

*Farmers' attitudes to disease risk  
management in England: a comparative  
analysis of sheep and pig farmers*

Article

Accepted Version

Garforth, C. J., Bailey, A. P. and Tranter, R. B. ORCID:  
<https://orcid.org/0000-0003-0702-6505> (2013) Farmers'  
attitudes to disease risk management in England: a  
comparative analysis of sheep and pig farmers. *Preventive  
Veterinary Medicine*, 110 (3-4). pp. 456-466. ISSN 0167-5877  
doi: 10.1016/j.prevetmed.2013.02.018 Available at  
<https://centaur.reading.ac.uk/31113/>

It is advisable to refer to the publisher's version if you intend to cite from the  
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To link to this article DOI: <http://dx.doi.org/10.1016/j.prevetmed.2013.02.018>

Publisher: Elsevier

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1 **Farmers' attitudes to disease risk management in England: a comparative analysis of**  
2 **sheep and pig farmers**

3 C. J. Garforth, A. P. Bailey and R. B. Tranter

4 School of Agriculture, Policy and Development, University of Reading, PO Box 237,  
5 Reading RG6 6AR, UK

6

7 Corresponding author:

8 C J Garforth

9 Tel: +44 118 378 8134

10 Fax: +44 (0) 118 935 2421

11 email: [c.j.garforth@reading.ac.uk](mailto:c.j.garforth@reading.ac.uk)

12

13 Address for proofs:

14 Prof C J Garforth, SAPD, Room 2L38, Agriculture Building, PO Box 237, Reading RG6  
15 6AR, UK

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25 **Abstract** (302 words)

26 The UK Department for Environment, Food and Rural Affairs (Defra) identified practices to  
27 reduce the risk of animal disease outbreaks. We report on the response of sheep and pig  
28 farmers in England to promotion of these practices. A conceptual framework was established  
29 from research on factors influencing adoption of animal health practices, linking knowledge,  
30 attitudes, social influences and perceived constraints to the implementation of specific  
31 practices. Qualitative data were collected from nine sheep and six pig enterprises in 2011.  
32 Thematic analysis explored attitudes and responses to the proposed practices, and factors  
33 influencing the likelihood of implementation. Most feel they are doing all they can  
34 reasonably do to minimise disease risk and that practices not being implemented are either  
35 not relevant or ineffective. There is little awareness and concern about risk from unseen  
36 threats. Pig farmers place more emphasis than sheep farmers on controlling wildlife, staff and  
37 visitor management and staff training. The main factors that influence livestock farmers'  
38 decision on whether or not to implement a specific disease risk measure are: attitudes to, and  
39 perceptions of, disease risk; attitudes towards the specific measure and its efficacy;  
40 characteristics of the enterprise which they perceive as making a measure impractical;  
41 previous experience of a disease or of the measure; and the credibility of information and  
42 advice. Great importance is placed on access to authoritative information with most seeing  
43 vets as the prime source to interpret generic advice from national bodies in the local context.  
44 Uptake of disease risk measures could be increased by: improved risk communication  
45 through the farming press and vets to encourage farmers to recognise hidden threats;  
46 dissemination of credible early warning information to sharpen farmers' assessment of risk;  
47 and targeted information through training events, farming press, vets and other advisers, and  
48 farmer groups, tailored to the different categories of livestock farmer.

49

50 Keywords: animal disease risk; adoption; biosecurity; communication; policy; veterinarians;  
51 biosecurity; prevention.

## 52 **1. Introduction**

53 England's climate lends itself to the production of grass (4.8 m hectares) and crops (4 m  
54 hectares), primarily winter cereals, supporting 5.4 m cattle, 14.3 m sheep and 3.6 m pigs  
55 (Defra, 2011). Sheep production is the most extensive system using both the less productive  
56 uplands and also lowland grass for finishing lambs in a stratified system involving regular  
57 movement of sheep and lambs between farms (Fogerty, et al., 2012; Harvey and Scott, 2012).  
58 Pig production is more intensive, although comprising both indoor and outdoor systems, with  
59 either combined breeding and finishing units or separate enterprises (Lewis and Grayshon,  
60 2012) again requiring movement across businesses.

61

62 Animal disease outbreaks have recently made headlines and the threat of disease is diverse  
63 and changing (POST, 2011). Some diseases are endemic, others characterised by specific  
64 outbreaks with new diseases arriving from expanding trade and climate change. The impact  
65 ranges from a small set-back in production to a devastating infection leading to widespread  
66 culling and every disease contracted affects farmers' returns.

67

68 To reduce the risk of animal disease, and its impact and cost, the UK Department for  
69 Environment, Food and Rural Affairs (Defra) identified key factors contributing to disease  
70 risks on farms and the mitigation measures needed (Table 2). Understanding whether farmers  
71 could be encouraged to adopt such measures is not comprehensive (Collier, et. al., 2010).

72 Previous work in Europe identified that size of enterprise influences the adoption of  
73 biosecurity measures. Small and/or hobby farms generally lack appropriate biosecurity  
74 measures whereas commercial and larger businesses tend to have higher biosecurity measures  
75 associated with higher awareness and recognition of risk (Ribbens, et al., 2008; Nöremark, et  
76 al., 2009 & 2010; Valeeva, et al., 2011). Enterprise type is also an influence, with higher

77 levels of biosecurity in pig enterprises (Boklund, et al., 2004) and less in sheep enterprises  
78 (Nöremark, et al., 2010).

79

80 However, farmer characteristics, including motivations and attitudes, also affect decision  
81 making on farms. There is evidence that farmers give more weight to biosecurity than animal  
82 health programmes (Valeeva, et al., 2011). Yet research in Denmark (Kristensen & Jakobsen,  
83 2011) suggests that even legislation on biosecurity plans does not always lead to uptake if  
84 benefits are not perceived. Farmers are strongly influenced by practice and implement what is  
85 familiar (Casal, et al., 2007). This is partly down to lack of awareness (Racicot, et al., 2012)  
86 but also confusion from inconsistent and contradictory information (Moore, et al., 2008).  
87 Furthermore, lack of understanding limits effectiveness of implementation (Racicot, et al.,  
88 2011 & 2012). Cost is also an influence (Fraser, et al., 2010) with farmers needing evidence  
89 of effectiveness before implementation (Gunn, et al., 2008). There is also a feeling that both  
90 responsibility for biosecurity and cost should be shared and the way forward involves  
91 Government and industry including farmers and vets. There is also a need to build trust  
92 amongst stakeholders (Benjamin, et al., 2010; Gunn, et al., 2008; Hernández-Jover, et al.,  
93 2011).

94

95 The study reported here examined factors encouraging and discouraging adoption of  
96 measures to mitigate disease risk, in order to determine policy levers and engagement  
97 strategies most likely to lead to risk reducing behaviours, overcome embedded resistance and  
98 encourage farmers to adopt these measures. We focus on sheep and pig enterprises, diverse  
99 sectors where the former are perceived as less concerned about biosecurity (Hovi, et al.,  
100 2005) whilst the latter are perceived as extremely biosecurity conscious.

101

102 What follows outlines study method, results relating to understanding disease risk, Defra's  
103 mitigation measures, farm assurance, health plans and who should bear responsibility for  
104 disease control, before concluding what influences intentions and behaviours including  
105 awareness, knowledge, experience and attitudes, and implications of the findings for policy.

106

## 107 **2. Method**

108 The research involved face to face interviews with a sample of farmers running livestock  
109 enterprises. Most recent research in this area has used quantitative methods of data collection  
110 (mainly postal questionnaires) and analysis including summary descriptive statistics  
111 (Benjamin, et al., 2010), factor analysis (Boklund, et al., 2004), logistic regression (Ellis-  
112 Iversen, et al., 2010), Theory of Reasoned Action (Garforth, et al., 2006), Theory of Planned  
113 Behaviour (Jan, et al., 2012) and rating scales (Jansen, et al., 2010). We used the ability of  
114 qualitative methods to provide complementary insights to an understanding of human  
115 behaviour, using as their raw data the words in which participants in semi-structured, in-  
116 depth, face-to-face interviews articulate their knowledge, perceptions and feelings.

117

118 Interviews took place between February and April 2011 in three areas of England (south  
119 west, central southern, and Welsh Borders) providing good coverage of enterprise types,  
120 scales and systems. The focus was on farmers who were likely to be non-compliant with  
121 some of the disease risk reducing practices of interest to Defra. The study covered cattle and  
122 poultry (not reported here) as well as pigs and sheep (Garforth, et al., 2011). Interviewee  
123 selection was based on a commercial telephone database and local knowledge through  
124 veterinary practices, to achieve an agreed quota of participants (see Table 1) in each sector.

125

126 [TABLE 1 about here]

127



128 Interviews were semi-structured. Where farmers operated more than one site, the interview  
129 focused on the site where the interview was conducted. Farmers were asked about  
130 interventions for reducing disease risk from: new diseases being brought onto farm by  
131 introduction of infected animals; disease being brought onto farm by visitors; new disease  
132 being brought onto farm from neighbouring farms; spread/multiplication of disease on the  
133 farm; introduction of new diseases onto farm by other animals; diseases propagating or going  
134 undetected; and disease spreading from their farm to other farms.

135

136 [TABLE 2 about here]

137

138 Each was specified in the interview schedules in terms of practices relevant to the enterprises  
139 (Table 2). Data gathered were largely qualitative, although information on the business and  
140 the area that might affect attitudes to disease risk mitigation was also obtained. Nine sheep  
141 farmers were interviewed and six pig farmers; interviews lasted 45-75 minutes, were audio-  
142 recorded and transcribed.

143

144 To help analysis, a framework was developed from literature on the influences on farmers'  
145 decisions regarding animal health and husbandry (Figure 1). This identified factors expected  
146 to affect the intention to carry out actions to reduce, or manage, disease risk. Drawing on  
147 studies that have applied the Theory of Reasoned Action (TRA), Theory of Planned  
148 Behaviour (TpB) (Ajzen, 1985) and the Health Belief Model (HBM) (Rosenstock, 1964) in  
149 the field of animal health and farmer decision making (e.g. Garforth, 2011; Ellis-Iversen et  
150 al., 2010; Jansen, et al., 2009; Garforth, et al., 2006), we expected farmers' behaviour in  
151 respect of disease risk management would be influenced by: their *knowledge* of specific  
152 practices; their *attitudes* to specific practices (including their assessment of benefits, costs

153 and risk) and to disease risk management in general; their view on the *efficacy* of practices in  
154 reducing disease risk (which, in TpB terms, are reflected in ‘outcome beliefs’ and attitudes)  
155 and of disease risk management; their *previous experience*, and that heard from others, of  
156 specific practices; their *perception of their ability* to put specific practices into effect, and  
157 their perception of *factors that constrain* their ability to put specific practices into effect  
158 (which, in TpB terms, relates to ‘Perceived Behavioural Control’; and in HBM, to ‘self-  
159 efficacy’) which may include *current habitual behaviour*; their perception of what *other*  
160 *farmers in similar situations are doing* with respect to disease risk management; and their  
161 perception of what *other people important to them would think* about their doing or not doing  
162 specific practices (‘subjective norms’ in TpB). The framework was used to code transcripts,  
163 as we looked for phrases reflecting the above factors .

164

165 [FIGURE 1 about here]

166

167 Emerging themes from the analysis were presented to a workshop of 22 people representing a  
168 range of stakeholders (including Defra, the British Veterinary Association (BVA) and the  
169 National Farmers Union (NFU)). The outcomes of the workshop, reported elsewhere  
170 (Garforth et al., 2011), broadly validated the findings and helped inform the discussion,  
171 below, of the policy implications of the study.

172

### 173 **3. Results**

#### 174 **Overview**

175 The interviewees felt that they are doing all that makes sense towards disease risk reduction.  
176 Few felt they should be doing more and all had what seemed to them sound reasons for not  
177 complying with practices they had not implemented. This is brought out in the analysis below  
178 of current behaviour in relation to intervention practices for reducing disease risk listed in

179 Table 2. All quotations are verbatim extracts from the transcripts; reference numbers by each  
180 quotation indicate the interviewee (see Table 1).

181

182 All sheep farmers felt they had a good understanding of disease risk control while only three  
183 of the six pig enterprises said they had a good understanding (Table 3). This understanding  
184 comes from experience rather than any specific training. A typical response from a larger pig  
185 enterprise was: ‘I’ve been working with them for years’. [KA030]

186

### 187 **Farm Assurance Schemes and Flock/Herd Health Plans**

188 Just over half the enterprises belonged to Farm Assurance Schemes with the larger  
189 enterprises more likely to be members. The prevailing view among scheme members is that  
190 the only reason for joining is to gain market access. Those not needing a market channel  
191 requiring Farm Assurance do not join, perhaps because they have a strong reputation in a  
192 niche or local market: ‘We felt our name spoke for itself. We want to sell our produce as  
193 [*farm name*] additive free pork and not from anyone else’ (KA020). Others cite cost, lack of  
194 financial return and hassle of paperwork and inspections as reasons for not joining. No  
195 scheme members mentioned enhanced biosecurity or disease control as a benefit – it was just  
196 something they had to do to sell their produce.

197

198 One of the smaller pig producers summed up reasons for scepticism about Farm Assurance  
199 voiced in varying degrees by the other non-members:

200 I can’t see what scheme would help me. We are a small producer and the cost  
201 of joining is prohibitive. And there are many schemes that have been  
202 discredited. I’m not sure of the Little Red Tractor. And Freedom Food. We do  
203 our own thing and say that you can come and see what we do at any time. We

204 participate in ‘Open Farm Sunday’ and have open days so I don’t think I need  
205 to join anything or be accredited. ... The schemes are quite unclear. You can  
206 put a stamp on a piece of meat but what does it mean. I don’t know if the  
207 average consumer understands what you are selling. [KA027]

208

209 Five of the sheep enterprises had flock or farm health plans because it is a requirement of the  
210 assurance scheme they belong to; for all but one, the plan was drawn up by or with the help  
211 of their vet. One of them said they look at it; the others suggested it was for the benefit of the  
212 vet or scheme inspectors:

213 *[Do you have a health plan?]* Yes, but don’t ask me where it is. *[Do you*  
214 *review it?]* Sitting around chatting about it over lunch, we’re always reviewing  
215 things and we constantly change. We don’t write it down, we just do it. We  
216 have one somewhere because we’re supposed to have one. [KA016]

217 Those without a plan either didn’t know what it is, or felt it wasn’t necessary (‘because we  
218 know every sheep’ [PA006]), or that it was associated with assurance schemes:

219 *[Do you have a health plan?]* No; because I’m not farm assured so I don’t  
220 know whether I’m meant to have one or not [KA026]

221

222 With pig farmers there is a clear divide between the three largest enterprises, who have a  
223 health plan, and the others who do not. These plans are there, not to comply with assurance as  
224 in the sheep enterprises, but because the farmers’ recognition of the importance of having a  
225 systematic, agreed way of addressing health issues:

226 It is just what we do. If we see some pens aren’t doing well we call the vet and  
227 he’ll say put a bit of this in the water. If we find a mortality we don’t worry

228 but if we find more than one it is investigated. The plan is drawn up by the vet  
229 and reviewed over the phone. It is not part of the scheme. [KA030]

230

### 231 **Practices to reduce disease risk**

232 Responses to questions relating to the practices listed in Table 2 are summarised in Table 3.

233

234 [TABLE 3 about here]

235

236 The interviews provide rich data on what farmers are, and are not, doing, and their reasons.

237 As Table 3 shows, much of the ‘non-compliance’ is explained by farmers’ seeing practices as

238 irrelevant to them, or impractical, or not necessary. Some apparent ‘compliance’ is not

239 because of concerns over animal disease risk but for other reasons. For one sheep enterprise,

240 for example, sourcing from well-known suppliers was for convenience rather than disease

241 risk reduction. Several interviewees said, of hygiene on farm, that keeping things clean is

242 normal good husbandry and not something they do specifically to reduce disease risk. Some

243 distinguished between what they try to do and the compromises they have to make from time

244 to time. With the pig enterprises, there was a distinct pattern relating to size of operation:

245 larger, more intensive enterprises are more likely to comply than smaller ones.

246

247 Responses on using optimal disease control tools such as vaccines recommended by a vet

248 gave interesting insights into farmers’ use of veterinary advice. Although they generally

249 regard vets as credible sources of information and guidance, they do not automatically follow

250 their advice. With vaccination, most seemed to take a calculated risk. A prevailing attitude

251 among the sheep farmers, with respect to bluetongue, was that there would be time after

252 hearing bluetongue is around to vaccinate and so the cost of routine preventive vaccination is

253 not justified. Some were also concerned about the stress to sheep of vaccination. One also  
254 mentioned a widespread view that as most sheep farmers are vaccinating the risk is reduced,  
255 making it less important for them to vaccinate.

256

257 With some practices, the extent of compliance varies. All but one of the pig farmers, for  
258 example, take action to keep rodents away from their pigs ranging from having cats to using  
259 rodenticides. None felt it feasible to keep large mammals, such as deer and foxes, away.

260

### 261 **Responsibility for advice and disease control**

262 The overwhelming view on disease control advice is that advice from their vet is more  
263 credible than that from other sources: vets' knowledge is locally contextualised, they are  
264 there for immediate one-to-one advice, and they work in the farmer's interest. Nevertheless,  
265 some recognised that Defra has a role in providing advice.

266

267 Of the nine sheep enterprises, five said Government should bear the cost of controlling both  
268 endemics and exotics with four saying farmers should pay for endemics as part of normal  
269 costs of running a good business. As for advice, vets are seen as more credible than Defra but  
270 one interviewee suggested that if farmers have to pay for advice, many will not seek it and so  
271 Defra should continue the practice of disseminating advice. One sheep farmer pointed out  
272 that providers of advice have their agendas so the farmer has to assess the relevance of advice  
273 for them:

274 Vets are quite good at giving advice but you always have this feeling that they  
275 will try and sell you something more than you need or more expensive. So  
276 anything a vet tells you, you need to take with a pinch of salt. Obviously  
277 respect what they say because they are experts. [PA06]

278

279 Another echoed the link between cost and responsibility, in respect of paying for advice:

280 I wouldn't mind paying but I would want a say in how it was going to be spent

281 because Defra have no idea, it's like all Government bodies, they've got no

282 idea on how money is spent other than they go on and spend it willy nilly.

283 [KA26]

284

285 When it comes to exotics, all said Government should be responsible. Several referenced the

286 strategic nature of their industry, in terms of food security, in justifying this insistence on

287 Government paying for advice and control measures in respect of exotics.

288

289 Pig enterprises had differing views on organisations who are potential sources of advice and

290 information. Some saw a role for Defra to act as a universal source of advice with others

291 seeing Defra becoming marginalised because producers can turn to several sources for their

292 information needs. One larger enterprise with one of the younger respondents (40-49 years),

293 felt the industry has advice on endemics covered but that Defra has a role in relation to

294 notifiable diseases:

295 If you look at important organisations to the pig industry, you have BPEX

296 [British Pig Executive], the NPA [National Pig Association], the trade

297 association with a powerful voice, Pig World magazine, the Pig Veterinary

298 Society and individual vets. Defra has a role there but, in terms of endemic

299 disease, pretty small. If you have a notifiable disease, you deal with Defra

300 because they set the rules and how you deal with it. [KA29]

301

302 Another larger enterprise (run by an interviewee of 60-69 years) felt Defra should have a role  
303 in advice but that it is out of touch:

304 Defra aren't in touch with the industry. The NFU have a livestock committee  
305 but they are not really in touch. It is pig farmers who are very much in touch  
306 with the whole system and we network with them. I suppose Defra should give  
307 the advice as they have overall control. [KA30]

308

309 Others highlighted the role of vets in advice, another larger enterprise suggesting:

310 I think vets in the main are on the ground with the expertise and experience  
311 and local knowledge. I think the Ministry should have a big input into that ...  
312 we work closely with one of their vets ... and I will pick the phone up and talk  
313 to him quite regularly. [KA28]

314

315 The two smaller enterprises felt that Defra should be the body responsible for both advice and  
316 disease control, one volunteering:

317 I think Defra, during foot and mouth, were very good. I looked on the website  
318 every day to see what was going on. They would be the people I would turn to  
319 for policy advice, the NFU as well. [KA27]

320

#### 321 **4. Discussion and conclusions**

322 Figure 1 shows factors from recent research on farmer decision making on animal health  
323 matters, thought likely to affect intention and behaviour for disease risk management.

324 Discussion will be structured around these, with several themes emerging.



325

326 **Knowledge and awareness of practices**

327 Livestock farmers feel they understand risk control measures well. However, the fact that  
328 someone knows about a measure and understands what it is designed to do does not make it  
329 more likely that they will implement it. Indeed, comments on the measures suggest that  
330 assessment of efficacy and practicability are much more important. Knowledge and  
331 awareness is obviously a necessary, but far from sufficient, condition for implementation.  
332 Views on the credibility of the science underpinning the recommendation of measures were  
333 mixed. Most thought the science was sound, though some questioned how science was  
334 translated into recommended measures for farmers.

335

336 **Attitudes to disease risk**

337 Interviewees recognise that disease risks can be managed by good husbandry and reduced  
338 through implementing measures that are practical for each individual. However, disease  
339 cannot be avoided entirely. This is not seen as fatalistic but as realistic: one can take  
340 precautions to reduce risks, but the nature of livestock keeping is that disease will occur now  
341 and again. Furthermore, some risks cannot be controlled by farmers as the lack of effective  
342 control of risks by people off farm, including lorry drivers and people using public footpaths  
343 across farms, can undermine their efforts. Attitudes to risk are informed by previous  
344 experience, as in the comment in Table 3 on scab being transferred among sheep on  
345 moorland. The interviews show that farmers' compliance with recommended practices is  
346 strongly influenced by attitudes to disease risk. Those who feel a particular risk is serious and  
347 manageable are more likely to try to reduce it if they feel that the costs are justified.

348

349 Many farmers also associate risk with the current local disease status. If, for example, a  
350 neighbour is known to have a transmittable disease, they are likely to take additional  
351 precautions. The fact that the disease may have been present but undetected in the  
352 neighbour's stock for months does not necessarily translate into readiness to prevent such  
353 unseen threats from entering the herd or flock. There is a similar attitude to vaccination as  
354 several said they had stopped vaccinating against some diseases because the risk was low but  
355 they would consider starting again if the disease increased in the area.

356

357 Similar views came from a question on what they would do in the event of an exotic disease  
358 outbreak: several said they would deploy measures widely promoted during previous  
359 outbreaks, including disinfectants, restricting movements of people onto and off the farm, and  
360 spraying vehicles. Several referred to luck – ‘keeping fingers crossed’ and ‘touching wood’ –  
361 and the sense of doing what one normally does, only more intensively.

362

363 Many of the biosecurity measures viewed as unnecessary are aimed at reducing the risk of  
364 this ‘silent spread’ of disease. To be effective, they must be done routinely even when it  
365 appears there is no threat, for example isolating bought-in animals and separating species.  
366 This suggests there is a difference in risk perception between farmers and Defra and the  
367 veterinary profession. This has two implications: it highlights the important responsibility of  
368 vets (both public and private), and of farmers, to ensure surveillance functions well so that  
369 threats become visible as early as possible; and it suggests an area where education and  
370 communication are needed to enable farmers to recognise the ‘unseen’ risk of disease. Within  
371 these responses, there is a mixture of farmers accepting a slightly higher level of risk than  
372 perhaps Defra would like, and farmers balancing risk against the inconvenience and expense  
373 of more extreme measures.

374

375 **Attitudes to disease risk management practices**

376 Attitudes to disease risk measures seem strongly linked to attitudes to disease risk itself.

377 Many interviewees base their decisions on implementing specific practices on their personal  
378 assessment of trade-offs between risk, efficacy and cost. Typical was this sheep farmer's  
379 explanation of his decision not to vaccinate against bluetongue:

380 Vaccines are a good thing, I couldn't manage without them but the less you  
381 jab animals is good. You have to weigh up whether it's worth doing or you  
382 take a risk and probably this year, I'm going to take the risk and not do it. If I  
383 was further east, I might do it a bit more. [KA26]

384

385 Another common theme was questioning the efficacy of practices, not because of the  
386 underlying science or theory but because they cannot be implemented or because other  
387 factors intervene. Scepticism was expressed by one of the larger pig enterprises in respect of  
388 action to reduce the risk of salmonella:

389 When people talk about salmonella control it's a farce. ... let's not be naïve  
390 enough to think that because we have got a salmonella control programme it is  
391 going to make any difference because it doesn't. [KA28]

392

393 The practices most commonly applied were those regarded as common sense or part of good  
394 husbandry. They included vaccination, being selective over sources of new animals, keeping  
395 new animals separate from existing stock on arrival, and cleaning buildings between batches.  
396 These practices were adopted where returns seemed to justify it. However, other practices  
397 did not make sense for individuals. Double fencing, for example, was rejected by most  
398 including this sheep farmer with a smaller flock:

399 Double fencing? No, if I've got one fence that works I think I'm doing well.

400 Avoid grazing on fields next to neighbours? No, I don't think that is practical

401 for us ... Double fencing, a load of rubbish. [KA13]

402

### 403 **Perceived farm constraints and ability to implement measures**

404 Many interviewees referred to a feature of their enterprise when explaining why they had

405 decided it was unnecessary or impractical to adopt one or more of the proposed measures.

406 Features making a measure unnecessary include geographical isolation and the protection

407 from neighbouring stock afforded by boundary roads and watercourses; those making a

408 measure impractical include the construction or layout of buildings, lack of space, and

409 fragmentation of the holding into parcels.

410

411 Some saw trade-offs between tighter disease risk management and values important to them,

412 particularly welfare, as seen in the earlier comment about bluetongue vaccination. One pig

413 farmer felt they could not do any more to prevent disease transmission from wildlife without

414 compromising their commitment to running an open system:

415 Without boarding up, I don't know what I could do. We have a big thing about

416 health and welfare. We would like to run them outdoors but you can't here

417 because we are on clay. In the winter it's under water. What we do is make it

418 as easy as possible. If we start boarding up, it would cause problems and

419 compromise welfare. [KA20]

420

421 Apart from these farm level constraints, two themes emerged regarding their ability to

422 implement measures: ease of implementation and cost. For the former, specific practices that

423 make sense are not implemented because they are time-consuming and, for the latter, it is  
424 perceived they are not justified by the cost.

425

#### 426 **Previous experience**

427 Livestock farmers' disease risk behaviour is strongly influenced by experience of practices  
428 that have worked or not, of farm diseases, of working with animals and of the organisations  
429 they deal with.

430

431 If a practice does not work, or seems to makes things worse, farmers are quick to change,  
432 even if the change is one that others might regard as idiosyncratic. As one of the larger pig  
433 enterprises said about cleaning housing between batches:

434 We found out quickly that the worst thing to do was pressure wash and  
435 disinfect between batches because we found they built up immunity. Now, we  
436 clean out and have foot dips but we don't pressure wash. [KA20]

437

438 Farmers' experience of organisations can work either for or against compliance and relates to  
439 credibility. This is clearly seen in comments on Defra's role in providing information on  
440 disease. Some regard Defra as having done a reasonable job on information and advice, for  
441 example during Foot and Mouth outbreaks, and see it as a credible and useful source. Others,  
442 with less positive experience of Defra , are more likely to regard their advice as unhelpful or  
443 less relevant than that from other sources. This was expressed by colourful anecdotes  
444 including one from an Oxfordshire sheep farmer:

445 If you ring Defra, you might just as well ring Thames Water. There's never  
446 anybody there that knows anything about it and by the time they find

447 somebody we could be two months on before you hear anything back. So, I've  
448 not got a great deal of faith in Defra. [KA26]

449

#### 450 **Inertia and habit**

451 There was frequent reference to farmers having found a pattern of disease risk management  
452 practices that works, but no strong indication that they are keeping to a pattern because of  
453 inertia. Indeed, most referred to occasions, often recent, where they had changed. Inertia or  
454 continuing habitual behaviour does not seem a strong driver of the use or non-use of specific  
455 measures. Farmers are willing to be convinced to use measures they currently do not, but  
456 need supporting advice from credible sources such as a vet whose opinion they trust.

457

#### 458 **Exposure to sources of information**

459 Most interviewees do not go out of their way to search for new information. Those that do,  
460 keep up to date through the farming press, or through vets. No interviewees mentioned farm  
461 assurance schemes as sources of advice. One farmer with a smaller sheep enterprise  
462 mentioned using the Internet for information.

463

464 A consistent theme was using the vet to check advice from other sources, whether local, in  
465 the mass media and Internet, or from national organisations. Some vets are proactive in this  
466 field. One farmer with a smaller sheep enterprise, when asked about sources, replied:

467 Local vet practice. I phone them first. We go to regular health-based meetings  
468 with them. We pick up interesting points. [KA13A]

469

470 Those more exposed to sources of information are in a better position to choose a particular  
471 measure. But the influence of that exposure is always mediated by farmers' assessment of  
472 relevance, an assessment often made after referring to the vet for information and opinion.

473

#### 474 **Social influences**

475 Literature on farmer uptake of new technology often identifies 'other farmers' as a major  
476 source of new ideas. Here, other and neighbouring farmers hardly figure. In fact, a strong  
477 theme from the interviews was that what others are doing and saying has little influence on  
478 what the interviewees do for disease risk management. They rely on their experience and  
479 ideas of what is sensible. The exception is the few less experienced interviewees who  
480 mentioned specific other people in the sector who they regard either as role models or with  
481 superior knowledge to them. Smaller enterprises were also more likely to discuss disease  
482 measures with others, whether smaller or larger enterprises. One farmer with 80 ewes put this  
483 in the context of needing reliable advice when something goes wrong:

484 I find the vet not the easiest person to contact when we need him. For  
485 example, this week we had a sick sheep and we phoned and he didn't even  
486 answer. That's no good. [KA14]

487

488 Even among these smaller enterprises, the ones who had been keeping animals for a long  
489 time were also not particularly interactive with others. There was also little sense of  
490 interviewees being influenced by how they think others would view their carrying out or not  
491 of disease risk measures (the 'subjective norm' of the TpB). Several referred to carrying out  
492 measures because they represent good practice but these seemed related more to personal  
493 values than to a need to conform with others' views.

494

495 **Attitudes to sources of advice**

496 Although the credibility of sources was not identified in the framework, it comes through as a  
497 strong theme in the interviews. Vets are seen as the most credible and reliable source on  
498 disease and disease risk management, providing more farmer-focused advice than  
499 government. The following comment represents their views:

500         If Defra say something you take it quite seriously but you might not take it so  
501         seriously if you think they're trying to tell you [to do] something you're  
502         already doing. If the NFU told you or maybe an assurance scheme or you read  
503         it in the Farmers Weekly, you'd be much more willing to take up that strategy.

504         [PA06]

505

506

507 Overall then, the study farmers accept that action taken on farm can reduce the risk of  
508 endemic disease breaking out among their animals. Most also feel they are doing all they can  
509 to minimise such risks. The measures most commonly implemented are vaccination, policies  
510 for sourcing new stock, and separation of new from existing stock. The measures least  
511 commonly implemented are staff and visitor management policies, and staff training. Some  
512 measures are widely regarded as common sense, such as good hygiene and having a sensible  
513 system for manure disposal, rather than as disease risk measures. Pig enterprises put more  
514 emphasis than sheep enterprises on controlling wildlife access, and on staff and visitor  
515 management. Members of farm assurance schemes are more likely to have health plans but,  
516 for most, this is seen as a scheme requirement rather than a useful disease risk measure.

517

518 Interviewees see themselves as already making rational decisions, based on circumstances, on  
519 what to implement, irrespective of what others are doing. There is great confidence in their



520 knowledge built up over years. In contrast, less experienced farmers, those with higher levels  
521 of agricultural education and those managing large units, are more likely to be proactive in  
522 looking for up-to-date information on livestock disease. This suggests some complacency in  
523 the self-reported levels of knowledge and understanding.

524

525 Farmers clearly place great importance on being able to access authoritative information  
526 relevant to them, which most see as available from vets – principally their local vet but also a  
527 local ‘Defra vet’ (a vet with the former State Veterinary Service, now the Animal Health and  
528 Veterinary Laboratories Agency) whose opinion they respect. Information that is general and  
529 appears as released to all is more likely to be ignored at best and, at worst, to reinforce  
530 attitudes that advice from central sources is not relevant or practical to the individual.

531 Farmers look to vets to interpret and contextualise information and advice received.

532

533 Many farmers also obtain information on disease risk and management from the farming  
534 press; they see this as up-to-date and relevant. Scientific findings related to animal disease are  
535 generally trusted but not always seen as practical with some wanting more relevant and  
536 practical guidance.

537

538 The reliance of most interviewees on vets for risk assessment and advice on control measures  
539 for diseases is based on trust, credibility and previous experience. Relevant here is the current  
540 trend in England towards concentration of farm vets into fewer, larger practices, which  
541 enables practices to have specialists for different systems capable of giving the sort of  
542 targeted information and advice that farmers value and the scale to be able to devise and offer  
543 training courses to develop skills and confidence among farmers to make better informed  
544 decisions.

545

546 Most farmers accept they should pay part of the costs of disease risk advice for endemics and  
547 that they should bear the cost of measures they voluntarily implement to address risk factors.

548 With exotics, however, and notifiable diseases in particular, they feel Government has a  
549 strategic responsibility to protect agriculture from external disease threats and should,  
550 therefore, coordinate the provision of advice and information, and pay for disease controls.

551 Furthermore, with no say in the design of measures to protect against exotics or tackle any  
552 outbreak, they feel they should not contribute towards costs.

553

554 The specific attitudes and behaviours reported here are formed by the policy, economic,  
555 institutional and disease history context in which sheep and pig farmers in England operate.

556 Further research in other industrialised economies is needed before their validity in other  
557 settings could be assessed. However, as these findings are consistent with prevailing socio-  
558 psychological analytical frameworks, similar themes may well emerge elsewhere.

559

### 560 **Policy implications**

561 There is no current specific plan or policy linking the measures promoted by Defra to  
562 compensation or to insurance premiums. However, under the rubric of ‘Responsibility and  
563 Cost Sharing’, Defra is consulting on how future costs of addressing disease outbreaks should  
564 be shared between industry and government and has established the Animal Health and  
565 Welfare Board for England to advise on this (<http://www.defra.gov.uk/ahwbe/> 18/12/2012). It  
566 is, therefore, relevant to consider the implications of the study findings for future policy.

567 While it is hard to identify ‘quick fix’ policy levers to encourage farmers to implement more  
568 disease risk measures, possible ways forward centre on information and communication.

569

570 (1) Risk communication Where farmers are not implementing measures that others suggest  
571 are beneficial in reducing disease risk, this indicates a gap in their understanding of the level  
572 of risk their animals are exposed to. This suggests one way to encourage farmers to consider  
573 applying more measures, or applying measures more stringently, revolves around risk  
574 communication. This should be tailored to situations faced by different enterprises and  
575 involve local vets, who are widely regarded by livestock farmers as the main players in  
576 interpreting and filtering information from national bodies. The farming press should also be  
577 used to enhance risk communication to farmers.

578

579 (2) Disease surveillance Farmers' assessment of disease risk and their implementation of risk  
580 reducing measures are influenced by recent incidence. This reinforces the importance of  
581 effective surveillance to provide early warning about disease threats. Livestock farmers need  
582 to be aware of both local and national situations. An important message is that of incubation  
583 time in relation to animal movement and isolation of incoming stock. Dissemination of  
584 credible early warning information through the farming press and vets will help sharpen  
585 farmers' assessment of risk and have an effect on the implementation of disease risk  
586 measures. Credibility is vital: the science on which recommended measures are based must  
587 be credible and clearly articulated, and the measures must be seen as realistic (i.e. cost-  
588 effective, have a significant impact on the risk they are designed to address and not subverted  
589 by factors outside the farmer's control).

590

591 (3) Targeted information and advice Perhaps the main message emerging is that information  
592 and advice livestock farmers receive needs to be relevant to their situation to be taken  
593 seriously. Differences between large operations with many paid employees and small-scale,  
594 part-time enterprises run by family labour and interacting with relatively local input and

595 output markets, should be reflected in the information that is put out on disease risk  
596 measures. The relevance of measures varies with species and production system, as does the  
597 affordability of measures because of different levels of profitability and future prospects.  
598 Defra could, perhaps, do more to fine tune their advice so that it is informed by an awareness  
599 of the different situations in which farm animals are kept.

600

601 Events run by vets are generally seen as offering practical advice and an opportunity to gain  
602 new knowledge, particularly in relation to disease threats. Subsidised training events would  
603 be one way of providing more bespoke information and advice to specific categories of  
604 livestock farmers. Farmer groups are another opportunity for exchanging ideas and accessing  
605 advice. Consultancy companies providing benchmarking services, which often cover animal  
606 welfare and health and financial aspects, are a third group. In summary, the key is  
607 communication which is up-to-date in terms of risk threat, targeted and delivered through  
608 trusted sources for both advice provision and training.

609

## 610 **Acknowledgements**

611 This paper results from project FFG1013/RC0101 ‘Increasing the uptake of improved animal  
612 disease risk measures by animal keepers: attitudes, behaviours and practical lessons for  
613 responsibility and cost-sharing’. We are grateful to Defra for funding and to the participating  
614 farmers. Interviews were carried by Keith Allison, who sadly passed away in January 2012,  
615 and Dr Patricia Aikman.

616

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736 **Tables**

737 Table 1. Pig and sheep farmers interviewed by size, age and county

738

Reference	Enterprise	Size	Category	Age of interviewee	County
PA006	Sheep	25 ewes	smaller	50-59	Somerset
KA009	Sheep	1600 sheep	larger	no response	Berkshire
KA009A	Sheep	600 ewes	larger	60-69	Warwickshire
KA013A	Sheep	30 ewes	smaller	30-39	Oxfordshire
KA013	Sheep	100 ewes	smaller	60-69	Hampshire
KA014	Sheep	80 ewes	smaller	20-29	Wiltshire
KA016	Sheep	300 ewes	larger	50-59	Shropshire
KA023	Sheep	52 sheep	smaller	50-59	Devon
KA026	Sheep	150 ewes	smaller	50-59	Oxfordshire
KA011	Pigs	30 finishers	smaller	50-59	Oxfordshire
KA020	Pigs	120 pigs	larger	60-69	Oxfordshire
KA027	Pigs	10 sows	smaller	50-59	Hampshire
KA028	Pigs	300,000/year	larger	40-49	Norfolk
KA029	Pigs	500,000/year	larger	40-49	Norfolk
KA030	Pigs	3,500 finishers	larger	60-69	Hampshire

739

740

741

742 Table 2. Disease risk intervention practices included in interview schedules

Practice	Enterprise
<b>Practices to avoid new diseases being brought onto the farm by introduction of infected animals:</b>	
<ul style="list-style-type: none"> <li>• <i>Livestock isolation units for animals brought onto the farm:</i> <ul style="list-style-type: none"> <li>○ keep newly acquired animals separate for a period before they join established groups in the flock/herd</li> </ul> </li> </ul>	Both
<ul style="list-style-type: none"> <li>• <i>Strict replacement sourcing policies:</i> <ul style="list-style-type: none"> <li>○ when you buy animals from a new flock, always ask about the disease status of that flock</li> <li>○ knowing the disease status of the herds where you buy pigs from</li> <li>○ trusting the owner to tell you about new diseases in his/her herd</li> </ul> </li> </ul>	Sheep Pigs Pigs
<ul style="list-style-type: none"> <li>• <i>Number of legal and tested movements onto farm ranked by risk of source:</i> <ul style="list-style-type: none"> <li>○ buying sheep from a few well known suppliers, versus buying them from different places such as markets, auctions, etc.</li> <li>○ buying pigs from a few well known suppliers</li> </ul> </li> </ul>	Sheep Pigs
<ul style="list-style-type: none"> <li>• <i>Reduce contact with wildlife in fields and in livestock sheds:</i> <ul style="list-style-type: none"> <li>○ taking specific action to keep wildlife out e.g. raised troughs, special fencing</li> <li>○ practice regular rodent control</li> </ul> </li> </ul>	Sheep Pigs
<b>Practices to avoid disease being brought onto farm by visitors:</b>	
<ul style="list-style-type: none"> <li>• <i>Staff and visitor management policies</i> <ul style="list-style-type: none"> <li>○ taking action (e.g. putting-up signs) to prevent visitors touching animals without your knowledge</li> <li>○ providing staff/visitors with designated clothing before entering your pig unit</li> </ul> </li> </ul>	Sheep Pigs
<b>Practices to avoid new disease being brought onto farm from neighbouring farms:</b>	
<ul style="list-style-type: none"> <li>○ avoiding grazing on common land</li> <li>○ minimise contact between livestock on neighbouring farm premises (outside units only)</li> </ul>	Sheep Pigs
<b>Practices to avoid spread/multiplication of disease on the farm:</b>	
<ul style="list-style-type: none"> <li>• <i>Slurry and manure management, treatment and disposal</i></li> </ul>	Both
<ul style="list-style-type: none"> <li>• <i>Hygiene on farm</i> <ul style="list-style-type: none"> <li>○ taking specific action to keep your animals clean</li> <li>○ neonatal disease control: hygiene in lambing areas/separation/cleansing/disinfection/afterbirth disposal/rearing lambs separately</li> <li>○ always clean and disinfect barns between batches</li> </ul> </li> </ul>	Sheep Sheep Pigs
<ul style="list-style-type: none"> <li>• <i>Using optimal disease control tools including treatments and vaccine as recommended by a vet</i> <ul style="list-style-type: none"> <li>○ vaccinating against bluetongue</li> <li>○ check and act on ZNCP scores</li> </ul> </li> </ul>	Sheep Pigs
<b>Practices to avoid spread/multiplication of disease on the farm, <u>and</u> introduction of new diseases onto farm by other animals:</b>	
<ul style="list-style-type: none"> <li>• <i>Reduce disease risks of multi-species farming</i> <ul style="list-style-type: none"> <li>○ have tools and clothing only used for the sheep/pig unit and not for other enterprises</li> </ul> </li> </ul>	Both
<b>Practices on farm to avoid diseases propagating or going undetected:</b>	
<ul style="list-style-type: none"> <li>• <i>Farmer/keeper training in disease management</i> <ul style="list-style-type: none"> <li>○ offer external training to your staff</li> </ul> </li> </ul>	Both

743

744

745 **Table 3 Compliance with recommended practices to reduce animal disease risk on farm**

Practice	Sector	Comply (number)	Not comply (number)	Sample comments
Isolate new stock	Sheep	7	2 (impractical, not necessary)	'In ideal circumstances we would try to isolate them from the rest but obviously sometimes that's not practical if you haven't got much grass' [PA06]
	Pigs	4	2 (irrelevant)	'We breed our own; we are pretty closed [but when we buy in] we always separate new stock' [KA27]
Sourcing policy	Sheep	7	2 (impractical, not necessary)	Impractical 'because they come from markets in North England' [KA09] We are nowhere near as vigilant as we are with cattle. Sheep aren't a big problem disease-wise' [KA023]
	Pigs	3	3 (irrelevant, not necessary)	'we only deal with people we have dealt with before' [KA27] 'The pigs don't belong to us, they are on contract ... they come to us to be grown on' [KA30]
Reduce contact with wildlife	Sheep	0	9 (impractical, not important)	'No you can't. Unless you shoot all the wildlife you can't do anything about it' [KA26]
	Pigs	5 (rodent control only)	1 (impractical)	'It's very difficult to properly fence in an outdoor unit to keep out wildlife ... I don't think it is a huge risk other than if the wild boar population exploded, then obviously there would be more pig diseases' [KA29]
Staff / visitor management policy	Sheep	4 (try to comply)	5 (irrelevant)	'as much as we can .. when they're out in the field and people pass through the field there's not much you can do about it' [KA09] 'we are very isolated here' [KA23]
	Pigs	3	3 (not necessary)	'We don't have visitors or customers. That is what we have always done' [KA20]
Avoid common grazing	Sheep:	2	3 (not relevant) 4 (can't avoid using it)	'The times when we have had scab in the past, they always caught it on the moor from other sheep ... if there's a problem there you are going to pick it up' [KA23]
	Pigs:	1 (double fence) 1 (unspecified)	2 (not relevant) 2 (not practical)	'not relevant; my neighbour's sheep are fenced in' [KA27] 'if you run outdoor pig systems, straw based systems, like we do, in open and naturally ventilated buildings, can someone tell me how I can prevent salmonella entering?' [KA28]
Slurry/manure management	Sheep	1	8 (not necessary)	'There's limited scope; we clean out the sheds once a year and then spread on the ground' [PA06]
	Pigs	1	5 (not necessary)	'Scrape it off when we move the huts then clamp and compost it for a year before spreading' [KA30] 'if there is something like dysentery we would be really careful' [KA29]
Hygiene on farm	Sheep:	9 (to some extent)	0	'I don't wear gloves to lamb because I find I just haven't got enough feel' [KA16]
	Pigs:	4	2	'All the growing units are washed out between batches' [KA29]

Practice	Sector	Comply (number)	Not comply (number)	Sample comments
Optimal disease control	Sheep:	1	8	‘If we did see that the problem [bluetongue] came back, naturally we would soon vaccinate for it’ [PA06]. ‘Not only does it [not vaccinating] save money it also saves stress on the sheep’ [KA026] ‘I’m on the phone to [the vets] every day. We liaise on a daily basis and they come here once a week’ [KA28]
	Pigs:	3	3	
Reduce risk of multi-species farming	Sheep:	0	9	‘It is part of our internal rules to keep good separation of species. We look at that with the vet’
	Pigs:	2	4 (not relevant)	
Staff training	Sheep:	1	8	‘I’d say our that our knowledge was sufficient to keep disease risk to a minimum’ [PA06] ‘We have done, but our pig man has been with us 25 years’ [KA30] ‘It’s not really relevant; we are self-taught and we help each other [KA27]
	Pigs:	3	3	

746 Source: Interviews 2011

747



749 **Figure caption**

750 Figure 1 Analytical framework linking factors that influence farmers' disease risk  
751 management behaviour

752