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

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17

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## 19 **Abstract**

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

37

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

39

## 40 **1 Introduction**

41 Lameness is one of the top five globally important diseases of sheep (Nieuwhof and Bishop,  
42 2005; Rather et al., 2011; Stewart, 1989); it reduces productivity (Wassink et al., 2010) and  
43 so decreases the sustainability of sheep farming (Eisler et al., 2014). Footrot is the most  
44 common cause of lameness in the UK and is present on over 90% of sheep farms (Winter et  
45 al., 2015) with estimated costs to the sheep industry of £20-£80 million per annum  
46 (Nieuwhof and Bishop, 2005; Wassink et al., 2010). In the light of this, reducing prevalence  
47 of lameness is a key target for the UK sheep industry and in 2011 the Farm Animal Welfare  
48 Committee set a target to reduce the national prevalence of lameness to less than 2% by  
49 2021 (Farm Animal Welfare Committee, 2011).

50

51 Information from recent scientific research has led to a paradigm shift in understanding of  
52 the management of footrot in sheep. The traditional treatment for footrot was to trim the  
53 hoof horn of feet with footrot to expose the lesions (Morgan, 1987; Wassink et al., 2003),  
54 however, research shows that foot trimming is detrimental and delays recovery from  
55 disease (Kaler et al., 2010; Wassink et al., 2010). In addition, routine foot trimming,  
56 traditionally carried out by farmers at least once per year as a whole flock measure, is  
57 associated with high levels of lameness (Kaler and Green, 2009; Wassink et al., 2003; Winter  
58 et al., 2015). Antibiotic treatment with no foot trimming is the current evidence-based  
59 practice to treat footrot (Duncan et al., 2012; Grogono-Thomas et al., 1994; Kaler et al.,  
60 2010; Wassink et al., 2010) and clinical trials have demonstrated that this reduces the flock  
61 prevalence of lameness to < 2%. However, for scientific evidence to have an impact on  
62 national lameness prevalence, farmers must change their paradigm and be knowledgeable  
63 of, and use, the new evidence (Garforth, 2015; Willems et al., 2015).

64

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

73

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

88

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

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

123

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

129

## 130 **2 Materials and methods**

131 Ethical approval for the study was obtained from the University of Warwick (REGO-2016-  
132 1870).

133

### 134 **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-](http://www.cedefop.europa.eu/en/events-and-projects/projects/european-qualifications-framework-eqf)  
170 [projects/projects/european-qualifications-framework-eqf](http://www.cedefop.europa.eu/en/events-and-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

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

234

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

244

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

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

255

### 256 *3.1.2 Students' beliefs about treatment of footrot*

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

266

267 College 2

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

269 Student 6: "Have a look at it."

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

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

272 Student 2: "Spray it."

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

274 Facilitator: "OK."

275 Student 2: "Foot bath."

276 Student 5: "Separate from the rest."

277

278 College 7, Group 2

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

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

284 Student 6: "No."

285 Student 2: "Put them in a footbath."

286 Student 3: "Plenty of blue spray."

287

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

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

305

306 College 3, Group 1

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

311

312 College 8

313 Student 6: "Yeah, they recommend using more antibiotics and not trimming, but ... but  
314 then it just leads to resistance and all stuff like that, so that's where it causes all arguments  
315 and everything!"

316

317 College 7, Group 2

318 Student 4: "Well, yeah, it's a lot more money, if you give it Metacam and then you give it  
319 some Alamyacin [antibiotic] you're spending a lot more money than if you just put some  
320 blue spray into it."

321

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

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

326

### 327 **3.2 Influence of trust on students' practices**

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

336

337 College 8

338 Student 3: "At home...you go back with new ideas and ... 'cause I do have my own stock,  
339 they're [student's parents] like, 'Well that's yours. You can make the decisions you want  
340 and see how it goes and see if they turn out better, worse; see if it makes a difference.'"

341

342 Lecturer 8: "There's always the, 'Well father's always done it this way'. And it's difficult  
343 sometimes to break that... and I think parents, work providers, farmers, are perhaps also  
344 reluctant to not trim, to put those trimmers away. I mean I've had students in the past  
345 that would tell me quite categorically that you have to make a foot bleed to let the bad  
346 out, yeah, it's very difficult to tell someone that no, that is not what you do because  
347 that's what they've been taught before they come to us."

348

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

359

360 College 7, Group 2

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

364

365 College 7, Group 2

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

370

371 College 8

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

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

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

377 Student 1: “Yeah.”

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

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

383

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

391

392 College 3, Group 2

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

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

397

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

403

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

410

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

414

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

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

421

422 College 8

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

429

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

435

436 College 2

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

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

440 Student 8: "Not just like all theory."

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

443

444 College 1, Group 1

445 Student 1: “Well we use stuff like that [social media]. But it’s harder to believe stuff on

446 there though, isn’t it? ‘cause one person can say something and then it’ll go around and by

447 the time it gets to you it’ll be completely different news...You can take things on the

448 internet with a big pinch of salt.”

449

450 In summary, students had companion trust for farmers they knew well, and these “known

451 farmers” had a strong influence on students’ beliefs. Students had competence trust for

452 veterinarians and “expert farmers” based on perceptions of their knowledge and expertise.

453 Most students would trust lecturers for information about “best practice”, however, for one

454 group of students the unwillingness of their lecturer to debate different treatments with

455 them had resulted in mistrust.

456

### 457 **3.3 How students acquired knowledge about footrot**

458 Students were taught about footrot at college and also experienced management of footrot

459 whilst working on farms. When asked about the teaching methods that students would

460 experience at college, the majority of lecturers stated that they used practical teaching.

461 They identified two key benefits of practical teaching; first that it helped students to

462 develop skills they would require to work in farming, and second that students were more

463 engaged with this method of teaching than classroom teaching. Demonstrating treatment of

464 lame sheep in the college flock was a common example of practical teaching; lecturers

465 reported that this provided an opportunity for students to discuss diagnosis and treatment

466 options and changes in management. Students at the higher qualification level (level 4 in

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

470

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

474

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

480

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

488

489 College 8

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

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

493 Student 1: “Yeah, getting shown.”

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

498

499 Lecturers reported that time constraints were a major barrier for teaching about footrot.

500 They highlighted that the syllabus had increased over time, and that this limited the amount  
501 of time available for each topic. There was pressure to prepare students to pass  
502 assignments, and so lecturers had less time for practical classes, interactive teaching,  
503 external speakers and farm visits.

504

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

508

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

512

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

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

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

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

543

544 College 1, Group 2

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

548

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

554

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

560

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

565

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

573

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

576

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

580

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

584

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.

727

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

741

## 742 **Conflict of interest**

743 Declarations of interest: none.

744

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749

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888 **Table 1 Colleges with a participating lecturer by number of student participants, focus**  
 889 **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)	1 <sup>st</sup> (n=8) 2 <sup>nd</sup> (n=4)	North	City & Guilds
2	8 (1)	2 <sup>nd</sup>	North	City & Guilds
3	12 (2)	3 <sup>rd</sup>	North	City & Guilds
4	NA	NA	South	City & Guilds
5	NA	NA	Midlands	City & Guilds
6	NA	NA	Midlands	BTEC
7	12 (2)	2 <sup>nd</sup>	South	City & Guilds
8	6 (1)	2 <sup>nd</sup>	South	City & Guilds
9	NA	NA	North	City & Guilds
10	NA	NA	Midlands	BTEC

890 NA = not applicable

891 \*n = number of students in each year

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