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Jenni Luukkanen, Mari Nevas, Maria Fredriksson-Ahomaa, Janne Lundén



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1 **Developing official control in slaughterhouses through internal audits**

2 Jenni Luukkanen^{a*}, Mari Nevas^a, Maria Fredriksson-Ahomaa^a, Janne Lundén^a

3 ^a Department of Food Hygiene and Environmental Health, Faculty of Veterinary Medicine,

4 P.O. Box 66, 00014 University of Helsinki, Finland

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23 *Corresponding author

24 Department of Food Hygiene and Environmental Health

25 Faculty of Veterinary Medicine

26 P.O. Box 66, 00014 University of Helsinki, Finland

27 E-mail: jenni.luukkanen@helsinki.fi

28

29 Abstract

30 In the European Union, competent authorities are obligated to arrange audits to ensure that the
31 official control (comprising meat and food safety inspections) in slaughterhouses is performed
32 according to legislation. Previous information on the functionality of these audits and on non-
33 conformities observed in the official control of slaughterhouses is limited. In this study, non-
34 conformities of the official control of slaughterhouses and their correction were analysed from the
35 internal audit reports of the Finnish Food Safety Authority Evira. To further assess the benefits and
36 needs for improvement of the audits, we conducted interviews with the chief official veterinarians
37 (OVs) responsible for the controls in slaughterhouses and the auditors of Evira. According to our
38 results, non-conformities, especially in the inspection of intestines of bovines and swine, were
39 common. Regarding food safety inspections, OVs should develop their documentation, perform the
40 follow-up of the correction of non-compliances more systematically, and improve the enforcement,
41 especially in smaller red meat slaughterhouses. Based on our results, internal audits appeared to
42 be beneficial, as non-conformities in the official control were noticed, most non-conformities were
43 corrected or corrective measures had been taken, and the audits were assessed as necessary by
44 both the auditors and auditees. Our results can be utilized in improving the official control and audit
45 procedures in slaughterhouses. In the future, the uniformity of meat inspection could be improved
46 by auditing also differences in the rejections and their reasons between official auxiliaries in post-
47 mortem inspection.

48

49 Keywords: non-conformity, meat inspection, food safety inspection, non-compliance, correction

50

51 1 Introduction

52

53 In slaughterhouses, official veterinarians (OVs) bear the primary responsibility for official control
54 comprising meat and food safety inspections (European Union [EU], 2004a). The goal of meat
55 inspection, which may be performed with assistance from official auxiliaries (OAs), is to ensure safe
56 meat for consumers, secure the welfare of animals, and prevent transmissible animal diseases

57 (Alban, Steenberg, Stephensen, Olsen, & Petersen, 2011; European Food Safety Authority [EFSA],
58 2011; EU, 2004a). Meat inspection consists of the inspection of food chain information, live animals
59 (ante-mortem inspection), and carcasses and offal (post-mortem inspection). In Finland, OAs
60 perform post-mortem inspection under the supervision of the OVs in red meat and poultry
61 slaughterhouses. Food safety inspections are performed to verify slaughterhouses' compliance with
62 food safety legislation including proper implementation of slaughterhouses' obligatory self-checking
63 systems (SCSs). These SCSs are based on basic hygiene and hazard analysis and critical control
64 point (HACCP) principles (EU, 2004c). A well-implemented SCS ensures, for instance, adequate
65 process hygiene (Blagojevic & Antic, 2014; Food and Agriculture Organization, 2004), thus
66 contributing to meat safety (Blagojevic & Antic, 2014; Nørrung & Buncic, 2008). In practice, food
67 safety inspections entail a comprehensive examination of various areas, such as maintenance and
68 hygiene of premises and equipment, temperature control, and employee practices. In Finland, OVs
69 perform food safety inspections, but OAs could participate by collecting information regarding good
70 hygienic practices and HACCP-based procedures (EU, 2004a).

71

72 To guarantee that official controls in food establishments, including slaughterhouses, meet their
73 objectives, the competent authorities of each EU member state are obligated to arrange either
74 internal or external audits by which the official controls are evaluated (EU, 2004b). In
75 slaughterhouses of Finland, the Finnish Food Safety Authority Evira has performed internal audits;
76 its auditors have also been involved in guiding and organizing official control in slaughterhouses.
77 Audits have been considered to be a good instrument to improve the functionality of organizations
78 (Bawole & Ibrahim, 2016; Junttila, 2014; Leeuw, 2011), but to our knowledge, their efficacy in relation
79 to slaughterhouse control has not been investigated in Finland or in other countries. In some of the
80 European countries, including Finland, the number of audits of official control has decreased
81 because of scarce economic resources (European Commission [EC], 2013). This further highlights
82 the need to assess whether the audits have been performed in the most efficient way and whether
83 they truly contribute to better control. The optimal frequency of audits should also be determined. To

84 receive a comprehensive view of the benefits and needs for improvement of the internal audits, both
85 OV's and auditors' views should be investigated.

86

87 Non-conformities in relation to post-mortem inspection have been reported at a general level to occur
88 widely in European countries (Alban et al., 2011; EFTA [European Free Trade Association]
89 Surveillance Authority, 2012; EC, 2013), and authorities have had problems in identifying and
90 addressing non-compliance of slaughterhouses (Alban et al., 2011). In Finland, a previous study
91 indicated that more efficient control measures should be used by the OVs in some slaughterhouses
92 (Luukkanen & Lundén, 2016). In order to develop the official control in slaughterhouses, more
93 thorough investigation of the frequencies and types of non-conformities should be performed.

94

95 Our study aimed to identify the types of non-conformities occurring in official control of
96 slaughterhouses and to examine the benefits of internal audits on official control. The optimal
97 frequency and potential need for improvement of internal audits were also investigated. The results
98 of this research can be used to enhance the official control and auditing procedures in
99 slaughterhouses.

100

101 2 Materials and methods

102

103 2.1 Audit reports

104 In total, 38 reports of internal audits of meat inspection in 19 slaughterhouses (performed by the
105 meat inspection unit of Evira) and 22 reports of internal audits of food safety inspections in 17
106 slaughterhouses (performed by the food hygiene unit of Evira) were analysed (Table 1). Audit reports
107 of meat inspection were from the period 2009-2013 and audit reports of food safety inspection from
108 the period 2010-2013, as the food hygiene unit started their audits one year after the meat inspection
109 unit. Meat inspection was audited twice, but food safety inspections only once in the majority of the
110 slaughterhouses (Table 1). Small-scale slaughterhouses processing under 20 livestock units (one
111 livestock unit = one bovine or five pigs) per week, under 1000 livestock units per year, or under 150

112 000 birds per year (Ministry of Agriculture and Forestry, 2011) were excluded from the study. The
113 audits followed clear instructions in which, for instance, the aims and the course of audits were
114 described in detail (Evira, 2010, 2011). Post-mortem inspection performed by OAs was audited in
115 red meat slaughterhouses. In poultry slaughterhouses, OV's supervisory duties in post-mortem
116 inspection, including the inspection of a representative sample of birds and a detailed inspection of
117 a random sample of birds declared unfit for human consumption by the OAs (EU, 2004a), were
118 audited. Non-conformities (in meat and food safety inspections) and targets for development (only
119 in food safety inspections) and their numbers were analysed. Auditing units had defined observations
120 not complying with the legislation or Evira's instructions as non-conformities, whereas observations
121 that were not non-conformities, but the correction of which would contribute to the efficacy of food
122 safety inspections were defined as targets for development. The correction of non-conformities was
123 also analysed based on following audits or on OV's reports of corrective measures. One audit report
124 and two of the OV's reports of corrective measures (one from each auditing unit) were not available
125 because they had not been filed in a uniform way.

126

127 2.2 Statistical analysis of the audit reports

128 Statistical analysis was performed with SPSS 21.0 (SPSS IBM, Armonk, NY, USA). Non-conformities
129 and targets for development were analysed between red meat and poultry slaughterhouses and
130 between slaughterhouses of different size. Slaughterhouses were divided into two groups of
131 approximately the same size based on information on the number of slaughtered animals received
132 from Evira. Larger slaughterhouses ($n = 10$) processed over 1000 red meat animals or over 200 000
133 birds per week and smaller slaughterhouses ($n = 9$) less than these figures. Statistical differences in
134 the occurrence of non-conformities and targets for development in each area of official control
135 between slaughterhouses were tested with Fisher's exact test. Differences between
136 slaughterhouses in the number of areas of official control in which non-conformities and targets for
137 development were observed were analysed with Mann-Whitney U-test. A confidence level of 95%
138 was used in evaluating the results.

139

140 2.3 Interviews

141 To examine internal audits of meat and food safety inspections in the slaughterhouses from OV's
142 and auditors' point of view, a semi-structured interview was conducted. In this interview method, a
143 set of questions was used and asked in a systematic order, but the researcher was also allowed
144 probing questions (Fylan, 2005). The interview included both structured and open-ended questions
145 regarding the necessity, benefits, preferred frequency, and potential need for improvement of the
146 audits. Questions on how necessary and beneficial the internal audits were had a scale ranging from
147 zero to ten (only minimum and maximum values were defined verbally). At the end of the interview,
148 the interviewees were allowed to clarify their answers. Interviews were conducted by a single
149 researcher and the answers were simultaneously written down. Before the interviews, participants
150 were informed of the purpose of the study and assured of the anonymity of their responses.

151

152 In total, chief OVs from 13 slaughterhouses and 8 central officials involved in the internal audits of
153 slaughterhouses participated in the interview in May-June 2015. Henceforth, for clarity the
154 interviewed central officials are referred to as auditors, although one of interviewees had not been
155 auditing, but was closely overseeing the auditing procedures and planning the audits. At the time of
156 the interviews, Finland had 19 slaughterhouses, but two of these slaughterhouses did not have a
157 regular OV and in four slaughterhouses the chief OVs declined to participate in the interview because
158 of time constraints. Ultimately, chief OVs from 2/5 poultry slaughterhouses and 11/14 red meat
159 slaughterhouses participated. Chief OVs' interviews were conducted by Microsoft Lync 2013 or by
160 telephone, and the auditors were interviewed in person. Chief OVs' interviews lasted approximately
161 47 (range 15-80) minutes and auditors' interviews approximately 77 (range 60-90) minutes.

162

163 2.4 Analysis of interviews

164 The interviews were analysed using inductive content analysis to identify thematic categories (Elo &
165 Kyngäs, 2008; Franzosi, 2009; Vaismoradi, Turunen, & Bondas, 2013) in relation to the following
166 questions: a) What are the benefits gained from the audits? and b) How should the audits be
167 improved in the future? An initial coding of the responses was made, related codes were grouped

168 into subcategories, and their frequencies were calculated. The final categories were formed by
169 grouping the subcategories. Initial coding and construction of the themes were manually performed
170 by one researcher. Themes were discussed with fellow authors and a consensus was reached.
171 Answers to questions with a scale from zero to ten were analysed using SPSS 21.0 (SPSS IBM,
172 Armonk, NY, USA). Differences in the means of the answers between different respondent groups
173 were analysed with Mann-Whitney U-test. The Wilcoxon signed-rank test, which is used to test the
174 distribution of dependent samples, was applied for the OVs' responses on how beneficial audits were
175 for meat and food safety inspections. A confidence level of 95% was used.

176

177 3 Results

178

179 3.1 Non-conformities in post-mortem inspection and meat inspection documentation

180 Non-conformities in the technical post-mortem inspection of bovine were observed in at least one
181 audit in nearly all (10/11) of the slaughterhouses (Table 2). The most common non-conformities were
182 related to palpation and possible incision of the gastric and mesenteric lymph nodes (observed in
183 ten slaughterhouses) and visual inspection of the udder and its lymph nodes (observed in six
184 slaughterhouses). In the technical post-mortem inspection of swine, non-conformities were also
185 observed in at least one audit in nearly all (5/7) of the slaughterhouses (Table 2). The most common
186 non-conformities were related to visual inspection of the gastrointestinal tract and gastric and
187 mesenteric lymph nodes and their palpation (observed in five slaughterhouses). In the majority of
188 the bovine or swine slaughterhouses where non-conformities in palpation of the gastric and
189 mesenteric lymph nodes or inspection of the udder were observed, the correction of the non-
190 conformity demanded structural changes to the slaughter line or recruiting an extra OA. No
191 significant difference was present in the occurrence or number of non-conformities in the technical
192 post-mortem inspection between larger and smaller red meat slaughterhouses ($p < 0.05$, Fisher's
193 exact test and Mann-Whitney U-test).

194

195 The majority of the non-conformities in the technical post-mortem inspection of bovine and swine
196 (50/60) were corrected or their correction had been initiated (Figure 1). Of the non-conformities, 37%
197 (22/60) were corrected based on the subsequent audits, and in 47% (28/60) OV's had taken
198 corrective measures according to their reports (Figure 1). In one slaughterhouse, two non-
199 conformities had not been corrected according to the OV's report because proper inspection of
200 bovine gut lymph nodes and udders would have demanded structural changes to the slaughter line.
201 According to their reports, OV's had started corrective measures in two of three of the non-
202 conformities that were not corrected in subsequent audits. The correction of the rest of the non-
203 conformities was unclear because OV's had not reported the measures taken (six non-conformities)
204 (Figure 1).

205

206 In poultry slaughterhouses, auditors observed non-conformities in the daily inspections performed
207 by the OV in one of the four slaughterhouses (Table 2). In this particular slaughterhouse, the OV did
208 not perform the daily inspection of the viscera and body cavities of a representative sample in all
209 cases due to a problematic construction of the slaughter line, and also the detailed inspection of a
210 random sample of condemned carcasses was insufficient (Table 2). Both of these non-conformities
211 had been corrected based on audits.

212

213 Non-conformities in the documentation of meat inspection were uncommon (Table 2) and concerned
214 insufficiently identified animals and the meat inspection decision. These non-conformities were
215 corrected after the audit according to the OV's reports.

216

217 3.2 Non-conformities and targets for development in food safety inspections

218 In the audits of food safety inspections, non-conformities were observed in 7/13 red meat
219 slaughterhouses and in none of the poultry slaughterhouses. The most common non-conformities
220 concerned documentation of food safety inspections and control measures (Table 3). Non-
221 conformities in documentation (observed in three smaller and two larger slaughterhouses) included
222 insufficient documentation of inspected areas, observations, or given time limits for corrections. In

223 two smaller slaughterhouses, the OV's could not present any documentation of the food safety
224 inspections. Non-conformities in control measures (observed in two smaller and two larger
225 slaughterhouses) included lack of systematically ensuring the approval of changes in operations and
226 premises, and too seldom or insufficient checks of the SCS, including HACCP. During the audits
227 OV's performed a routine food safety inspection observed by the auditors, and in two smaller red
228 meat slaughterhouses OV's did not detect non-compliance such as deficiencies in hygiene or
229 handling of by-products. The enforcement performed by the OV's was also observed to have non-
230 conformities in one larger slaughterhouse. Auditors stated that the OV had not started the required
231 enforcement measures in relation to correction of unhygienic structures. The control plan was
232 missing or insufficient in two slaughterhouses (Table 3).

233

234 Targets for development were observed in the food safety inspections in most (15/17) of the
235 slaughterhouses and in the same areas as non-conformities (Table 3). The auditors found targets
236 for development especially in documentation (in 12/17 slaughterhouses) but also in the follow-up of
237 the correction of non-compliances (in 9/16 slaughterhouses), as the auditors were left with the
238 impression that the OV's did not conduct follow-up inspections systematically after the time limit for
239 the correction had passed (Table 3). Targets for development in enforcement included, for example,
240 that the OV's should have been more prone to use enforcement measures (in two slaughterhouses),
241 as neither slaughterhouse had complied with the time limits set for corrections (Table 3).

242

243 The number of smaller red meat slaughterhouses in which non-conformities or targets for
244 development (together referred to as deficiencies) were observed in at least one audit in the
245 enforcement (5/6) was significantly greater than the number of larger red meat slaughterhouses with
246 these deficiencies (1/7) ($p < 0.05$, Fisher's exact test). Food safety inspections of smaller red meat
247 slaughterhouses had also on average more areas with deficiencies per slaughterhouse than larger
248 red meat slaughterhouses, although the difference was not significant ($p = 0.051$, Mann-Whitney U-
249 test). No significant difference in the occurrence of deficiencies or in the number of areas with

250 deficiencies per slaughterhouse between red meat and poultry slaughterhouses was observed ($p >$
251 0.05 , Fisher's exact test and Mann-Whitney U-test).

252

253 Of the non-conformities in the food safety inspections, 19% (3/16) were observed to be corrected on
254 the subsequent audits, and in 56% (9/16) OV's had taken corrective measures based on their reports.
255 Non-conformities (13%) that persisted to the second audit were being corrected after the audit
256 according to OV's reports. These non-conformities included insufficient checks of the SCS and
257 inadequate enforcement. The OV's report was missing in one slaughterhouse concerning two non-
258 conformities.

259

260 3.3 Interviews

261

262 3.3.1 Necessity and benefits of the audits

263 In the interviews, both the OV's and auditors assessed internal auditing of meat and food safety
264 inspections on average as necessary, and respondent groups' answers did not differ significantly (p
265 > 0.05 , Mann-Whitney U-test) (Figure 2). OV's considered the audits to be significantly more
266 beneficial for food safety inspection than for meat inspection ($p < 0.05$, Wilcoxon signed-rank test)
267 (Figure 2).

268

269 Benefits of the audits that were brought up by the interviewees were grouped into two categories: a)
270 improvements to the quality of official control and b) improvements to guidance, support, and training
271 (Table 4). OV's (11/13) most frequently mentioned that the audits were useful in enhancing the
272 correction of slaughterhouses' non-compliances; they deemed it beneficial that auditors also were
273 demanding corrections to non-conformities requiring slaughterhouses' actions. Audits were
274 furthermore assessed as beneficial because of improvements or corrections to the official control
275 (Table 4). Auditors (7/8) saw audits as especially important in perceiving the present state of official
276 control in slaughterhouses (Table 4), which according to them was sometimes difficult based only
277 on information available in the central authority's office. In relation to benefits to guidance, support,

278 and training, some of the OV's (6/13) and all of the auditors (8/8) mentioned audits to be
279 advantageous because of the possibility of discussion between OV's and officials from the central
280 authority (Table 4). Support received during the audits and assessment of the need for instructions
281 and training were also mentioned as benefits by a substantial number of interviewees (Table 4).

282

283 3.3.2 Improving the audits

284 The need for improvement of the audits mentioned by the interviewees was grouped into four
285 categories: a) content of the audits, b) expertise of the auditor, c) audit process and practices, and
286 d) follow-up of the audits (Table 5). The most commonly mentioned need for improvement in the
287 content of the audits was that the audits, mainly the meat inspection audits (mentioned by 6/8
288 respondents), should be more thorough and the uniformity of the meat inspection should be audited
289 (mentioned by 5/13 OV's). When asked whether the validity of the rejections should be audited, 11
290 OV's and two of three of the meat inspection auditors supported the idea. Some of the OV's (n = 6)
291 and auditors (n = 2) considered that the auditors' should have more experience of meat inspection
292 and as OV's in order to be able to audit more thoroughly (Table 5). In relation to needs for
293 improvement in the audit process and practices, two OV's stated that they needed more support from
294 their superiors when enforcement measures were deemed necessary based on audits (Table 5).
295 Most of the auditors (n = 5) noted that the follow-up of the correction of non-conformities required
296 improvement (Table 5). They mentioned that the reports should be, without exception, consistently
297 filed, and the reports received from OV's should be more unambiguous.

298

299 3.3.3 Frequency of audits

300 Of the OV's, 62% (8/13) considered that both meat inspection and food safety inspections should be
301 audited at least once every three years in each slaughterhouse, 23% (3/13) suggested every other
302 year, and 15% (2/13) every year. According to the majority (7/8) of auditors, all slaughterhouses
303 should be audited every other or third year.

304

305 4 Discussion

306

307 Our results show that non-conformities in inspection of the gastrointestinal tract, especially in
308 palpation and possible incision of the gastric and mesenteric lymph nodes, were common in post-
309 mortem inspection of bovines and swine in Finland. These non-conformities had remained because
310 their correction would have required expensive repairs to the slaughter line or recruiting of an extra
311 OA. Similar nonconformities regarding inspection of the gastrointestinal tract and related lymph
312 nodes have been observed commonly in other EU countries as well (Alban et al., 2011; EFTA
313 Surveillance Authority, 2012). These results support criticism of authorities' capacity to address non-
314 conformities and enable meat inspection to be performed according to the legislation. However, a
315 recent study conducted in the United Kingdom concluded that especially palpation and possible
316 incisions of the gastrointestinal tract and related lymph nodes of cattle, small ruminants, and swine
317 have limited importance for public health (Blagojevic, Dadios, Reinmann, Guitian, & Stärk, 2015),
318 and manual examination has been assessed to cause cross-contamination (EFSA, 2011;
319 Nesbakken, Eckner, Høidal, & Røtterud, 2003; Pointon, Hamilton, Kolega, & Hathaway, 2000). OVs
320 may have evaluated the contribution of the inspection of the gastrointestinal tract to be of lesser
321 importance for meat safety, with this, in part, resulting in a lack of enforcement of the problems
322 hindering proper inspection. Especially in situations where a shortage of inspection personnel
323 existed, prioritization of control tasks has probably been necessary. However, when performing meat
324 inspection according to legislation demands changes to the slaughterhouse structures or requires
325 more OAs, OVs should receive support from their superiors to ensure that sufficiently effective
326 control measures or actions are taken to reach compliance.

327

328 Relative to meat inspection, food safety inspections had fewer non-conformities, and in poultry
329 slaughterhouses in this study none were observed. However, when the targets for development are
330 taken into consideration, the results show that the OVs in Finnish slaughterhouses have room for
331 improvement, especially in the documentation of food safety inspections and in the follow-up of
332 correction of slaughterhouses' non-compliance. If follow-up inspections are not systematically
333 performed and if documentation of the inspections is scanty or missing, there is a risk that the control

334 becomes inefficient and inconsistent. Deficiencies were also observed in inspections of the SCS and
335 especially in smaller slaughterhouses regarding the enforcement. These results are worrisome since
336 smaller slaughterhouses, in particular, have been reported to have difficulties in implementing their
337 SCSs, and critical non-compliance regarding hygiene, such as problems in de-hiding, sterilization of
338 knives, and cleaning, has occurred (EFTA Surveillance Authority, 2012; Food and Veterinary Office
339 [FVO], 2002, 2013; Luukkanen & Lundén, 2016). In cases where slaughterhouses' SCSs fail, it is
340 very important that the OVs address non-compliance effectively and take further actions if the
341 necessary corrections are not performed. The audits of slaughterhouses in many European countries
342 have shown that the problems in the follow-up of correction of non-compliance (FVO, 2013) and
343 authorities' difficulties in effectively addressing non-compliance (Alban et al., 2011) are universal
344 challenges warranting attention. Finland has recently implemented a national system for publishing
345 food safety inspection results (Evira, 2013) that is anticipated to improve the uniformity and efficacy
346 of food safety inspections in Finnish slaughterhouses.

347
348 Based on our results, the internal audits of slaughterhouse control appeared to be necessary and
349 beneficial for the quality of meat and food safety inspections. They were perceived to improve the
350 correction of slaughterhouses' non-compliance and proven to induce correction of non-conformities
351 in official control, with the majority of non-conformities in post-mortem inspection and its
352 documentation and in food safety inspections either corrected or their correction had been initiated.
353 All of the OVs and auditors noted that internal audits should be performed at least every three years,
354 but a considerable number of OVs stated that they should be performed even more frequently. The
355 frequency of internal audits has declined in many countries due to economic difficulties (EC, 2013),
356 but our results attest to the importance of these audits and suggest that their frequency should be
357 maintained or even increased.

358
359 However, some improvements to the audits appear to be necessary. Interestingly, nearly all of the
360 OVs were of the opinion that meat inspection audits, where only technical inspection is audited, had
361 not been very beneficial, and therefore, the central authority should perform audits of also the

362 rejections and the underlying reasons. In a previous study, the frequency with which OVs in Finnish
363 red meat slaughterhouses observed post-mortem inspection performed by OAs varied considerably,
364 and one-third of the OAs considered that the performance of the OAs in post-mortem inspection was
365 not sufficiently evaluated (Luukkanen, Fredriksson-Ahomaa, Nevas & Lundén, 2017). Insufficient
366 supervision of meat inspection by OVs has been reported also in other EU countries (EFTA
367 Surveillance Authority, 2012; FVO, 2002, 2013), and differences between OAs in rating lesions have
368 been identified (Schleicher et al., 2013). These observations support the idea that the quality and
369 uniformity of meat inspection should be evaluated, not only by the OV present at the slaughterhouse,
370 but also by outside auditors from time to time. Should more thorough evaluation of meat inspection
371 be performed in the future, the auditors must be experienced (Dittenhofer, 2001; International
372 Organization of Supreme Audit Institutions, 2003; Lääkkö-Roto & Nevas, 2014) and peer-auditing
373 could be considered. Our findings also suggest that utilization of audit results and follow-up of the
374 correction of non-conformities should be improved; non-uniform filing of reports, for instance,
375 resulted in the correction of some of the non-conformities in meat and food safety inspections
376 remaining unclear. In addition, our results prompt more discussion between OVs and auditors, as
377 these parties raised partly various needs for improvement of the audits. Auditors should be well
378 aware of the auditees' perceptions in order to develop auditing procedures.

379

380 The auditing procedures of the official control in slaughterhouses can vary in EU countries, and
381 Finland has decided to perform internal audits, where the auditors are involved in guiding and
382 organizing official control in slaughterhouses. However, according to the European Commission (EC,
383 2006), the auditors should be independent of the activity being audited. How the auditors'
384 involvement in the audited controls could affect audit results is difficult to determine, but possible
385 unwillingness of the auditors to spot deficiencies would be a potential drawback. However, this did
386 not appear to be the case, as many non-conformities and targets for development were observed
387 during audits. Also none of the respondents suggested that auditors' involvement in guiding and
388 organizing official control ought to be changed in the future. On the contrary, auditors' involvement
389 in the audited controls may have had some positive effects since a considerable number of the OVs

390 assessed the audits as having benefitted their guidance and support. Auditors also noted that the
391 audits had increased their knowledge of the present state of official control and its problems,
392 increased their expertise, and enabled them to assess the training needs of OVs. These are
393 important positive effects because many chief OVs in a previous study in Finland did not consider
394 central officials' knowledge of the practical problems involved in OVs' work to be sufficient
395 (Luukkanen et al., 2017).

396

397 In conclusion, the internal audits performed by the central authority in slaughterhouses proved to be
398 beneficial for the quality of official control in Finnish slaughterhouses. Most of the non-conformities
399 observed during the audits in the meat and food safety inspections were corrected or their correction
400 had been initiated as a result of the audits, and both the OVs and auditors assessed the audits as
401 necessary. When actions of a more difficult nature, such as expensive correction of slaughter line
402 structures or an increase in the number of OAs, are required, the OVs should receive adequate
403 support from their superiors. Other areas that should receive attention are the enforcement of
404 corrections, documentation of food safety inspections, and a systematic approach to follow-up
405 inspections performed by the OVs. More thorough auditing of meat inspection to enhance the
406 uniformity of controls was also proposed by the OVs.

407

408 Declarations of interest

409 None.

410

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414

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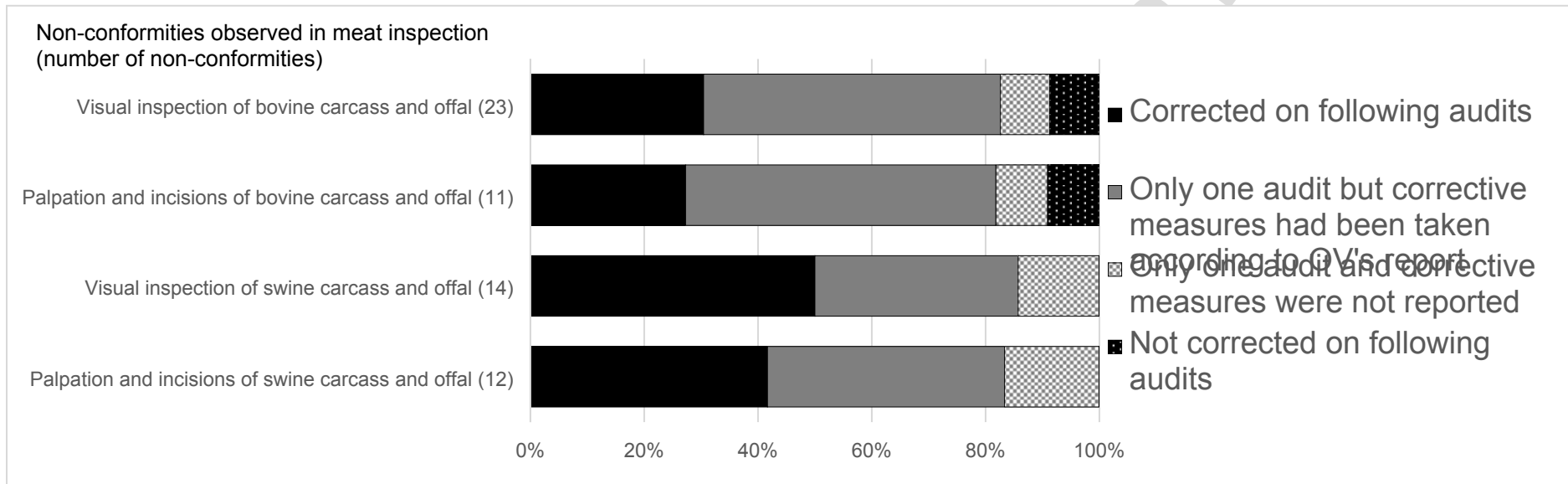


Figure 1.

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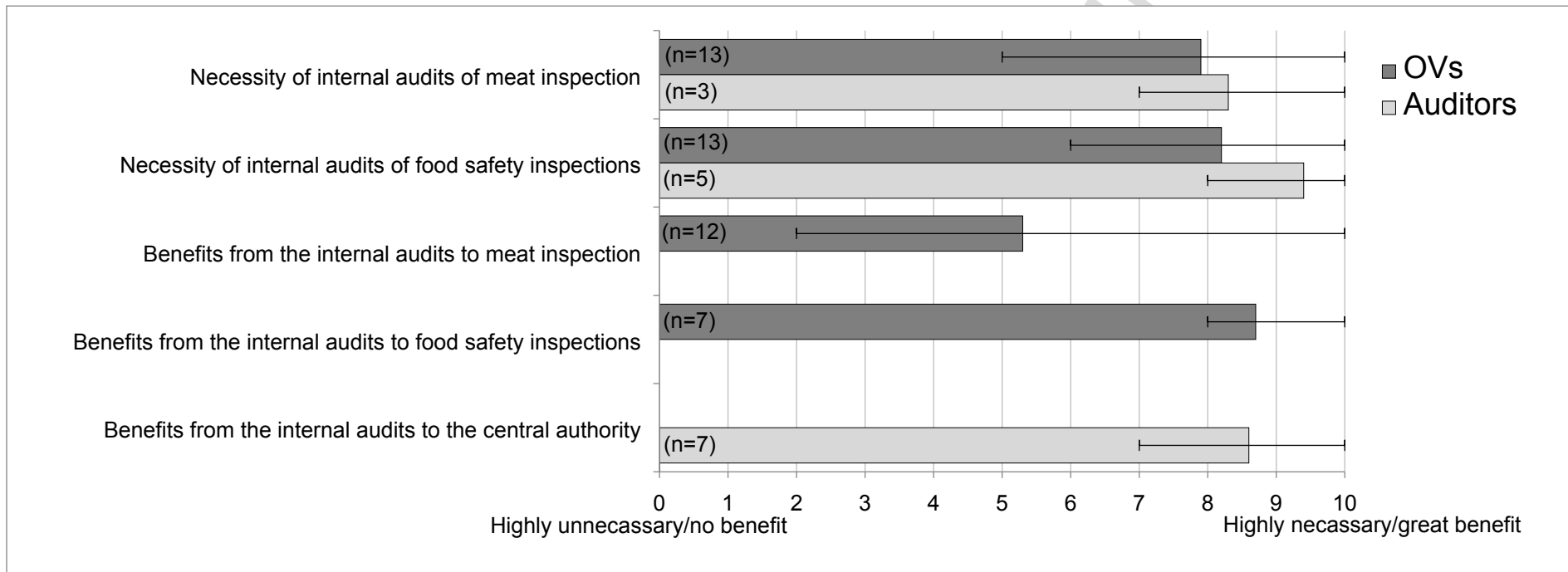


Figure 2.

Figure captions:

Figure 1. Correction of non-conformities observed in meat inspection of swine and bovine in the internal audits of technical meat inspection in Finland in 2009-2013. OV = official veterinarian

Figure 2. Means of chief official veterinarians' (OVs') (n = 13) and auditors' (n = 8) answers regarding the necessity and benefits of the internal audits of official control in slaughterhouses in Finland. The number of respondents is presented in the bars and the range of answers as a black line segment.

Highlights

- Internal audits induced correction of non-conformities in official control
- Internal audits supported official veterinarians (OVs) in demanding corrections
- Non-conformities in inspection of intestines of red meat animals were common
- Documentation of food safety inspections was insufficient in many slaughterhouses
- OVs required more thorough and unifying auditing of meat inspection

Table 1. Internal audits performed by the Finnish Food Safety Authority Evira to evaluate meat and food safety inspections in Finnish slaughterhouses (SHs).

Number of audits	Number of red meat SHs		Number of poultry SHs		Total number of SHs
	Smaller ^a	Larger ^b	Smaller	Larger	
Meat inspection audits in 2009–2013 performed in 19 slaughterhouses					
One time	3	0	0	0	3
Two times	3	7	1	2	13
Three times	1	1	1	0	3
Food safety inspection audits in 2010–2013 performed in 17 slaughterhouses					
One time	5	3	2	2	12
Two times	1	4	0	0	5

^aprocess less than 1000 red meat animals (pigs, bovines, horses, sheep, and/or goats) or 200 000 birds per week

^bprocess over 1000 red meat animals (pigs, bovines, horses, sheep, and/or goats) or 200 000 birds per week

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Table 2. Number of slaughterhouses (SHs) with non-conformities observed in the internal audits of post-mortem inspection and the documentation of meat inspection in Finland in 2009-2013.

Area of official control (number of audits)	SHs with non-conformities observed in at least one audit/number of audited SHs
Bovine post-mortem inspection (17)	10/11
Visual inspection of carcass and offal	7/11
Palpation or incision of carcass and offal	10/11
Swine post-mortem inspection (13)	5/7
Visual inspection of carcass and offal	5/7
Palpation or incision of carcass and offal	5/7
Poultry post-mortem inspection performed by the official veterinarian (7)	1/4
Daily inspection of the viscera and body cavities of a representative sample of birds	1/4
Detailed inspection of a random sample of condemned carcasses from each batch of birds	1/4
Documentation of ante-mortem inspection (19)	1/18
Documentation of post-mortem inspection (19)	2/18

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Table 3. Number of slaughterhouses (SHs) with non-conformities and targets for development observed in the internal audits of food safety inspections in Finland in 2010-2013.

Area of official control (number of audits)	SHs with non-conformities observed in at least one audit/number of audited SHs		SHs with targets for development observed in at least one audit/number of audited SHs		Total number of SHs with non-conformities or targets for development/number of audited SHs
	Red meat	Poultry	Red meat	Poultry	
Documentation (22)	5/13	0/4	8/13	4/4	14/17
Control measures (21)	4/13	0/4	9/13	2/4	11/17
Ensuring the approval of changes in operations and premises (20)	3/12	0/4	3/12	1/4	7/16
Inspections of self-checking plan and its implementation (21)	3/12	0/4	3/12	1/4	6/16
OV's ability to detect non- compliance (21)	2/13	0/4	0/13	0/4	2/13
Sufficient enforcement (20)	1/13	0/4	5/13	0/4	6/17
Follow-up of correction of non- compliance (21)	0/12	0/4	7/12	2/4	9/16
Planning of control and the utilization of its results (9)	2/7	0/2	6/7	0/2	6/9
Control plan (9)	2/7	0/2	2/7	0/2	4/9
Evaluation and utilization of inspection results (9)	0/7	0/2	6/7	0/2	6/9

Table 4. Emerging categories in the interviews of the chief official veterinarians (OVs) and auditors concerning the benefits gained from internal audits of meat and food safety inspections in Finnish slaughterhouses.

Categories and subcategories	Number of interviewees who mentioned the benefit	
	OV (n = 13)	Auditor (n = 8)
Improvements to the quality of official control	13	8
Enhance slaughterhouse's correction of non-compliance	11	4
Initiate improvements and corrections to official control	10	6
Help in identifying present state of official control and its problems	4	7
Unify official control	2	3
Improvements to guidance, support, and training	7	8
Possibility for discussion between OVs and auditors	6	8
OVs receive support and second opinion	5	3
Need for instructions and training is assessed	0	7
Increase in auditors' expertise	0	4

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Table 5. Emerging categories in the interviews of the chief official veterinarians (OVs) and auditors concerning the ways in which internal audits of meat and food safety inspections should be improved in Finnish slaughterhouses.

Categories and subcategories	Number of interviewees who mentioned the need for improvement	
	OVs (n = 13)	Auditors (n = 8)
Content of audits	8	3
Auditing should be more thorough	7	1
Include auditing of the uniformity of meat inspection	5	0
Audit less the documentation and more the practical work	4	0
Wider extent of audits	2	2
Expertise of auditor	6	2
More experience with meat inspection	4	2
More experience as an OV	4	0
Audit process and practices	5	7
More guidance and support for OVs during audits	2	2
Include an OV or an OA on the audit team	2	1
Increase co-operation between auditing units	1	4
Unify audit criteria	1	2
More risk-based audits	1	1
Follow-up of audits	1	6
Improve the follow-up of the correction of non-conformities	1	5
Improve the utilization of audit results	0	2