Best practice versus farm practice: perspectives of lecturers and students at agricultural colleges in England on management of lameness in sheep

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Abstract

We use the concepts of trust and knowledge to explore translation of scientific evidence about treatment of ovine footrot to students studying at agricultural colleges. We explore the role of different forms of trust (companion, competence and commitment) in facilitating relationships between students and informants. We also investigate how students acquire knowledge, and how this influences their practices for treating footrot. We find that despite being taught evidence-based practice (antibiotic treatment and no foot trimming) at college, most students would still use traditional farm practice (foot trimming) to treat footrot. Students develop tacit knowledge of traditional practices from farmers whilst working on sheep farms and these farmers have a strong influence on students' practices; students have high levels of companion trust for "known" farmers. College lecturers who demonstrate competence gain students' trust, but where this does not occur there is a failure in communication between lecturer and student. Students acquire explicit classroom knowledge of evidence-based practice at college because there is limited practical experiential learning. This explicit knowledge is typically insufficient to change behaviour, unless students trust their lecturer. Our findings indicate that farming experience dominates over classroom experience and so college education alone will not ensure uptake of evidence-based practice.

Keywords: Agricultural students, footrot, knowledge, sheep, translation, trust.

1 Introduction

Lameness is one of the top five globally important diseases of sheep (Nieuwhof and Bishop, 2005; Rather et al., 2011; Stewart, 1989); it reduces productivity (Wassink et al., 2010) and so decreases the sustainability of sheep farming (Eisler et al., 2014). Footrot is the most common cause of lameness in the UK and is present on over 90% of sheep farms (Winter et al., 2015) with estimated costs to the sheep industry of £20-£80 million per annum (Nieuwhof and Bishop, 2005; Wassink et al., 2010). In the light of this, reducing prevalence of lameness is a key target for the UK sheep industry and in 2011 the Farm Animal Welfare Committee set a target to reduce the national prevalence of lameness to less than 2% by 2021 (Farm Animal Welfare Committee, 2011).

Information from recent scientific research has led to a paradigm shift in understanding of the management of footrot in sheep. The traditional treatment for footrot was to trim the hoof horn of feet with footrot to expose the lesions (Morgan, 1987; Wassink et al., 2003), however, research shows that foot trimming is detrimental and delays recovery from disease (Kaler et al., 2010; Wassink et al., 2010). In addition, routine foot trimming, traditionally carried out by farmers at least once per year as a whole flock measure, is associated with high levels of lameness (Kaler and Green, 2009; Wassink et al., 2003; Winter et al., 2015). Antibiotic treatment with no foot trimming is the current evidence-based practice to treat footrot (Duncan et al., 2012; Grogono-Thomas et al., 1994; Kaler et al., 2010; Wassink et al., 2010) and clinical trials have demonstrated that this reduces the flock prevalence of lameness to < 2%. However, for scientific evidence to have an impact on national lameness prevalence, farmers must change their paradigm and be knowledgeable of, and use, the new evidence (Garforth, 2015; Willems et al., 2015).

In the last 15 years, translation of evidence-based practice for management of footrot has been achieved through booklets and press articles, veterinarians, farmer meetings, coverage at national and regional sheep events, and YouTube videos (AHDB, 2016a, b; Balsom, 2014). In England, there has been a reduction in the percentage of farmers practising therapeutic foot trimming from 94% in 2004 to 40%, and routine foot trimming from 76% in 2004 to 56% in 2013 (Kaler and Green, 2009; Winter et al., 2015). However, even by 2013 only 24% and 66% of farmers were always using antibiotic injections and topical spray respectively to treat footrot (Winter et al., 2015).

To ensure the uptake of evidence-based practice by sheep farmers, it is important to understand what influences their behaviour. In this paper we focus on the translation of evidence-based practice to manage footrot in sheep from lecturers to young farmers studying at agricultural colleges. Young farmers are more likely than older generations to adopt sustainable practices and practices to improve animal welfare (Mann, 2005; Van Passel et al., 2007). One route to increase the uptake of evidence-based practice might be to influence young farmers because we could change their farming practices for decades. There is currently no research regarding young farmers' beliefs about management of disease in livestock, how they acquire information and knowledge, nor what influences their decision to adopt new management practices from scientific research. Therefore whilst our research focuses on footrot in sheep, it will have implications for other diseases. Understanding how young farmers acquire and use knowledge is valuable because it will enable lecturers, researchers and industry organisations to optimise translation of knowledge.

89 Knowledge influences an individual's practices because it influences their attitudes and
90 beliefs (Blackmore, 2007; Nguyen et al., 2019). Farming knowledge is primarily tacit,
91 developed through experience, and family farming provides a knowledge culture (Irwin,
92 2002; Irwin et al., 1999) where information is passed from older generations to younger
93 generations over time (Wójcik et al., 2019). Young farmers therefore learn about livestock
94 health and production from their farming family and other farmers. Lecturers at agricultural
95 colleges can also provide knowledge to agricultural students from new scientific research
96 assuming that the lecturers have this knowledge and that they have the trust of their
97 students. Therefore, when considering translation of evidence-based practice to students, it
98 is important to establish what lecturers are teaching students about management of
99 footrot, and what influences students' uptake of new practices.
100
101 The importance of trust in the acquisition of knowledge has been explored in the fields of
102 education and rural social science. In an educational context, Landrum et al. (2015) argue
103 that accepting new information as reliable requires the learner to trust the informant
104 (trusting to learn), and that this trust is developed through the learner's appraisal of
105 previous information presented by that informant (learning to trust). In the context of rural
106 social science, trust between farmers and their advisors is key to facilitate knowledge
107 exchange (Fisher, 2013; McKitterick et al., 2016). Trust influences where farmers source
108 information and which practices they implement (Fisher, 2013; Heffernan et al., 2008;
109 Maclean et al., 2019; Sutherland et al., 2013). Given that trust is vital in knowledge
110 exchange with farmers, trust is also likely to be important in students' acquisition of
111 knowledge. Whom students trust and what forms the basis of this trust is unknown.
112

In order to explore how trust impacts students' practices for managing footrot in sheep we used the three types of trust described by Newell and Swan (2000): companion trust, competence trust and commitment trust. Companion trust is based on judgements of goodwill, personal friendships and identity. It develops slowly over time, is resilient, and is important for the maintenance of social networks. Competence trust is based on beliefs regarding another party's knowledge or ability to carry out a required task. Competence trust develops more quickly than companion trust but is more easily broken. Commitment trust is based on contractual agreements between parties where each party is expected to gain mutual benefit from the relationship. It relies on formal societal structures, and sits between companion and competence trust in terms of resilience.

In this paper we investigate the beliefs of students and lecturers at agricultural colleges about management of footrot in sheep. We explore how trust and the ways in which students acquire knowledge influence students' practices. We then consider the implications of our findings for uptake of evidence-based practice to manage footrot in sheep.

2 Materials and methods

Ethical approval for the study was obtained from the University of Warwick (REGO-2016-1870).

2.1 Interviews with college lecturers

135 Lecturers were recruited at an agricultural college lecturers' meeting organised by the
136 Agriculture and Horticulture Development Board (AHDB) in October 2016, at the National
137 Sheep Association Early Gathering event in January 2017 and by an invitation to opt in sent
138 by email to 246 lecturers on the AHDB college lecturer mailing list. Lecturers provided their
139 name, college and email address if they wished to participate in the study. A total of 10
140 lecturers from 10 colleges agreed to participate in the study and were interviewed. All 10
141 lecturers taught students about lameness in sheep and most had experience of working on
142 sheep farms. Participants gave written consent after reading an information letter with the
143 study objectives, interview process, and data confidentiality. Interviews were conducted
144 either in person or by telephone by one researcher (RC). A semi-structured question guide
145 (Supplementary material) was used for interviews. This covered three areas: (i) background
146 information on the college and courses taught, (ii) lecturer beliefs around treating and
147 managing footrot, and (iii) teaching methods. The interviewer used prompts and questions
148 to generate further information. At the end of each interview the participant was asked if
149 there was anything they wished to add that had not been covered. Each interview lasted
150 approximately 30 minutes. At the end of their interview, lecturers were asked if they would
151 be willing to organise student focus groups at their college
152
153 **2.2 Student focus groups**
154 Focus groups were chosen as the methodology for the students because students might be
155 more comfortable in a group discussion rather than individual interviews. Letters with the
156 study objectives, interview process, and data confidentiality were distributed to students by
157 the lecturer. Students were asked to contact their lecturer if they wished to participate.
158 Where students were under 18 years old, their parents were asked to inform the lecturer if

159 they did not want their child to participate in the study. Students provided written consent
160 for participation in the study at the start of focus group discussions.
161
162 Eight student focus groups were carried out at 5 colleges (Table 1) with 50 students aged
163 16-19 studying agriculture including sheep farming. Each group had between 5 and 8
164 participants. Students in each focus group had grown up on sheep farms, or other types of
165 farm, or were from non-farming backgrounds. Lecturers provided estimates for the
166 background of the students at their college, which suggest that about half of students come
167 from a farming background and, in addition, most have experience of working on sheep
168 farms. Students were studying for a level 3 qualification in agriculture (level 4 in the
169 European Qualifications Framework: http://www.cedefop.europa.eu/en/events-and-
170 projects/projects/european-qualifications-framework-eqf). Courses were accredited by
171 national qualifications providers: either City & Guilds or Business and Technology Education
172 Council (BTEC). All students had been taught about footrot in sheep by their lecturer at the
173 time the focus groups were conducted. Students were in their first, second or third year of
174 study (Table 1); focus groups contained students from one year group with the exception of
175 one group from college 1 which contained first and second year students.
176
177 All focus groups were carried out by the same moderator (RC) and observer (MR). The
178 moderator facilitated the discussion, and the observer made notes, handed out materials to
179 be used in the discussion and addressed any issues participants had with these materials.
180 A discussion guide (Supplementary material) was used by the moderator to facilitate
181 discussion. This included (i) student beliefs about treating and managing footrot, (ii) student
182 preferred learning methods, and (iii) student approach to sourcing information. At the end

183 of the discussion the moderator summarised the points covered during the meeting, and
184 students were given the opportunity to make further comments. Each focus group lasted
185 approximately 45 minutes.
186
187 **2.3 Analysis of interviews and focus groups**
188 All interviews and focus groups were audio recorded. Interviews and focus groups, were
189 conducted until saturation occurred, that is, no new information was acquired from the next
190 interview / focus group (Krueger and Casey, 2014). The recordings were transcribed by an
191 external company (Penguin Office Services, UK). Thematic analysis (Braun and Clarke, 2006)
192 of transcripts was carried out by two researchers (RC and MR). Transcripts were first read to
193 check for accuracy and to familiarise the readers with the content. RC and MR worked
194 separately and developed preliminary coding guides for interviews and focus groups, these
195 were discussed and the final guides were agreed. RC and MR coded 50% of the lecturer and
196 student transcripts each. Coding was carried out in NVivo 11.4 (QSR International). Coded
197 sections were then organised into preliminary themes which were discussed with JK and LG
198 and the final themes were agreed.
199
200 # 3 Results
201 Three themes emerged from the data, these were (i) beliefs about treatment of footrot, (ii)
202 influence of trust on students' beliefs, and (iii) how students acquired knowledge about
203 footrot.
204
205 **3.1 Beliefs about treatment of footrot**

206 *3.1.1 Lecturers' beliefs about treatment of footrot*

207 The majority of lecturers stated that antibiotics should be used to treat sheep with footrot,
208 however, there were a minority of lecturers who described using only topical antibiotics for
209 lesions of lower severity e.g. interdigital dermatitis (scald), although this is not evidence-
210 based (Wassink et al., 2003).

211

212 Lecturer 7: "they [sheep] tend to be treated depending on the severity, anywhere from
213 you know… from blue spray [a topical treatment with a bactericidal claim] up to
214 antibiotic injection"

215

216 The majority of lecturers did refer to recent advice which states that foot trimming should
217 be avoided and most of these lecturers stated that they would not trim the feet of sheep,
218 either as a treatment for footrot or as a routine practice. However, there were some
219 lecturers who, despite being aware of recent advice, commented that they thought minimal
220 routine foot trimming was acceptable, or that routine trimming would not be detrimental if
221 done correctly. Two of the ten lecturers advocated foot trimming, and did not appear to be
222 aware of recent advice that foot trimming is detrimental. These two lecturers did not come
223 from a sheep farming background, unlike the other eight lecturers; this could explain why
224 they were less aware of changes to advice regarding management of footrot. Their students
225 were not interviewed in the study.

226

227 Interviewer: "how do you think we should manage lameness in sheep at a flock level?"
228 Lecturer 6: "oh definitely correction [routine foot trimming] as often as, as possible"

229

Lecturer 8: "…looking at identifying the problem [foot lesion] to make sure we know exactly what issue we're dealing with to start off with, and if it was definitely footrot, then removing the affected sheep from the flock, treating it as an individual, so antibiotics … followed up with if necessary foot trimming…"

Not foot trimming represented a change in belief for most of the lecturers, with many having practised foot trimming in the past. A range of evidence had persuaded lecturers to change their beliefs, including articles in the farming press, attending talks and conducting their own trials. Some of the lecturers described how seeing evidence that feet could recover from footrot without trimming, for example through videos or in sheep they were treating themselves, was important in changing their beliefs. Trust was also an important factor in lecturers' uptake of new recommendations, with trusted sources including recognised organisations such as AHDB, scientific research papers, veterinarians, consultants (Winter and Green, 2018) and farmers.

Lecturer 9: "the case study we did here at college was … part of my Foundation Degree [when the lecturer was a student] and the tutor came back and said, 'There's a new idea of a Five Point Plan, we don't trim, we do this', and I said, 'No we should be trimming, we have to get air to the… problems.' So she set me a challenge for one of my work projects and we decided to do an on-farm test. And we followed 20 sheep treated by the traditional method of trimming, and the other ones were identified with the lameness [diagnosed] and treated accordingly. … we checked 'em every week and mobility scored as we went on … And the ones that we treated within the Five Point Plan of injecting and

assessing, [their] mobility score improved dramatically … And that actually changed how I believed how we should treat sheep's feet"

3.1.2 Students' beliefs about treatment of footrot

When students were asked how they would treat a sheep with footrot, students from all five colleges always stated antibiotic injections and topical antibiotic spray, however, at four of the five colleges students also stated foot trimming, although at one of these (college 8) there was debate amongst the students about whether they would trim feet. At college 7, students stated that they would not trim feet and that they would use pain relief, something that is considered good practice but is generally not part of evidence-based practice because of the lack of supportive research (Kaler et al., 2010; McLennan et al., 2016). In some groups, students also mentioned separating lame sheep from the flock; this is associated with lower flock prevalence of lameness (Wassink et al., 2003; Witt and Green, 2018).

College 2

Facilitator: "So can you describe to me how you'd treat a sheep with footrot?"

Student 6: "Have a look at it."

Student 2: "Clean it [the foot] out."

Student 5: "Yeah, just clean it, trim it."

Student 2: "Spray it."

Student 7: "Jab it [the sheep]."

Facilitator: "OK."

Student 2: "Foot bath."

Student 5: "Separate from the rest."

College 7, Group 2

Facilitator: “So can you describe to me how you would treat a sheep with footrot?”

Student 1: “Firstly work out what sort of severity’s at, it’s definitely gonna want something like Metacam [anti-inflammatory/pain relief], which is pain relief, then you’d want to try and maybe do a full course of antibiotics. You wouldn’t wanna clip [trim] it [foot], would you?”

Student 6: “No.”

Student 2: “Put them in a footbath.”

Student 3: “Plenty of blue spray.”

In groups where students stated that they would trim feet as part of treatment of footrot, the students generally acknowledged that their lecturer had taught them not to trim feet to treat footrot but they recalled learning to use foot trimming at home or on another farm. Students frequently identified a difference between “best practice”, which was what they were being taught at college, and “farm practice,” or the reality of on-farm work. Generally, when asked why they thought the dichotomy between “best practice” and “farm practice” existed, students answered that it was either due to sheep farmers’ unwillingness to change their habits, or to factors associated with the use of antibiotics, such as concerns about antibiotic resistance or cost. During the dialogue, the students often discussed antibiotic injections and foot trimming as two alternative treatments, and used arguments against using antibiotics as a rationale for foot trimming. In one group (again college 3, group 2) the students referring to antibiotic treatment commented “people just jab it [the sheep] don’t they, and leave it” and stated that they did not agree with this treatment because it was not “sufficient” for severe

lesions where trimming hoof horn was (in their opinion) necessary. This indicates a lack of understanding of the mechanism for antimicrobial therapy as well as the detrimental effects of foot trimming and possibly highlights a placebo effect in belief in foot trimming (invasive trimming and pain must lead to a good outcome).

College 3, Group 1

Student 1: “I think that, well, now we’re being taught not to foot trim and things like that we never used to think about at home but, as I say, I think farming’s always changing and I think at agriculture college you always learn probably the correct way of doing it rather than the way we’re used to doing it.”

College 8

Student 6: “Yeah, they recommend using more antibiotics and not trimming, but … but then it just leads to resistance and all stuff like that, so that’s where it causes all arguments and everything!”

College 7, Group 2

Student 4: “Well, yeah, it’s a lot more money, if you give it Metacam and then you give it some Alamycin [antibiotic] you’re spending a lot more money than if you just put some blue spray into it.”

Overall, the majority of lecturers were aware of evidence-based recommendations for treatment of footrot and many had changed their beliefs in response to this evidence. In

contrast, despite being taught evidence-based practice, the majority of the students would still use foot trimming to treat footrot.

3.2 Influence of trust on students' practices

Information from both students and lecturers highlighted that farming family, friends and colleagues had the strongest influence on students' practices. Discussions with students revealed that farmers could have a positive influence on uptake of evidence-based practice, with some students having families who were supportive of them implementing new practices they had learnt about at college. However, some lecturers reported that some students from farming backgrounds were challenging to teach because they were more strongly influenced by the beliefs and attitudes of their parents and grandparents than what their lecturers taught them.

> College 8
>
> Student 3: "At home…you go back with new ideas and … 'cause I do have my own stock, they're [student's parents] like, 'Well that's yours. You can make the decisions you want and see how it goes and see if they turn out better, worse; see if it makes a difference.'"
>
> Lecturer 8: "There's always the, 'Well father's always done it this way'. And it's difficult sometimes to break that… and I think parents, work providers, farmers, are perhaps also reluctant to not trim, to put those trimmers away. I mean I've had students in the past that would tell me quite categorically that you have to make a foot bleed to let the bad out, yeah, it's very difficult to tell someone that no, that is not what you do because that's what they've been taught before they come to us."

Students described obtaining information about footrot from farmers that they knew well, such as their employers and their families. Students trusted these "known farmers" based on their familiarity and close relationship, an example of companion trust. Most of the students stated that they trusted their lecturers to provide them with information regarding evidence-based practice and believed that lecturers were knowledgeable and well qualified, an example of competence trust. However, many believed that what lecturers taught them was not practical, that is lecturers did not understand the working realities of commercial farming operations (Sutherland et al., 2013). Several groups commented that it was useful to hear alternative perspectives from people working within the industry who were more in touch with the realities of farming.

College 7, Group 2

Student 4: "I just sort of ask people that I know and they know the answer, so I'll go talk to my cousin or I'll go talk to my boss and then they'll know what they're on about so I'll trust what they say."

College 7, Group 2

Student 1: "Your lecturers know what they're talking about and teach us what they need to but it's good to hear other people who we have no connection to at all come in and say, 'Actually, if I was you I wouldn't do it how she said, I'd do it this way', and they give you an alternate opinion"

College 8

Facilitator: “And what do you think in the future if you had your own sheep, what would you do?”

Student 1: “I’d probably try and follow what college says, just because [lecturer] does know what she’s talking about and she’s probably done like a degree now.”

Student 5: “I’d try and mix the two things together.”

Student 1: “Yeah.”

Student 5: “‘cause I think the old-timers are right some of the time. They’ve been there and done it … but then … yeah.”

Student 3: “You kind of almost want to go for the quickest way as well ‘cause you don’t wanna go and get a flock of 200 sheep in to treat one ewe if she’s out a couple of miles away. There’s no point.”

One group of students (Group 2, college 3) disagreed with the evidence-based practice taught by their lecturer. They described having “fallen out” with a lecturer earlier in the year because he treated them like children. They also stated that when they challenged their lecturer about evidence-based practice he told them that they were wrong, and then avoided teaching them about footrot because it led to arguments. This group trusted the college shepherd to teach them about footrot because they felt more of a shared identity with him and he took time to explain why different treatments were used.

College 3, Group 2

Student 5: “He’s [the college shepherd] more down to earth, he’s more down to our level ‘cause he’s not that old. So he’ll sit down with you and explain to you on your level

whereas there's one of the tutors at the start of the year that some of us had a falling out with."

Lecturers and students stated that some students attended meetings organised by veterinary practices or industry organisations such as AHDB. Some students considered that these were reliable sources of information, although given that many students stated that they would foot trim, which is not advocated in any of AHDB's material, it is questionable whether they were following the guidance provided by these sources.

Lecturers described using external speakers and farm visits to challenge students' beliefs because they thought that hearing different perspectives from within the industry and seeing new recommendations in practice might encourage students to try them on their own farms. These "expert farmers" were not previously known to the students, but one of the lecturers explained that students would trust the information they provided if their competence was evidenced in the health of their sheep.

Lecturer 3: "Where we've got farmers stood there talking and saying things and you know, and saying, 'Look, this is what we've done. We've now only got 1% lameness or 2% lameness in the herd, in the flock, and … this has been done by treating with injections'"

Students also described visiting farms as part of their college course and in agreement with the quote above they stated that these farmers could be trusted if their knowledge and expertise were evidenced through the health of their sheep. For these "expert farmers", trust was not guaranteed by their status as a farmer, with a few students stating that some

farmers' opinions have to be taken "with a pinch of salt". This illustrates that, as suggested by the lecturers, trust for "expert farmers" was competence trust.

College 8

Student 1: "Just being out on farm, listening to an actual farmer speak to you about how he's … how he always does it. Like a farmer you can see, if you get there and you're impressed by his animals, you can see that he's doing something right. If he then goes and tells you what he's doing, you can think about that a bit more and you'll believe what he's saying more than someone just sat in the classroom telling you, if you can see it working, then you can listen to him more."

Both lecturers and students also highlighted that social media influenced student's beliefs. A few students mentioned Facebook, Youtube or Twitter where they followed farming pages and discussion forums. Some students trusted information on social media; they felt it was credible because it came from farmers with practical experience. Other students stated that they would not always trust information on the internet because it often wasn't reliable.

College 2

Facilitator: "So why do you prefer using [social media]? Why [is it] good for finding information?

Student 7: "There's real life stuff that people have had problems with. It's not like …"

Student 8: "Not just like all theory."

Student 7: "That someone in an office has typed up saying, 'This is what happens'. It's someone who's got their own problem"

College 1, Group 1

Student 1: “Well we use stuff like that [social media]. But it’s harder to believe stuff on there though, isn’t it? ‘cause one person can say something and then it’ll go around and by the time it gets to you it’ll be completely different news…You can take things on the internet with a big pinch of salt.”

In summary, students had companion trust for farmers they knew well, and these “known farmers” had a strong influence on students’ beliefs. Students had competence trust for veterinarians and “expert farmers” based on perceptions of their knowledge and expertise. Most students would trust lecturers for information about “best practice”, however, for one group of students the unwillingness of their lecturer to debate different treatments with them had resulted in mistrust.

3.3 How students acquired knowledge about footrot

Students were taught about footrot at college and also experienced management of footrot whilst working on farms. When asked about the teaching methods that students would experience at college, the majority of lecturers stated that they used practical teaching. They identified two key benefits of practical teaching; first that it helped students to develop skills they would require to work in farming, and second that students were more engaged with this method of teaching than classroom teaching. Demonstrating treatment of lame sheep in the college flock was a common example of practical teaching; lecturers reported that this provided an opportunity for students to discuss diagnosis and treatment options and changes in management. Students at the higher qualification level (level 4 in

the European Qualifications Framework) were given the independence to decide the treatment for themselves. Lecturers stated that seeing real cases of lame sheep made the information more memorable for students.

> Lecturer 7: "…there's no point me sitting in a room going on about it continuously when I can go out and I can do something quite practical and quite applied… that they feel like they're getting a skill out of and they could actually go out recognise it themselves."

> Lecturer 10: "I try and do it as practically as possible…I'd much rather be there with a ewe between their legs…and actually looking at it and seeing it, using…all their senses, so smell and …'cause it's all very well me standing in classroom going, 'Well, if you sniff the foot it's going to smell horrible.'…But if they do it, they're gonna remember it much better."

Students universally stated that they did not like to learn through traditional classroom methods of slideshow presentations and lectures and preferred practical sessions. In agreement with their lecturers, they stated that they were better able to remember information when taught in practical settings. Students viewed their future careers as more dependent on their practical skills rather than their understanding of theory, although a small number of students acknowledged the importance of learning theory before applying it practically.

> College 8

Facilitator: “And which part of the things that you’ve done do you enjoy the most or do you think you learn best from?”

Student 5: “I think the practicals. That’s where I always learn better that way.”

Student 1: “Yeah, getting shown.”

Student 5: “You see how it’s done and then you have a go at it yourself and you think oh yeah, I can do that, and then that’s what I find, ‘cause sat in a classroom just someone putting something on a PowerPoint, it goes in one way and goes straight out the other with me.”

Lecturers reported that time constraints were a major barrier for teaching about footrot. They highlighted that the syllabus had increased over time, and that this limited the amount of time available for each topic. There was pressure to prepare students to pass assignments, and so lecturers had less time for practical classes, interactive teaching, external speakers and farm visits.

Lecturer 1: “the restricted amount of time that we’ve got now, in terms of my teaching career, we’ve got less time to teach the same or a probably more content. The agriculture sort of content has expanded but we’ve probably got less time to teach it in”

Lecturer 6: “So of course we talk about health, we talk about management and we talk about different health issues, not just lameness, because there’s just so much we need to cover, so it’s a part, it’s not the, the most important thing.”

513 This time pressure was also reflected in the discussions with the students, who commented
514 that subjects were not explained properly, or that they did not spend enough time doing
515 practical work to embed new knowledge. In several of the groups the students indicated that
516 they were not provided with sufficient detail during their classes on lameness; they
517 described getting an overview of different foot lesions with pictures but no detailed
518 explanations of the aetiology of lesions or the rationale for recommended treatments. In
519 many of the groups the students reported that they had very little practical teaching about
520 footrot at college. However, the students at college 7 (who had stated they would not trim
521 feet) described having considerable practical teaching about footrot. This supports the
522 assertion from both lecturers and students that practical teaching was effective.
523
524 College 2
525 Facilitator: "what kind of classes have you had, practical or theory in terms of lameness?"
526 Student 4: "We haven't really touched on it."
527 Student 1: "More theory than…"
528 Student 5: "[more] theory, just quick PowerPoint, gone over it."
529 Student 2: "That's it. Told the symptoms, what to look for, pictures and that's that."
530
531 Students highlighted that the lack of practical teaching at college meant that they learnt
532 better whilst working on farms than at college. When students were working on farms they
533 were developing tacit knowledge, or in their words "learning by doing". They stated that they
534 enjoyed working on farms and felt more comfortable there.
535
536 College 7, Group 2

Student 4: “Well, you know where you are then [when on the family farm], don’t you, you’re in your own environment, you’ve always been there so you’re just comfortable to do it and then get on with it and you learn as you do it.”

Student 1: “Yeah, somewhere you can go to make mistakes [the family farm] and then understand and then say to you, ‘Try not to do that again, this is what you did wrong’.”

Student 4: “Without having the mick taken out of you <laughs>.”

College 1, Group 2

Student 3: “Spotting it [identifying foot lesions] and learning it you can just identify it easier because you’ve already done it outside, when in a class you’ve just sat there and talked about it.”

The lecturers described that students who had experience of working on farms had developed tacit knowledge of farmers’ practices for managing footrot, often over several years. They reported that this made it difficult to change these students’ beliefs regarding treatment of footrot, and that this was interlinked with changing practices in the sheep industry as a whole.

Lecturer 3: “we will get a 16, 17-year-old from a large sheep farm, maybe, whose dad has been teaching him since he was 10 or 12 to turn a sheep over and trim it, and they will be adamant that you’ve got to trim feet. And it can be frustrating with them, because you know although they’ve even said in the classroom, ‘Yeah, yeah, yeah, yeah, yeah,’ you know they’ll go home that night and they’ll turn a sheep over and trim it.”

Lecturer 4: “It’s sort of bit of a chicken and egg, if, if the industry starts to change, the young people working in the industry will be picking that up … but the industry won’t change until you’ve got the young people coming into the industry taking the new ideas on board.”

There was a consensus among lecturers that what they considered to be good practice to manage footrot was not being achieved on all UK sheep farms. They highlighted that attitudes to lameness need to change within the industry, with lameness currently seen as inevitable and acceptable. They identified a variety of barriers to changing practices, including (i) that change in agriculture is slow, with farmers following traditional practices, (ii) that new information is not reaching farmers, (iii) that information is not provided to farmers in the right format.

Lecturer 8: "I think it’s probably still accepted in the industry that lame, you have sheep, you have lameness."

Lecturer 2: "I think farmers are very stubborn and they’re very stuck in their ways, if it’s not what their grandfather did or their great grandfather did then it’s not worth doing it ‘cause it worked for them"

Lecturer 2: “the farming press need to pick up on it that, you know, foot trimming and, and you just got to talk about worming and things like that. I don’t think we scream loud enough, I don’t think it gets enough press really, I don’t”

585 In summary, lecturers knew that practical teaching engaged students better than classroom
586 lectures, however, the time available to teach the whole syllabus meant that not all new
587 information could be taught practically. This was reflected in the comments of the students
588 who enjoyed practical teaching but reported that it was uncommon at college. Most
589 lecturers considered that it was difficult to change the practices of students who had
590 acquired tacit knowledge of traditional practices whilst working on farms.
591

592 ## 4 Discussion

593 This is the first study as far as the authors are aware to explore how agricultural students
594 acquire knowledge about disease management. Farmers were a strong influence on
595 students' practices, with high levels of trust existing within these relationships. In addition,
596 students' practical experience of working on farms resulted in them acquiring tacit
597 knowledge of practices used by farmers. In contrast, students trusted lecturers to provide
598 them with information regarding "best practice" but not knowledge that would be
599 practically useful on commercial sheep farms.
600

601 ### 4.1 Trust

602 Trust has previously been described as essential for knowledge exchange (Fisher, 2013) and
603 learning (Landrum et al., 2015). The importance of trust was evident for students in our
604 study. Farmers were the informants that students trusted the most, and this was both
605 companion trust based on long term personal relationships with "known farmers" as well as
606 competence trust for more experienced or "expert farmers".
607

608 A lecturer's ability to demonstrate competence was essential for the students to trust them.
609 At college 7 the students had a strong trust in their lecturer and viewed her as competent.
610 Most other students had some competence trust for their lecturers based on their
611 perception that lecturers were knowledgeable about evidence-based practice, but not
612 sufficient to implement this. The fragile nature of competence trust was demonstrated at
613 college 3 where the lecturer's unwillingness to discuss students' concerns over evidence-
614 based practice had led to distrust and a rejection of any information from the lecturer,
615 instead students had put their trust in the college shepherd. Theoretically, commitment
616 trust could exist between students and lecturers because both parties enter into the
617 education process with an expectation of what the other party will provide, and are held to
618 this by the rules of the educational institution. The students would therefore trust their
619 lecturer on the basis of their position, however there was no evidence of this in in our study.
620
621 Students' perceptions of competence were generally based on credibility, which is a
622 component of trust (Kasperson et al., 1992). Students trusted external farmers they visited
623 as part of their college course whose knowledge and practices were evidenced by the health
624 of their livestock; Saunders (2015) also reported that farmers believed that the visual
625 appearance of farming landscapes was an indicator of knowledge. In contrast, lecturers
626 were frequently perceived to present information that did not fit with the practical realities
627 of commercial farming. The students' trust was therefore context dependent (Maclean et
628 al., 2019); students trusted their lecturers to present them with correct evidence-based
629 practice information, but if they wanted practical solutions that would work in the farm
630 environment they would trust farmers. Context dependent trust has been previously
631 demonstrated with cattle farmers who perceived the government to be out of touch with

632 the practical realities of farming, but able to provide them with information regarding
633 legislation (Sutherland et al., 2013).
634
635 **4.2 Knowledge acquisition**
636 Learning is defined as acquiring knowledge, and occurs when information is interpreted,
637 understood and applied (Lee and Yang, 2000; Lejeune, 2011). Zuboff (1989) describes tacit
638 knowledge as action-centred skills, also defined as learning by doing (Lee and Yang, 2000),
639 and this was the students' preferred method of learning. Students highlighted that they
640 learnt well when working on farms, both at home or on other farms. Learning on farm was a
641 practical learning experience with success and failure being acceptable and students felt
642 able to learn in a 'comfortable' environment. At college, learning by doing occurred in
643 practical classes, however due to time pressures faced by lecturers this was infrequent at
644 many colleges. Most of the knowledge students acquired regarding "best practice" was
645 therefore explicit through classroom teaching. The students' preference for practical
646 learning would agree with previous reports regarding the acquisition of farming knowledge.
647 However, it is also increasingly recognised in the medical field that to diagnose and treat
648 disease requires experience-based knowledge as well as scientific knowledge (Estabrooks et
649 al., 2005; Fulbrook, 2003; Yardley et al., 2012). This has become a recent focus of discussion
650 regarding education of students in medical professions, with increasing emphasis placed on
651 experience-based learning (Corlett, 2000; Maudsley and Strivens, 2000). It is therefore
652 reasonable to suggest that the same would apply to agriculture students, and that if we
653 wish them to learn evidence-based treatments we need to ensure teaching methods
654 provide them with the necessary route to acquire the knowledge.
655

656 The students in our study were not passively acquiring information, rather they were
657 understanding it with respect to their own experiences. This was most clearly evident in
658 their comparison of “best practice” and “farm practice”, with students describing how the
659 practices taught by their lecturers did not fit with their experience of working on
660 commercial farms. Students were keen to debate information provided by their lecturers
661 and present their own experiences and viewpoints, although at college 3 this resulted in
662 management of footrot not being discussed at all. This process of sharing experiences
663 within the community is a part of the way farming knowledge is acquired (Wójcik et al.,
664 2019), and the reluctance to engage in this process by a lecturer is likely to have negative
665 consequences for uptake of evidence-based practice, as demonstrated at college 3.
666
667 The importance of learning with understanding has been recognised in education
668 (Carpenter and Lehrer, 1999), and a lack of understanding can reduce uptake of new
669 practices by sheep farmers (O’Kane et al., 2017). There was evidence that students did not
670 understand the mechanism of action of antibiotic treatment or the detrimental effect of
671 foot trimming. Some students stated that they were not provided with the rationale for
672 evidence-based practice, and lack of clarity (for example that foot trimming could be used if
673 necessary, lecturer 8) may have contributed to students’ lack of understanding of whether
674 to foot trim or not. In addition, students often discussed antibiotic treatment or foot
675 trimming as two contrasting treatments, whereas in fact the evidence is that avoiding foot
676 trimming is beneficial to recovery from footrot and using injectable antibiotic is a further
677 benefit (Kaler et al., 2010). The students’ rationale for the use of “farm practice” (foot
678 trimming rather than antibiotic injection) often centred around concerns that antibiotics
679 were expensive or risked the development of antibiotic resistance, again suggesting lack of

680 understanding of appropriate antibiotic use in treatment of individual diseased sheep
681 (Green and Clifton, 2018).
682

683 ## 5 Conclusions and implications for knowledge exchange

684 The premise of our study was that by understanding the practices of young farmers to
685 manage lameness in sheep, and what influenced those practices, we could identify routes to
686 increase uptake of evidence-based practice in the sheep industry. A key finding from our
687 study was the discrepancy between what most agricultural students in further education
688 were taught as best practice to treat footrot in sheep and the farm practice that they used.
689 We show that this is in part because students were influenced by "known farmers" for
690 whom they had high levels of companion trust. Furthermore, students' trust for lecturers
691 was dependent on lecturers demonstrating competence and where this did not occur the
692 result was mistrust and a failure in communication. By exploring the ways in which students
693 acquired knowledge, we demonstrate that the second reason the students continue to
694 practise foot trimming was that they had developed tacit knowledge of traditional practices
695 whilst working on farms. Time constraints at college resulted in students developing only
696 explicit, partial knowledge of evidence-based practice, with misunderstandings around the
697 role of antibiotics and recognition of causes of lameness.
698

699 The strength of learning from trusted farmers was important and commonly highlighted by
700 students. This is valuable information that could be used to improve knowledge exchange to
701 agricultural students, however, it relies on farmers also using evidence-based practices.
702 Winter et al. (2015) also reported that that there are still many farmers using traditional

703 treatments, with appropriate use of parenteral antibiotic treatment particularly low, the
704 students' concerns regarding antibiotic use are likely to reflect the beliefs of such farmers.
705 The current study highlights that all farmers need to be exposed to evidence-based practice
706 to ensure its uptake across the sheep industry and that we cannot rely on educating
707 students alone to maximise the rate of change in behaviour but need to ensure that
708 students learn on farm from well informed farmers using evidence-based practice. The rate
709 of change in the sheep industry in the UK will be slow unless we educate influential farmers.
710
711 The value placed on learning outside the classroom highlights the challenge that college
712 lecturers face when teaching agricultural students in the 16 – 19 age group. The knowledge
713 of "farm practice" that students develop whilst working on farms is tacit; it is acquired
714 through carrying out tasks and observing more experienced farmers over a period of time.
715 This knowledge therefore becomes embedded. In contrast, because of time constraints
716 faced by lecturers, knowledge regarding "best practice" is mainly explicit coming from
717 theoretical teaching over a short time period. We found that in many cases lecturers were
718 not able to overcome the students' beliefs regarding foot trimming, although this is
719 probably due to both students' tacit knowledge of foot trimming and the stronger
720 companion trust they had for "known farmers" compared to the competence trust they had
721 for lecturers. Tacit knowledge of foot trimming represents a wider problem for uptake of
722 evidence-based practice by farmers, with foot trimming being part of farming knowledge
723 and practised for many years. Our findings reflect those of Nguyen et al. (2019), where
724 explicit knowledge of climate change did not result in farmers adopting mitigation practices,
725 and as suggested by Nguyen et al. (2019), directing efforts towards developing tacit
726 knowledge of evidence-based practice may encourage change in behaviour.

We have demonstrated that both trusted informants and the development of tacit knowledge were important influences on students' practices. These two factors do not act independently; trust is essential for the acquisition of knowledge (Fisher, 2013), and knowledge of an informant contributes to the development of trust (Landrum et al., 2015). Students' practices will therefore depend on a more complex interplay between these two factors. The development of tacit knowledge whilst working with a highly trusted informant had the strongest influence on students' practices; this occurred on farms and at college 7 where students trusted their lecturer and experienced practical teaching. Where one or both of these factors were missing, the influence on students' practices was reduced. At colleges 1, 2 and 8 students trusted their lecturer and gained explicit knowledge of evidence-based practice, but were unlikely to implement this on farms. At college 3 where students did not trust their lecturer, they were strongly in favour of traditional practices and believed evidence-based practice to be incorrect.

Conflict of interest

Declarations of interest: none.

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Table 1 Colleges with a participating lecturer by number of student participants, focus groups, year of study, region of England and accrediting body

College / Lecturer identification	No. students (No. groups)	Students' year of study*	Geographic Region	Qualification** Accreditation
1	12 (2)	1st (n=8) 2nd (n=4)	North	City & Guilds
2	8 (1)	2nd	North	City & Guilds
3	12 (2)	3rd	North	City & Guilds
4	NA	NA	South	City & Guilds
5	NA	NA	Midlands	City & Guilds
6	NA	NA	Midlands	BTEC
7	12 (2)	2nd	South	City & Guilds
8	6 (1)	2nd	South	City & Guilds
9	NA	NA	North	City & Guilds
10	NA	NA	Midlands	BTEC

NA = not applicable

*n = number of students in each year

** National qualifications providers: either City & Guilds (https://www.cityandguilds.com) or Business and Technology Education Council (BTEC; https://qualifications.pearson.com/en/about-us/qualification-brands/btec.html).