception,<sup>30</sup> and if that is so perhaps perceptions of maggots as 'disgusting' could conceivably be 'unlearned'; for example, if the risk association with maggot therapy can be disaffirmed and more positive information provided of the medicinal and health benefits of maggot therapy. If so, there would need to be a major concerted public health drive to change this inherent negative

perception of maggots used for therapy. Additionally, feeling disgust/dislike towards a particular object or organism is not always innate. For example, somewhere within childhood, people may begin to learn that maggots are creatures related to acts of decomposition and decay, and as a result, a negative perception is developed which appears to persist into adulthood. In order to tackle the development of learned and associated disgust, one way could be perhaps to introduce to younger schoolchildren the notion of maggots as beneficial insects.<sup>31</sup>

The question over patient apprehension or uneasiness regarding treatment of hard-to-heal wounds with maggots is an ongoing one. However, while we report a level of discomfort expressed by participants (members of the public) in our survey, studies postulate that this factor may not really exist in patients. Due to wound chronicity, individuals with severe, non-healing wounds rarely refuse maggot therapy.<sup>19,32</sup> A small, qualitative study (VenuS II trial) undertaken involving 18 patients with hard-to-heal wounds found that all patients reported disruption to their lives because of the wound. Distresses such as wound pain, restricted mobility and disturbed sleep were described, and, as such, the majority of participants (n=15) were willing to try maggot therapy.<sup>22</sup>

Other open-ended comments in our survey which were perceived as barriers included the 'sight' of maggots, and the dislike of the term 'maggot.' For some individuals the very word 'maggot' can invoke immediate negative connotations, such as images of rot and decay,<sup>18</sup> and it is perhaps for this reason that the major European company that produces clinical grade larvae for medical distribution (BioMonde), refers to maggots as 'larvae'. In addition, for clinical use, maggots are enclosed in a small, sealed bag and covered with a dressing, so patients would not normally see them, except perhaps on removal if they wished.

Unsurprisingly, participants who 'strongly agreed'/'agreed' with perceived barriers showed less readiness to accept maggot therapy. For these participants, the preference of conventional dressings, and/or to take medication, were significant factors linked to a lesser likelihood of considering maggot therapy.

#### Sex difference in perception of barriers to maggot therapy

Sex differences were found between participants' responses to perceptions of maggot therapy barriers. Women were more likely to find maggots disgusting; they were more likely to be worried about the sensation of maggot therapy; and they were more likely to feel ill at the thought of maggot therapy. These results indicated a higher level of discomfort and unease in women about maggot therapy. This finding reflects other studies exploring sex differences in patient perception of maggot therapy. For example, a survey of preferences and acceptability of maggot therapy revealed that the majority (7/8 patients who refused

maggot treatment were women).<sup>27</sup> It has been hypothesised from an evolutionary perspective and in relation to offspring survival, that women reportedly have much higher levels of disgust for many different things, including pathogens, sexual and moral disgust.<sup>33</sup>

#### Perceived benefits of maggot therapy

Study participants were able to perceive several benefits of maggot therapy. The most agreed benefit was relief from wound pain, but also the efficacy and short duration of the treatment. Over 70% of participants felt that they trusted treatment if offered by a medical professional, emphasising the influence that health practitioners may have over patients' (and public) acceptance of the therapy. With maggot therapy, clinicians may have to deal with multiple disgust responses (stagnant wounds and bodily secretions as well as any negative emotions that maggots might invoke). This may affect their own willingness to offer or participate in this therapy. While there has been some research conducted on how patients deal with hard-to-heal wounds, there has been very little research on how nurses manage their own feelings of disgust.<sup>34</sup> However, one survey showed that healthcare professionals and administrators were much more likely to be repulsed by the thought of maggot dressings than the actual patient with the hard-to-heal wound.<sup>35</sup> Some studies also suggest that more thought needs to be given to psychological/psychosocial issues for health professionals involved with patient and wound care,<sup>36,37</sup> and some authors consider that if clinicians themselves have negative feelings or an inherent dislike of maggots, perhaps they may be less keen to prescribe or use them.<sup>38</sup> We are currently investigating this in a separate study.

#### Sex differences in perception of benefits of maggot therapy

Our study showed that women were significantly more likely to perceive certain benefits of maggot therapy than men. Such perceived benefits included the belief that nature has the answer, and the liking of alternative treatments. The latter finding is in line with several studies on sex and the use of alternative treatments. In a study examining the use of complementary and alternative medicine (CAM) for patients with migraines/severe headaches, women were found to consistently use CAM more frequently than men.<sup>39</sup> Similarly, a large study examining adults with multiple chronic conditions revealed that significantly more women had previously used CAM, but were also more likely to use it to try and help their condition.<sup>40</sup> Explanation for this sex difference in acceptance of alternative therapies include a belief that women have a greater propensity to seek care,<sup>41</sup> and are considered more proactive towards health issues.<sup>42</sup> Indeed, 66.4% of our study participants were women, perhaps indicating a prior interest in the topic or a greater willingness to complete the survey. The skewed interest has been reported before for surveys on alternative therapies, for example,

significantly lower numbers of men (93/408) were found to participate in online surveys about herbal medicine and medicinal plants.<sup>43</sup>

#### Participants' knowledge of maggot therapy

Participants in our study had a good awareness of maggot therapy and appeared to have heard of many of the facts we presented regarding maggot therapy. Importantly, calculation and analysis of knowledge scores revealed that participants with a higher knowledge score were more likely to accept maggot therapy in the hypothetical wound scenarios. Moreover, participants with higher knowledge scores also perceived fewer barriers towards maggot therapy. The existence of these positive relationships between knowledge scores and acceptability of maggot therapy treatment provides encouraging evidence to suggest that information dissemination and education regarding maggots and maggot therapy may be an important and influential factor in the perception of maggot therapy. This was indeed mentioned by the focus group participants (in Stage one) who agreed that more general information about maggot therapy was needed and should be made readily available to the public. Also, some participants had fears or worries based on inaccurate knowledge and beliefs, for example, the fear that the maggots used could invade their bodies. The concern that maggots could somehow burrow or embed into the skin and body tissue was also raised by two participants in free comments at the end of the survey. The maggot species used in maggot therapy is non-invasive and cannot do this, so this sort of worry or fear is easily abatable, but the comments do highlight the need to offer better information to improve public understanding. A common strategy to challenge mistaken beliefs and remove the influence of erroneous information is by providing correct information and educating the public and patients about maggot therapy.<sup>44</sup> This could perhaps be an important public health consideration, if increasing acceptability and uptake of maggot therapy is to be achieved.

#### Other free comments on maggot therapy

Participants did make several positive free comments about maggot therapy, including that recommendation by a healthcare practitioner was a reason to agree to the therapy. This is clearly an important point which has already been discussed above. A few positive comments reflected that knowledge and learning new information about maggots made participants more likely to consider the treatment if needed, emphasising again the importance of enhancing awareness and understanding of maggot therapy through public education opportunities.

However, 28/49 comments made by survey participants were associated with negative perceptions, fears and worries. Some participants felt that they could not overcome prior negative associations with death.

Participants often associated maggots with harm, for example, with death or as bait for fishing, or a 'cultural aversion'. They found it hard to disassociate from this. Conversely, a study on perception and acceptance of maggot therapy in patients with leg ulcers found that all patients who went fishing had no fear of maggots and all would consider maggot therapy.<sup>27</sup>

A few participants raised the idea that they were phobic to insects. This made them very anxious about the concept of maggots crawling on them. People with a phobia of insects (entomophobia) may have a real anxiety and insurmountable fear, perhaps based on prior experience or trauma, or may consider insects as dirty, disease-spreading creatures.<sup>45</sup> Invertebrates, in general, are held in low regard with the public.<sup>46-48</sup> Relevant to the present study, Davey<sup>49</sup> ranked maggots as sixth out of 35 in terms of animals that caused anxiety in a cohort of university students. Phobic individuals with high anxiety to maggot therapy may not be able to decondition enough to accept it, although recent studies have considered the use of gaming elements and the development of new gaming approaches to try and reduce various types of phobia.<sup>50</sup> Perhaps the development of an online maggot therapy video/computer game may be a useful tool to accompany any public information dissemination on maggot therapy.

A concern was also noted regarding perceived stigma of maggot therapy, and one participant described how they would worry that, if they were having treatment, others would have a negative reaction and avoid them. A survey among 38 patients with hard-to-heal wounds in the Netherlands, found that a high number of patients reported adverse social interactions as a result of undertaking maggot therapy.<sup>19</sup> The authors suggested that public acceptance is important to reduce worry, keep adverse feelings of patients to a minimum, and felt that there was a need to decrease the general prejudice towards maggot therapy so that people may reconsider their ideas about maggots.<sup>19</sup> However, it must be noted that patients living with a hard-to-heal wound may already experience negative effects of self-image which could impact on social interactions.<sup>51</sup> Another study reported that patients who refused maggot therapy under any circumstance, reported a 'squeamishness', an aversion to maggot therapy and a negativity that was shared by their family members.<sup>22</sup> In addition, researchers have observed that while a negative perception may not necessarily be paramount in patients with hard-to-heal wounds, it was, nonetheless, evident in family members and other people in their social spheres.<sup>52</sup>

Finally, for one participant, the perception of maggot therapy as an 'alternative' treatment discouraged them. Although, as discussed earlier, sex analysis did reveal that significantly more women participants liked alternative therapies, the preference for conventional treatments and taking medication over maggot therapy was reflected in our findings on barrier perception, suggesting a wariness of maggot therapy as an alternative

therapy. Other surveys report that while the use of complementary/alternative medicine has gained in popularity, it is still very dependent on sociodemographic factors such as education and sex but also belief and attitude.<sup>53</sup> Even though maggot therapy is an FDA and UK NHS approved clinical treatment, it is still considered an alternative therapy. It may therefore be a good time to review this label and align maggot therapy with other mainstream wound treatments.

#### Limitations

This study by its nature was confined to exploring attitudes from a select group of members of the public, the majority of whom, by association to the university, had a good awareness (89%) of maggot therapy (even though this was not reflected with a corresponding high acceptability of maggot therapy). It would therefore have been more ideal to undertake the study in a wider demographic population, since further investigations by our group with a more representative sample of the general UK population have revealed that general public awareness of maggot therapy can be much lower, (53%).<sup>54</sup> Another limitation was that this study was confined to the perception and hypothetical acceptability of maggot therapy within a relatively healthy public, and not a survey of patients with current hard-to-heal wounds, who may feel or respond differently when offered an alternative treatment option of maggot therapy for their wound.

#### Conclusion

Our study has shown that public perception of maggot therapy is varied. The majority of participants in our survey would not agree to, or were unsure about, choosing maggot therapy for an initial painful wound. However, if faced with a severe, prolonged hard-to-heal wound or limb amputation, the majority of participants felt that they would agree to maggot therapy. Clearly, there is scope to inform and convince members of the public who waver in their acceptance of maggot therapy. However, we did identify concerns over the potential sensation experienced and an element of unease about the use of maggots. We also showed how important knowledge and a better understanding about maggot therapy could be on acceptability. Hard-to-heal wounds are unlikely to decrease in number or severity in the future. Accumulated evidence suggests that maggot therapy sits high among wound management treatments with regards to its speed and efficacy. It would be important to ensure that the potential advantages that maggot therapy can offer are not lost due to public reluctance, lack of understanding or perceived fears. A key component in combatting negative perceptions of maggot therapy may lie in a public engagement campaign or improved public and patient engagement with health practitioners (and others), in order to temper fears and anxieties, provide reassurance and advance communication of its significant clinical benefits. **JWC**

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## Reflective questions

- Would it be desirable to help the public (patients) to acquire a greater knowledge of maggot therapy?
- How could better dissemination about the life cycle and action of medicinal maggots be achieved?
- Should we pay more attention to the opinions and views of health practitioners given that they appear to have a large influence on patient acceptability of maggot therapy?



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## International Consensus Document

### Device-related pressure ulcers: **SECURE prevention**

Can you differentiate device-related pressure ulcers (DRPUs) from pressure ulcers arising from body weight? Does your team know which devices can cause DRPUs? Do you have a pathway in place to prevent DRPUs in your daily practice?

Such questions are answered in JWC's latest international consensus document, where you will also find:

- A thorough analysis of when and how to take action, based on clinical research evidence
- A practical mnemonic (SECURE) for an integrated pathway for DRPU prevention
- A discussion on how to change the focus of health professionals and policy-makers to reduce the risk of DRPUs

Download for **free** this informative, concise, must-read consensus document:

[www.magonlinelibrary.com/page/jowc/resources](http://www.magonlinelibrary.com/page/jowc/resources)

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