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The role of education and attitudes towards hen welfare: a case study of furnished cages

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The role of education and attitudes towards hen welfare: a case study of furnished cages

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Project Summary

Project Title	The role of education and attitudes towards hen welfare: a case study of furnished cages
Project No.	18– 429
Date	Start: 20/10/2018 End: 20/06/2019
Project Leader(s)	Peta Taylor
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Project Aim	This project aimed to identify public attitudes towards, and knowledge of, poultry housing systems and associated impacts on welfare. Furthermore, this project aimed to determine the barriers of adoption of alternate housing systems in relation to public perception of poultry welfare, specifically related to language and knowledge gaps.
Background	The social licence of farming systems has a major impact on their success and sustainability. Industries must maintain a social licence in order to remain sustainable, thus the social movement towards ‘ethical’ food production must be understood by stakeholders to ensure community expectations are met. Obtaining a thorough understanding of the relevance and importance of public belief and knowledge of animal welfare will enable targeted approaches to address issues of social licence.
Research Outcome	Survey respondents that were educated via a short video increased knowledge of hen welfare, management and practices. Language (cage vs coop) did not impact the level of knowledge. We provide evidence that education campaigns of new housing systems can increase the level of community support, despite the use of potentially negatively loaded terms such as ‘cage’.
Impacts and Outcomes	We provide evidence that the Australian community largely support furnished cage housing systems for egg laying hens, but education campaigns are required. We provide evidence that knowledge of hen welfare, management practices and the Australian egg industry is relatively low, suggesting an opportunity for industry engagement. Education campaigns are required to address the knowledge deficit identified in the Australian community. Such education campaigns are likely to improve the dialogue between the Australian community and egg industry and increase support for alternative housing systems. Progression in this field will require industry engagement as poor industry engagement will prevent further analysis into improvements for communication strategies between the industry and community members. A better understanding is required to minimise conflict that compromise the egg industries social licence and potentially compromise hen welfare.
Publications	Nolan, H.R.J., Hemsworth L., Taylor, P.S. (2019). ‘What’s in a name? The role of education and rhetoric in improving laying hen welfare’. <i>Proceedings of the ISAE Symposium</i> , 53. Power– Geary J., Nolan, H.R.J., Hemsworth L., Taylor, P.S. (2019). ‘Understanding the perceptions and knowledge of laying hen welfare: industry and community stakeholder focus groups’. <i>Proceedings of the APSS</i> , 30. Sydney, Australia.

Executive Summary

The aim of this research was to develop an understanding of the Australian community's knowledge and perception of hen welfare and furnished cages and to determine the impact of and effectiveness education campaigns in relation to language. Additionally, this research attempted to understand the potential barriers of communication between industry and the Australian community in matters of hen welfare and housing systems. We hypothesised that the community's knowledge of poultry housing and welfare would be low, there would be little awareness of furnished cages and that effectiveness of education campaigns and positive perceptions of furnished cage systems would be related to education and language.

Knowledge of hen welfare, management practices and the Australian egg industry was low, suggesting that appropriate education campaigns are likely to improve the dialogue between the Australian community and egg industry. Education treatment groups increased knowledge of hen welfare, management and practices. Language did not impact the level of knowledge scores post treatment. Respondents predominately supported furnished cage housing systems for egg laying hens, but education campaigns were required. There was little evidence to support concerns that the 'a cage is a cage' rhetoric negatively impacts support for furnished cage support in Australia (Weary, Ventura et al. 2016). Therefore, industry may consider investing in RD&E to optimise the furnished cage design for Australian conditions to safeguard hen welfare, worker health and safety, and economics to ensure the industry is ready for transition to such an alternate housing system should the market require.

A lack of industry participation in the current study prevented insight into the similarities and disparities in values, language and belief between community and industry stakeholders. This understanding is critical to ensure future dialogue and consultation processes are respectful and productive. Further efforts to increase industry engagement is required to obtain an understanding of the similarities' and differences in language, values and perceptions of hen welfare between industry and the community. We provide some evidence that discussions industry and community stakeholders may be using terminology that is interpreted through differences in experiences, knowledge and values. However, the validity of these findings are questionable because of the low sample size of industry participants. The current industry survey could be altered to focus on differences in language and values regarding hen welfare to provide a greater understanding.

Although these data suggest belief can be overcome by education tools, further research is required to determine the specific factors that resulted in an effective education campaign, for example the scientific approach, industry-independent education or short engaging animations. However, there are clear benefits and opportunities for education campaigns that can improve the understanding and support for the Australian egg industry and hen welfare.

Table of Contents

Executive Summary	4
Introduction	6
Perceptions of animal welfare	6
Perceptions of hen welfare	7
Knowledge and education	7
Language	8
Objectives	9
Methodology	10
Survey description	10
Survey designs	10
Data analysis	11
Discussion of Results	12
Part I – Perceptions of hen welfare	12
Egg consumption	12
Hen welfare	14
Knowledge	21
Part II – Education and language	24
Impact of language on education	24
Impact of language and education on support for furnished cage housing systems	26
Implications	28
Recommendations	28
Acknowledgments	30
Media and Publications	30
References	31
Appendices	1
Appendix 1. Demographics of Australian public and survey respondents	1
Appendix 2. Industry stakeholder survey	1
Appendix 3. Community stakeholder survey	13
Appendix 4. Control group video scripts; C _{CA} control cage treatment, C _{CO} Control coop treatment	29
Appendix 5. Education treatment group video scripts; E _{CA} education cage treatment, E _{CO} education coop treatment*	30
Appendix 6. Participant responses to rank the factors associated with hen welfare	1
Appendix 7. Publications arising from this project	2

Introduction

There is an increasing trend of public concern for animal welfare, particularly regarding animals which are used for food and fibre (1-3). An agreement on community values and beliefs regarding animal welfare is required for the development of animal– related policies and legislation (4). Whilst science can determine the risk that a particular practice may have to welfare, societal expectations will ultimately determine an acceptable level of risk (5). Obtaining community agreement is difficult as the term “animal welfare” is loaded with underlying beliefs and values influenced by culture, economics, religion and geographies (6).

Approximately half of the Australian public (56%) are likely to engage in activities that oppose specific livestock farming practices, such as signing petitions, donating money or engaging in discussions (7). Public attitudes are often studied as indicators of risk to livestock industries and previous research suggests that attitudes may be more indicative of consumer concern, thus social licence, than buying behaviour (8). The poultry and pork industries attract the greatest welfare concerns from the Australian public, relative to the red meat industries (9).

Perceptions of animal welfare

A large portion (71%) of the Australian community regard farm animal welfare to be of concern (7). Attitudes are reflective of individual’s experiences, societal norms and perceived control (10). As such, education, geographical location, culture and economics can impact perceptions towards animal welfare and animal livestock industries. For example, rural consumers are more likely to trust food production methods compared to consumers that live in cities (9, 11). It is suggested that the increased level of trust is reflective of more food supply experience with consumers from rural areas relative to consumers that live in cities (11). In light of the impact that experience has on perceptions towards animal welfare, it is not surprising that there is disparity between industry stakeholders and community members in relation to what constitutes good animal welfare.

Consumers highly value the ability for animals to engage in natural behaviours, relative to stakeholders who are more likely to prioritise animal health and production (12). Even in a scientific framework, the definition of Animal Welfare is largely debated and thus is not completely void of value– based judgments (13-16). Broom (17) defines animal welfare as the state of an animal as it attempts to cope with its environment, an approach which includes concepts of biological functioning (e.g. stress physiology and evolutionary history). Alternate authors place greater emphasis on an animal’s emotions, commonly referred to as “affective state”, such as the prevention of suffering and promotion of pleasure. However, an alternative approach suggests good welfare is predominately based on the provision of a relatively natural environment and ability to express all natural behaviour as being best for animal welfare. It is clear that these aforementioned concepts of animal welfare are not mutually exclusive, and whilst there is agreement that welfare is the state of the animal which varies along a continuum from very poor to very good (17), the relative importance of an animal’s health, feelings or natural living is greatly debated. Various philosophers have effectively communicated the natural behaviours approach to animal welfare to the public via popular novels including *Animal Machines* by Ruth Harrison in 1964 and *Animal Liberation* by Peter Singer in 1975. This source of information and experience may be the reason that the public

place greater weight on the natural living approach to animal welfare than other stakeholders (12).

Perceptions of hen welfare

Sales of eggs from free-range housing has increased (18) which partially reflects the consumer perception that free-range housing is better for hen welfare (19, 20). The number of eggs sold from free-range housing systems increased by 10% throughout 2017 (18) providing some evidence that consumer perceptions can have great impact on the egg industry.

Interestingly, there is little evidence to suggest that free-range housing is better for hen welfare than conventional cage housing systems. Rather each hen housing system has a range of trade-offs for welfare (21). There are more improvements to hen health and production in conventional cage compared to non-caged systems (21, 22). However, behavioural expression is restricted in conventional cages compared to non-cage systems (21). Although the differences in experience and knowledge between industry stakeholder and community members may in part explain disparity between the groups in relation hen welfare, the perceived importance of behaviour relative to health for community members, and vice versa for industry stakeholders may additionally contribute.

Knowledge and education

Knowledge of farming practices have been reported to be below what would be expected by chance (23). This suggests that misinformation may be common around some particular industry practices. Communities obtain knowledge of livestock practices from various sources. Coleman and Toukhsati (23) surveyed the Australian community and found that the majority of Australians obtain their knowledge of livestock from television and animal welfare organisations. Fewer members of the public were informed from formal education and government campaigns (23).

Despite a potential lack of knowledge, there are members of the community that actively participate in community activities that may have detrimental impacts on livestock industries, such as calling into talkback radio and writing to politicians (9). People that disseminate information between social groups are referred to as ‘opinion leaders’ (24). Opinion leaders transfer knowledge from media, newspapers and radio to community members who are less engaged (9). Although when quantified, the level of knowledge of opinion leaders is no better than other members of the public, despite a self-reported higher level of perceived knowledge (9). The impact that opinion leaders have on other community members is unknown, such misinformation may be effectively disseminated and subsequently have damaging impacts on livestock industries. Although, there is evidence that community members are critical depending on the source of information, specifically in relation to animal welfare activist groups (25). As the public are often consulted and invited to comment on the proposals and development of poultry welfare legislation, it is critical to determine if these demands are informed.

Education interventions may be a critical component of improving attitudes towards industry and reducing controversy surrounding welfare legislation. It has been shown that community members are more concerned about pain than industry stakeholders who often put pain in context of the long term consequences (26). Education may provide an appropriate platform to inform consumers of specific practices in an appropriate context for a more productive discussion regarding animal welfare. Indeed, Erian and Phillips (27) highlight the economic

impact that increased industry knowledge of consumers can have to the poultry industry. Erian and Phillips (27) found that knowledge of production practices was positively associated with chicken meat consumption; suggesting that greater knowledge of industry practices results in increased consumer support. Yet the most effective way to educate the public to improve industry support is largely unknown. In an attempt to improve engagement and community support for the chicken meat industry, Howell, Rohlf (3) attempted to educate consumers about common misconceptions in the Australian chicken meat industry. Although objective knowledge increased, consumer perception and support for intensive systems did not. This may reflect that education, in isolation, is not an effective tool to improve industry support. Of note, information was provided by industry stakeholders in the Howell, Rohlf (3) study, which may not be as ‘trust worthy’ in the eyes of consumers, a belief that has been previously reported (The Centre for Food 28). Therefore, the role and effectiveness of education on public perception of the poultry industry remain largely unknown.

Language

Language provides a tool to structure personal experiences of oneself and the world (29). The study of the role that language has on societal issues such as inequality due to race, gender, class or religion (see (30)), however there has been minimal investigation into the role of language in relation to animal welfare. Although, the importance of language is reflected in consumer perception of ‘ethical’ products, as observed in the organic market as consumers describe organic products ‘fresh’ and ‘earth friendly’ despite no evidence provided to support such claims (31). Thus, terminology, such as ‘cage’, may have a greater impact on public perception than scientific assessments of welfare (32). Current examples of such controversy in an Australian context include the definition and labelling of free-range poultry products and poultry housing.

Insight into the effectiveness of education and terminology to inform the public of poultry welfare in an Australian context is required to inform future approaches to positively engage the community. Additionally, an understanding of consumer attitudes towards the Australian poultry industry and poultry welfare is required, to ensure that public demands are based on knowledge of poultry practices, housing and welfare rather than beliefs. Industry must maintain a balance of informing consumer attitudes and demands and acknowledging and addressing public values in a proactive way to protect their social licence and consequently the sustainability of the egg and chicken meat industries.

Objectives

This project aimed to identify public attitudes towards, and knowledge of, poultry housing systems, management and hen welfare. Furthermore, this project aimed to determine the barriers of adoption of alternate housing systems in relation to public perception of poultry welfare, specifically related to language and knowledge gaps. Furnished cage housing systems were utilised as an education case study due to a predicted lack of awareness and furthermore to determine the feasibility of a successful and sustainable furnished cage egg industry in Australia.

Hypotheses:

- Australian community stakeholders would have little awareness of furnished cage housing systems for laying hens
- Knowledge of hen welfare, management and impacts of housing would be low
- The effectiveness of education programs would be impacted by language
- Positive perceptions of furnished cage systems would be related to language, in addition to poultry welfare education

A greater understanding of public perceptions was expected to inform targeted approaches to inform the public of specific areas of poultry welfare and subsequently maintain social licence of the egg industry in Australia.

Methodology

This study was approved by the University of New England Human Ethics committee (HE18– 284).

Survey description

Two surveys were developed to investigate perceptions of hen welfare; one targeted industry stakeholders and the other community stakeholders. The surveys were informed by industry and community focus groups. The survey, and recruitment of participants for the community survey, was conducted through Qualtrics^{XM} (Provo, UT, USA). Recruitment of the community participants included criteria to ensure the sample of the population was reflective of the Australian population, specifically in relation to gender, age and geographical location (Appendix 1). Recruitment for the industry survey was achieved via newsletter advertisements, email lists and industry conferences.

Survey designs

Industry survey (Appendix 2) consisted of questions of demographics (n = 7), hen flock housing and management (n = 4), hen welfare (n = 6), sources of information and trust (n = 3), misconceptions of the egg industry (n = 16) and furnished cage housing systems (n = 15). Responses included a combination of multiple choice, free text and Likert scale formats.

Community survey (Appendix 3) included questions of demographics (n = 9), preferences of egg choice (n = 5), hen welfare (n = 5) and behavioural, normative and control belief (n = 9). Additionally, knowledge of hen welfare and management practices were tested with true or false statements (n = 9) and free text questions (n = 4) where participants were asked to define four terms associated with hen welfare and egg production. These aforementioned questions contribute to Part I – perceptions of hen welfare in this report.

The second part of the community survey focused on education and the impact of language (Part II – Education and language). Participants were allocated to one of four treatment groups; control cage (C_{CA}, n = 283), control coop (C_{CO}, n = 279), education cage (E_{CA}, n = 282), or education coop (E_{CO}, n = 278). Participants in the control groups (C_{CA} and C_{CO}) were provided with a 3 min 32 second video (<https://youtu.be/deHHEaDeaVQ>; script provided in Appendix 4) containing general information regarding chickens but not specifically related to hen welfare or egg production management or any knowledge statement question asked during the survey. Participants in the education treatment groups (E_{CA} and E_{CO}) were provided with a 3 min 43 second video (<https://youtu.be/xJlzo6Q7W5c>; script provided in Appendix 5) that educated participants with science based evidence on various aspects of hen welfare and commercial hen housing, including educational facts on four of the 10 previously asked true/false questions, two of the three free text definitions and provided information about furnished cage housing systems. The furnished cage housing system was chosen for the education focus, as our focus groups identified this housing system as unfamiliar by the Australian community (33). Scripts for the video interventions (appendix 1) were informed by current scientific information and through consultation with industry representatives.

To investigate the impact of language on the education and perceptions towards hen welfare and management furnished cages were either referred to as furnished cages (C_{CA} and E_{CA}) or furnished coops (C_{CO} and E_{CO}). Of note, although control groups were not educated on the

furnished cage system, the survey contained questions related to their perceptions of various housing systems including furnished cages (or furnished coops).

Data analysis

Data analysis was performed in SPSS statistical software (v22, IBM Crop, Armonk, NY, USA). Chi-square analyses were used to compare the impact of demographics on egg consumption, purchasing decisions, perceptions of hen welfare and support for furnished cage housing systems. Post hoc analysis between groups was achieved with z-tests correcting for multiple comparisons. Scores were calculated for ranking of factors important for welfare, perceived knowledge and support for housing systems. Scores were calculated by prescribing a number starting at 1 to each response (for example (never (1), rarely (2), sometimes (3), often (4), always (5) or I don't know anything (1), I know a little bit (2).....I consider myself an expert on the topic (5)). Mean scores were calculated and treated as continuous data. All continuous data met the criteria for normality, including percentage incorrect and correct answers after square root transformation. General linear models (GLM) were used to analyse the impact of demographics on perceived and actual knowledge. Furthermore, GLM were utilised to investigate the impact of education and language on knowledge and support scores, including treatment and time (pre- post-intervention) and the interaction between treatment and time as fixed factors and demographics of respondents as random factors. All post hoc analyses were corrected for multiple comparisons with the Bonferroni method.

Discussion of Results

There was extremely low uptake of the industry survey despite multiple attempts to engage participants including direct email requests, face to face invitations at industry meetings, newsletter promotions and providing an iPad prize incentive. The number of industry stakeholder respondents that fit our criteria for inclusion (e.g. currently working in the Australian poultry industry as a farm manger, producer or business manager) was 9 participants.

Understanding the differences and similarities in the language, knowledge and dialogue between industry stakeholders and community members is critical to ensure that discussions of hen welfare and the Australian egg industry are productive and respectful. Future research is required to fully understand the Australian egg industry perceptions towards hen welfare and more importantly the language, values and misconceptions (of the general public or industry). Improving the dialogue between industry and community on issues of hen welfare is likely beneficial however the risk of not improving such discussions to the social licence of the egg industry in Australia may be much greater.

Part I – Perceptions of hen welfare

Egg consumption

The majority of respondents consumed eggs 2 to 3 times a week (41.6%, $n = 500$; Table 1). Males consumed eggs more frequently than females ($\chi^2_{(4,1199)} = 12.7$, $p = 0.013$; Table 1). Few survey respondents (6.2%, $n = 74$) did not consume eggs. Respondents indicated that an important factor (16.2%, $n = 12$) or very important factor (32.4%, $n = 24$) for why they did not consume eggs was animal welfare, this was particularly true for females (F) compared to males (M) (very important factor: F – 47.4%, $n = 18$; M – 16.7%, $n = 6$; important factor: F – 15.8%, $n = 6$; M – 16.7%, $n = 6$; unimportant factor: F – 21.1%, M – 52.8%; $\chi^2_{(3,74)} = 10.6$, $p = 0.031$). Fewer respondents indicated that environmental factors (35.2%, $n = 26$), cost (17.6%, $n = 13$) and taste (21.5%, $n = 19$) were important or very important factors in their decision to not to eat eggs.

Table 1. Weekly egg consumption of total respondents and separated by gender

Egg consumption	Total respondents (%)	Female (%)	Male (%)
never	6.2 ($n = 74$)	6.2 ($n = 38$)	6.1 ($n = 36$)
less than once a week	0.2 ($n = 2$)	0.2 ($n = 1$)	0.2 ($n = 1$)
once a week	32.9 ($n = 395$)	18.7 ^a ($n = 224$)	14.3 ^b ($n = 171$)
2– 3 times a week	41.6 ($n = 499$)	41.4 ($n = 254$)	41.8 ($n = 245$)
> 3 week	19.1 ($n = 229$)	15.7 ^a ($n = 96$)	22.7 ^b ($n = 133$)

Most respondents brought eggs from the supermarket (84.8%, $n = 1017$) only 4.8% ($n = 57$) brought eggs from a farmers market and 2.0% ($n = 24$) from cafes, local stores or directly from an egg producer. The majority of respondents (54.7%, $n = 52$) that indicated that they did not buy eggs was because they, or friends or family, owned back yard chickens.

Respondents were less likely to purchase eggs from conventional cage, aviary or furnished cage housing systems, however the lack of support for aviary and furnished cages is likely due to unfamiliarity of the housing systems compared to conventional cage housing. Aviary and furnished caged systems were the most unfamiliar housing system and free-range the most well-known (Table 2).

Although furnished cage eggs are not labelled on egg cartons in Australia at the point of sale, 32.6% (n = 391) of respondents indicated that they had brought eggs from furnished cage housing systems at least rarely, and 3.1% (n = 32) indicated they always buy furnished cage eggs. This may be indicative of a lack of understanding of the housing system by participants, false reporting of their buying behaviour or lack of quality responses in the survey.

Fewer females brought eggs from conventional caged housing (Never: F – 40.6% n = 249, M – 25.3%, n = 148; always: F – 9.1%, n = 56, M – 14.7%, n = 86; $\chi^2_{(5,1199)} = 40.8$, $p < 0.0001$) and were more likely to purchase free-range eggs than males (never: F – 2.8% n = 17, M – 5.3%, n = 31; always: 42.3%, n = 259, M – 34.1, n = 200; $\chi^2_{(5,1199)} = 13.3$, $p = 0.021$). More females indicated that they were not familiar with furnished cage housing systems and reported that they brought them less than males (rarely purchased: F – 9.3%, n = 57, M – 14.3%, n = 84; often purchased: F – 5.1%, n = 31, M – 7.8%, n = 46, unfamiliar: F – 42.1%, n = 258, M – 35.3%, n = 207; $\chi^2_{(5,1199)} = 16.8$, $p = 0.005$). There was no effect of gender on the purchase of eggs from barn ($p = 0.397$) or aviary system ($p = 0.069$).

Fewer respondents that earned more than \$100,000 annually always bought conventional caged eggs (8.9%, n = 25) compared to respondents with an annual income of less than \$20,000 (19.8%, n = 20; $\chi^2_{(15,1200)} = 35.2$, $p = 0.002$). Conversely, more respondents with an average annual income of less than \$20,000 rarely bought free-range eggs (14.9%, n = 15) and were less likely to always buy free-range eggs (27.7%, n = 28) compared to respondents that earned more than \$100,000 annually (rarely: 1.8%, n = 5; always: 44.3%, n = 124; $\chi^2_{(15,1200)} = 40.3$, $p < 0.001$). However, there was no other impact of income on egg purchasing from different housing systems suggesting that price may not be a major factor on decision making of egg purchases.

More 18 - 24 years old never bought conventional caged eggs (46.8%, n = 73) than all other age groups (25 - 44 years: 31.4%, n = 132; 55 - 65 years: 32.6%, n = 125; 65+ years: 28.0%, n = 67; $\chi^2_{(15,1200)} = 31.7$, $p = 0.007$). More 18 - 24 year olds always bought free-range eggs (51.3%, n = 80) compared to 55 - 65 year olds (33.9%, n = 130) and 65+ (32.6%, n = 78; $\chi^2_{(15,1200)} = 50.1$, $p < 0.001$).

There was no impact of living in a capital city, territory/state or highest level of education on reported buying behaviour of eggs from any of the housing systems.

Table 2. Respondents (%) that never, rarely, sometimes, often or always buys eggs from hens housed in various housing systems. Respondents could also indicate if they were not familiar with a particular housing system

Housing system	Never (%)	Rarely (%)	Sometimes (%)	Often (%)	Always (%)	Unfamiliar (%)
Conventional cage	33.1 (n = 397)	16.7 (n = 200)	18.5 (n = 222)	16.7 (n = 200)	11.8 (n = 142)	3.3 (n = 39)
Free-range	4.0 (n = 48)	6.8 (n = 82)	20.3 (n = 243)	29.2 (n = 350)	38.3 (n = 459)	1.5 (n = 18)
Barn	18.7 (n = 224)	14.2 (n = 171)	32.8 (n = 394)	18.7 (n = 224)	3.9 (n = 83)	8.7 (n = 104)
Aviary	30.5 (n = 366)	11.1 (n = 133)	9.8 (n = 118)	5.3 (n = 63)	2.6 (n = 31)	40.8 (n = 489)
Furnished cage	28.7 (n = 344)	11.8 (n = 141)	11.3 (n = 136)	6.4 (n = 77)	3.1 (n = 37)	38.8 (n = 465)

Respondents were asked to rank six factors that contribute to their decision when purchasing eggs, from most important to least important; hen welfare was most frequently ranked as the most important (hen welfare 25.8%, n = 309) followed by the housing system (17.8%, n =

214), food safety (16.8%, $n = 202$), price (16.3%, $n = 196$), environmental sustainability, 14.2%, $n = 171$) then locally produced (9.0%, $n = 108$). Fewer males ranked hen welfare as the most important factor when purchasing eggs than females and females ranked food safety higher than males (Table 3).

Table 3. Most important factor (% respondents) that respondents consider when making decisions about purchasing eggs.

Rank	Female	Male
1	Hen welfare 30.2% ($n = 185$) ^a	Hen welfare 21.0% ($n = 123$) ^b
2	Food safety 19.4% ($n = 119$) ^a	Housing system 20.1% ($n = 118$) ^b
3	Price 16.0% ($n = 98$)	Environmental sustainability 16.9% ($n = 99$) ^b
4	Housing system 15.7% ($n = 96$) ^a	Price 16.7% ($n = 98$)
5	Environmental sustainability 11.7% ($n = 72$) ^a	Food safety 14.2% ($n = 83$) ^b
6	Locally produced 7.0% ($n = 43$) ^a	Locally produced 11.1% ($n = 65$) ^b

Subscript with differing letters indicate the difference between male and female respondents within a factor; e.g. the number of males that ranked hen welfare as most important factor compared to the number of females that ranked hen welfare as the most important factor.

Fewer 18 - 24 year olds reported housing system as an important factor, compared to all other age groups (18 - 24: 7.7%, $n = 12$; 25 - 44: 18.8%, $n = 77$; 55 - 65: 19.0%, $n = 73$; 65+: 21.8%, $n = 52$; $\chi^2_{(15,1200)} = 26.8$, $p = 0.030$). There was no impact of state territory ($p = 0.051$), capital city ($p = 0.418$), education ($p = 0.054$), or income ($p = 0.767$) on the most important factors when purchasing eggs. Although housing system was regarded as important for most respondents (most important factor for 17.8% of respondents), it is not possible to understand what the term ‘housing system’ represented to each participant in the current study. Housing system may reflect price, food safety, hen welfare or environmental sustainability, or a combination of these factors in addition to others not listed in the survey.

Hen welfare

Few respondents were current members of an animal welfare organisation (3.3%, $n = 39$) or were previously but were no longer a member (1.3%, $n = 15$). This is lower than previously reported (7). However, is important to note when interpreting the survey results. These results are likely to reflect a typical Australian community, not populations that may be specifically interested in, or passionate about, animal welfare.

Most of the respondents indicated the hen welfare was important or extremely important (Figure 1) and indicated that they perceived that hen welfare in Australia was ‘OK but [there is] room for improvement’ (Figure 2). This data suggests that communicating the welfare status of hens in commercial egg production will continue to be an important component of maintaining social licence, specifically continual improvements to hen welfare.



Figure 1. The importance of hen welfare as perceived by community stakeholders (orange bars, $n = 1200$) and industry stakeholders (blue bars, $n = 9$).

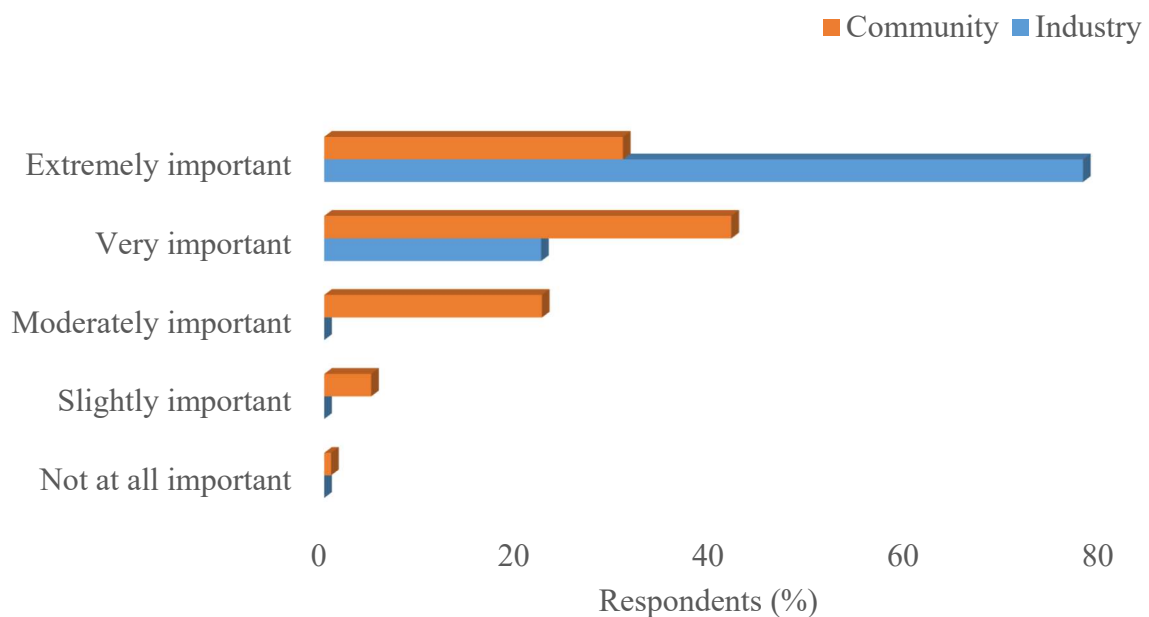


Figure 2. Perceptions of hen welfare in Australia by community stakeholders (orange bars, $n = 1200$) and industry stakeholders (blue bars $n = 9$).

Industry survey respondents perceptions of welfare did not appear to differ from community stakeholders, although a low samples size of industry respondents ($n = 9$) prevented any statistical analysis and thus meaningful interpretation. Industry respondents indicated that hen welfare is extremely important (Figure 2). Yet why most industry stakeholders ranked hen welfare as extremely important remains unknown, but may include concern for animal welfare in its own right, implications of poor welfare on productivity (16, 34, 35),

implications of negative perceptions of hen welfare in the community (Figure 3) or a combination of all of these factors in addition to factors not identified in the current research.

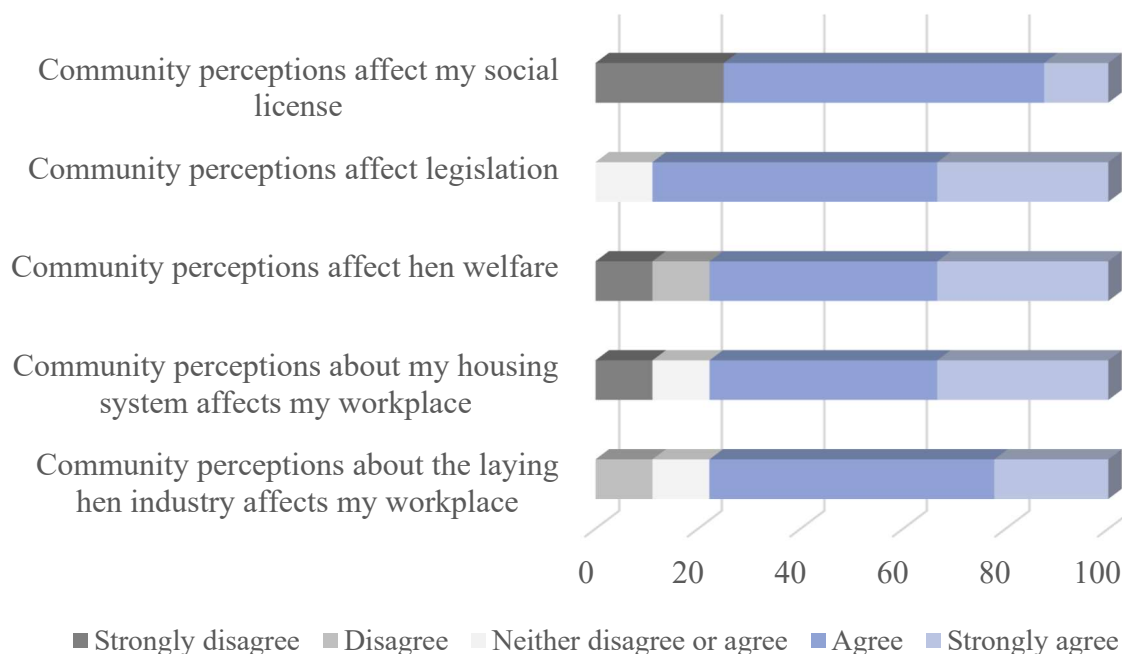


Figure 3. Industry responses ($n = 9$) that indicate the level of agreement with the statements regarding how community perceptions may impact the egg industry.

In an attempt to understand how the community understands concepts of hen welfare, in addition to the specific characteristics that community members value in relation to hen welfare, participants were asked to indicate how important a list of factors are for hen welfare (

Table 4). Factors included resources and characteristics that were related to physical health and biological functioning, mental health (affective states) and natural living. The top three ranked factors for hen welfare were food and water, protection and disease and injury (

Table 4). Although, there were too few industry responses to perform any statistical analysis, some qualitative differences suggest that industry may perceive hen feelings as more important than members of the community, yet natural resources such as sunlight and space as less important (

Table 4). Choice was considered the least important factor for hen welfare by the community participants, and was ranked relatively low by the industry (

Table 4).

Table 4. Mean community ($n = 1200$) and industry ($n = 9$) scores and standard error of the mean (SEM) for various factors of hen welfare. Scores were calculated by assigning each Likert category a number; not at all important (1), slightly important (2), moderately important (3), important (4) and extremely important (5) and calculating the average score across all respondents in each community and industry group. As there were few participants in the industry stakeholder group no statistical analysis were performed.

Community stakeholders ($n = 1200$)		Industry stakeholders ($n = 9$)	
Factor ranking	mean score +/- SEM	Factor ranking	mean score +/- SEM
1. Food and water	4.63 ± 0.02	1. Food and water	5.00 ± 0.0

2. Protection	4.48 ± 0.02	2. Protection	4.78 ± 0.2
3. Disease and Injury	4.41 ± 0.02	3. Disease and Injury	4.56 ± 0.2
4. Stress	4.31 ± 0.02	4. Feelings	4.38 ± 0.3
5. Sunlight	4.26 ± 0.02	5. Mental health	4.33 ± 0.2
6. Space	4.24 ± 0.02	6. Stress	4.22 ± 1.1
7. Natural behaviours	4.23 ± 0.02	7. Natural behaviours	4.00 ± 0.4
8. Freedom	4.22 ± 0.02	8. Alive	4.00 ± 1.4
9. Alive	4.20 ± 0.03	9. Space	3.89 ± 0.4
10. Mental health	4.16 ± 0.02	10. Growth and Production	3.78 ± 0.3
11. Natural resources	4.15 ± 0.03	11. Freedom	3.67 ± 0.4
12. Feelings	4.07 ± 0.03	12. Choice	3.50 ± 0.4
13. Growth and Production	4.06 ± 0.03	13. Sunlight	3.44 ± 0.5
14. Choice	3.79 ± 0.03	14. Natural resources	3.33 ± 0.5

The greatest and most consistent differences observed in the ranking of factors important for hen welfare were between females and males and dietary preferences. Vegetarian and vegans more likely to rank freedom as extremely important (Vegetarian and vegan: 65.8%, n = 48) compared to respondents that consumed a variety of foods including meat and animal products (40.5%, n = 450; $\chi^2_{(8,1200)} = 30.4$, $p < 0.001$).

Table 5. Mean scores and standard error of the mean (SEM) for various factors of hen welfare. Scores were calculated by assigning each Likert category a number; not at all important (1), slightly important (2), moderately important (3), important (4) and extremely important (5) and calculating the average score across all respondents in each community and industry group. Scores are reported categorised by gender and dietary preferences.

Female (n = 613)		Male (n = 586)		Variety of foods (n = 1112)		Vegetarian or vegan (n = 73)	
Factor ranking	mean score ± SEM	Factor ranking	mean score ± SEM	Factor ranking	mean score ± SEM	Factor ranking	mean score ± SEM
1. Food and water	4.71 ± 0.02	1. Food and water	4.54 ± 0.03	1. Food and water	4.62 ± 0.02	1. Food and water	4.64 ± 0.09
2. Protection	4.60 ± 0.03	2. Protection	4.36 ± 0.03	2. Protection	4.48 ± 0.02	2. Stress	4.55 ± 0.09
3. Disease and Injury	4.50 ± 0.03	3. Disease and Injury	4.31 ± 0.03	3. Disease and Injury	4.41 ± 0.02	3. Freedom	4.53 ± 0.10
4. Sunlight	4.44 ± 0.03	4. Stress	4.20 ± 0.03	4. Stress	4.29 ± 0.02	4. Space	4.53 ± 0.10
5. Stress	4.42 ± 0.03	5. Alive	4.11 ± 0.04	5. Sunlight	4.23 ± 0.02	5. Sunlight	4.53 ± 0.10
6. Space	4.40 ± 0.03	6. Freedom	4.10 ± 0.03	6. Space	4.22 ± 0.03	6. Natural behaviours	4.51 ± 0.09
7. Natural behaviours	4.37 ± 0.03	7. Natural behaviours	4.10 ± 0.03	7. Natural behaviours	4.21 ± 0.03	7. Natural resources	4.48 ± 0.10
8. Freedom	4.34 ± 0.03	8. Space	4.08 ± 0.04	8. Alive	4.20 ± 0.03	8. Protection	4.47 ± 0.11
9. Natural resources	4.33 ± 0.03	9. Sunlight	4.07 ± 0.04	9. Freedom	4.19 ± 0.03	9. Mental health	4.45 ± 0.10
10. Mental health	4.30 ± 0.03	10. Mental health	4.02 ± 0.03	10. Mental health	4.14 ± 0.03	10. Feelings	4.45 ± 0.10
11. Alive	4.29 ± 0.04	11. Growth and Production	4.01 ± 0.03	11. Natural resources	4.12 ± 0.03	11. Disease and Injury	4.36 ± 0.12
12. Feelings	4.25 ± 0.04	12. Natural resources	3.96 ± 0.04	12. Growth and Production	4.07 ± 0.03	12. Choice	4.27 ± 0.10
13. Growth and Production	4.11 ± 0.04	13. Feelings	3.87 ± 0.04	13. Feelings	4.03 ± 0.03	13. Alive	3.95 ± 0.13
14. Choice	3.93 ± 0.04	14. Choice	3.64 ± 0.04	14. Choice	3.75 ± 0.03	14. Growth and Production	3.97 ± 0.12

The theory of planned behaviour is a framework used to explain/predict an individual's intention to engage in specific behaviours. This model incorporates facets of behavioural, control and normative beliefs reflective of an individual's attitude and perceived behavioural control and the subjective norms of the community respectively (36). Participants were asked questions related to the theory of planned behaviour to reflect attitudes towards hen welfare, community values regarding purchasing 'welfare friendly' eggs and participating in activities that aim to improve hen welfare and their level of perceived control to purchase 'welfare friendly' eggs or contribute to changes in hen welfare (e.g. legislation).

Approximately half of respondents (52.8%) agreed that welfare was an important consideration when buying eggs. Although, 23.3% said that welfare was not a consideration, most respondents (79.2% agree or strongly agreed) indicated that they felt societal pressure to buy eggs that are produced with good welfare practices (Figure 4). There was no evidence to suggest that respondents felt societal pressures to lobby governments to improve hen welfare (16.4% agreed or strongly agreed), despite the majority of participants agreeing that lobbying the government for improved welfare practices is important (66.4% agreed or strongly agreed, Figure 4). There was a perception of control when buying purchases for 65.9% of participants who indicated that it was easy to purchase welfare friendly eggs, however 22% of respondents did indicate that purchasing welfare friendly eggs was too much effort. Although industry stakeholders indicated that community perceptions affect legislation (Figure 3), 40% of community participants felt it was out of their control to lobby the government for positive change for hen welfare.

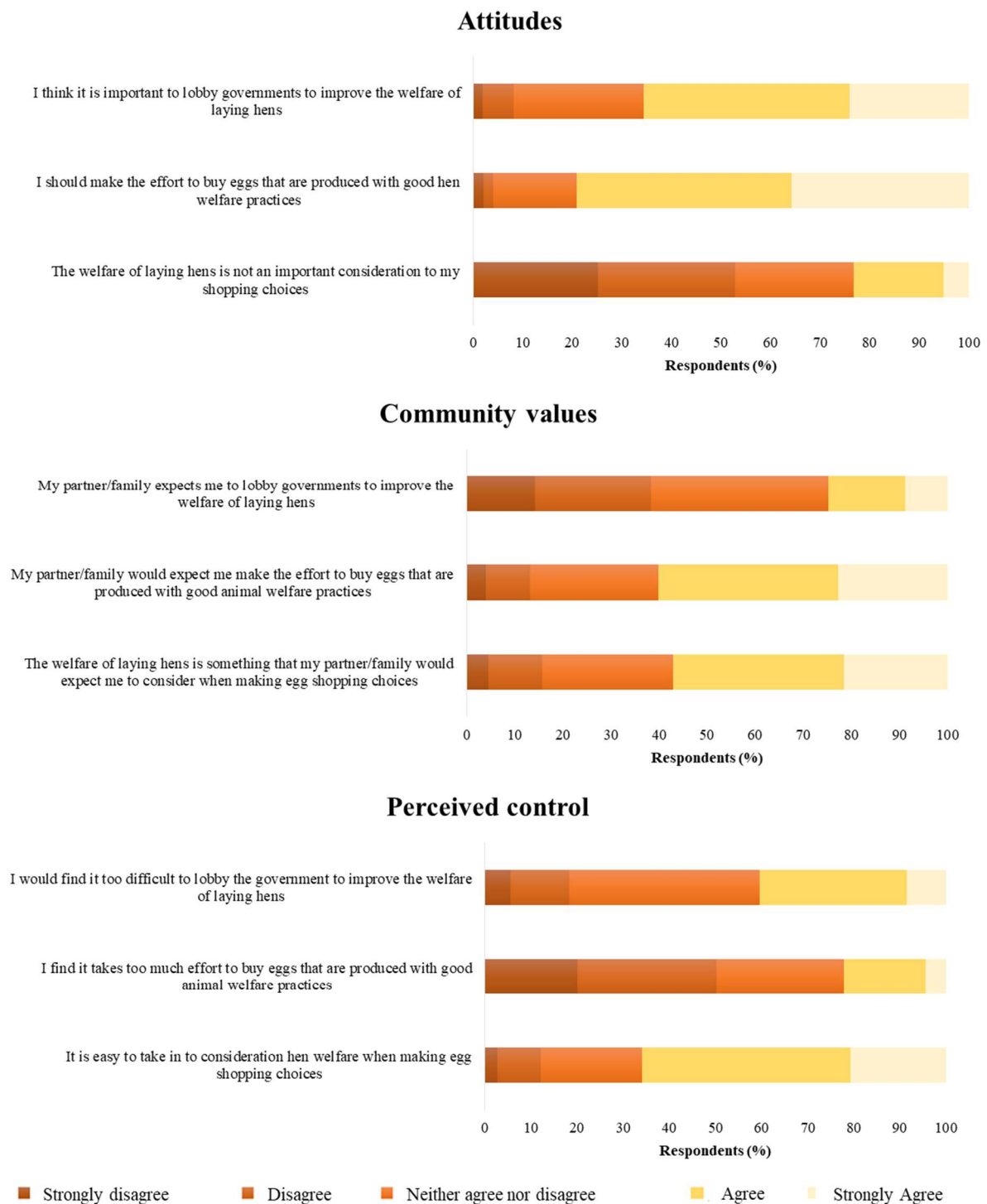


Figure 4. Responses from community participants ($n = 1200$) indicating the level of agreement with statements that reflect to their attitudes towards hen welfare (attitudes), societal norms (community values) and their perceived control (perceived control).

Knowledge

Participants were asked to report their perceived knowledge of animal welfare, laying hen welfare, the Australian laying hen industry, management practices and animal welfare legislation. Perceived knowledge of hen welfare, management and practices of the Australian egg industry were relatively low, with most respondents indicating they knew ‘a little bit’ or ‘as much as anyone else’.

Table 6. Perceived knowledge of community respondents indicating the level of knowledge of matters relating to hen welfare, management and regulations.

	I don't know anything	I know a little bit	I know as much as anyone	I know more than the average person	I consider myself an expert on the topic
Animal welfare	7.7 (n = 92)	32.5 (n = 390)	39.9 (n = 479)	18.6 (n = 223)	1.3 (n = 16)
Laying hen welfare	17.2 (n = 206)	30.3 (n = 364)	36.8 (n = 442)	13.8 (n = 166)	1.8 (n = 22)
The Australian laying hen industry	32.9 (n = 395)	28.8 (n = 346)	29.6 (n = 355)	7.3 (n = 88)	1.3 (n = 16)
Management practices of laying hens	33.7 (n = 404)	27.3 (n = 328)	27.3 (n = 327)	9.8 (n = 118)	1.9 (n = 23)
Animal welfare legislation	33.3 (n = 399)	28.5 (n = 342)	27.6 (n = 331)	9.0 (n = 108)	1.7 (n = 20)

Despite a higher perceived knowledge of laying hen welfare and industry practices of males than females ($F_{(1,1179)}=5.71$, $p = 0.017$), males did not perform better on the knowledge test than females (correct $p = 0.768$, incorrect $p = 0.491$, unknown $p = 0.970$; Table 7).

Respondents without a high school diploma had lower perceived knowledge scores than respondents with higher education qualifications ($F_{(1,1179)}=6.66$, $p < 0.001$) however actual knowledge did not differ from many of the other education demographic groups on the knowledge test (Table 7).

The oldest age group of respondents (65+) perceived their knowledge to be higher than other age groups ($F_{(1,1179)}=3.33$, $p = 0.005$) and was confirmed by a great proportion of correct answers and fewer unknown answers on the knowledge test than respondents from all other age groups (Table 7). The 65+ age demographic performed better than any other demographic group on the knowledge test with 35.6 ± 2.6 % of answers correct.

Respondents that lived outside of a capital city perceived their knowledge to be greater than residents that reside in a capital city ($F_{(1,1179)}=8.58$, $p = 0.003$). In agreement, residents outside of capital cities got more correct answers during the knowledge test ($F_{(1,1165)}=6.74$, $p = 0.010$) however also got more incorrect ($F_{(1,1165)}=6.27$, $p = 0.012$) and fewer unknown ($F_{(1,1165)}=9.57$, $p = 0.002$). This suggests that residents from outside capital cities likely had an increased chance at picking a correct answer, and as such their actual knowledge did not reflect their perceived knowledge.

Vegetarians and vegans had a higher perceived knowledge score ($F_{(1,1179)}=13.60$, $p < 0.001$) and performed slightly better on the actual knowledge test compared to respondents that ate a variety of foods (correct answers: Vegetarian and vegan: $30.1\% \pm 2.5$; variety of foods: $24.5\% \pm 0.6$; $F_{(1,1183)} = 4.2$, $p = 0.041$). However, the percentage of correct answers for all respondents regardless of demographics was low (24.9 ± 0.6 % correct and 55.1 ± 0.8 % unknown) suggesting that few respondents were ‘experts’ on hen welfare and management.

Demographic	Category	Perceived knowledge	Actual knowledge		
			Correct (%)	Incorrect (%)	Unknown (%)
Gender	Female	2.64 ± 0.10 ^a	30.9 ± 2.3	22.7 ± 1.9	46.4 ± 3.3
	Male	2.75 ± 0.29 ^b	30.3 ± 2.4	23.2 ± 1.9	46.4 ± 3.3
Age	18 – 24	2.80 ± 0.12 ^a	28.9 ± 2.7 ^a	23.6 ± 2.1 ^a	47.5 ± 3.8 ^a
	25 – 44	2.72 ± 0.11 ^a	28.7 ± 2.4 ^a	23.8 ± 1.9 ^a	47.5 ± 3.4 ^a
	45 – 64	2.54 ± 0.11 ^b	29.3 ± 2.4 ^a	21.1 ± 1.9 ^b	49.5 ± 3.3 ^a
	65+	2.72 ± 0.12 ^a	35.6 ± 2.6 ^b	23.3 ± 2.1 ^a	41.0 ± 3.7 ^b
Reside in capital city	Yes	2.77 ± 0.11 ^a	29.0 ± 2.4 ^a	21.9 ± 1.8 ^a	43.8 ± 3.4 ^a
	No	2.62 ± 0.10 ^b	32.1 ± 2.3 ^b	24.0 ± 1.9 ^b	48.9 ± 3.2 ^b
Highest level of education	Less than high school diploma	2.47 ± 0.12 ^a	27.0 ± 2.8	22.2 ± 2.2 ^a	50.9 ± 3.9 ^a
	High school diploma	2.58 ± 0.10 ^b	30.0 ± 2.4	21.2 ± 1.9 ^a	48.9 ± 3.4 ^{ab}
	Associate degree	2.80 ± 0.11 ^c	31.7 ± 2.5	24.4 ± 2.0 ^{bc}	43.7 ± 3.5 ^{bc}
	Bachelor degree	2.76 ± 0.11 ^c	33.2 ± 2.5	22.8 ± 2.0 ^c	43.9 ± 3.4 ^c
	Post graduate degree	2.87 ± 0.13 ^c	31.1 ± 2.9	24.3 ± 2.3 ^{ac}	44.5 ± 4.1 ^{ac}
Income	< \$20,000	2.49 ± 0.13 ^a	29.3 ± 2.9	21.3 ± 2.3 ^{ac}	49.2 ± 4.0
	\$20,000 - \$69,000	2.67 ± 0.10 ^b	28.4 ± 2.3	23.3 ± 1.8	48.3 ± 3.2
	\$70,000 - \$99,000	2.89 ± 0.11 ^c	32.5 ± 2.6	25.0 ± 2.0	42.5 ± 3.6
	> \$100,000	2.73 ± 0.11 ^b	32.2 ± 2.5	22.2 ± 2.0	45.5 ± 3.5
Diet	Variety of foods	2.73 ± 0.06 ^a	26.4 ± 1.4 ^a	21.5 ± 1.1	51.9 ± 1.9
	Vegetarian or vegan	2.92 ± 0.12 ^b	32.3 ± 2.6 ^b	21.6 ± 2.1	46.0 ± 3.7
	Other	2.80 ± 0.24 ^{ab}	33.0 ± 5.3	25.7 ± 4.1	41.2 ± 7.4

Table 7. Perceived and actual knowledge of animal welfare, Australian egg industry, laying hen welfare, management and legislation. Estimated marginal means ± standard error of the mean are presented for each category of demographic. Actual knowledge scores were back transformed. Differing subscript indicates a statistical difference ($p < 0.05$) between knowledge scores (perceived or actual) within a demographic.

Question	Correct (%)	Incorrect (%)	Unknown (%)
1. Shed lights are on 24 hours a day so each hen produces to eggs a day	28.1	14.2	57.8
2. Yolk colour is related to housing system	25.9	28.3	45.7
3. Free-range flocks consist of less than 5,000 hens	12.2	26.3	61.5
4. Hens are killed between 16 – 25 weeks of age because their egg production decreases	15.0	22.0	63.0
5. Chicken meat and eggs come from two different types of chickens	41.9	17.6	40.5
6. Commercial strains of hens each produce over 300 eggs per year	35.8	4.8	59.4
7. The current outdoor stocking density for hens in free-range egg production systems in 10,000 hens/hectare	25.6	7.0	67.5
8. Moulting is practiced in Australia	17.6	7.0	75.4
9. Hens in free-range housing systems have no welfare problems	43.4	18.4	38.2
10. Define Free-range	26.8	60.4	12.7
11. Define beak trimming	35.3	14.3	50.4
12. Define moulting	23.6	9.4	66.9
13. Define feed conversion ratio	8.7	14.5	76.7

Including an option for respondents to choose ‘I don’t know’ was an important component when assessing knowledge. Coleman and Toukhsati (23) suggest that deviations from expected correct answers by chance may indicate misconceptions of farming practices. Whilst knowledge in the current survey was very low, the average correct responses was less than a quarter of respondents (24.7%), most respondents indicated they were unsure, or did not know, with the exception of defining free-range (12.7% of respondents indicated unknown) which also had the most incorrect responses (60.4%).

We used the definition of free-range outlined in the Australian consumer law standard (Australian Consumer Law (Free Range Egg Labelling) Information Standard 2017) indicating that free-range means that chickens ‘*had meaningful, and regular access to an outdoor range during daylight hours during the lay cycle, able to roam and forage on the outdoor range*’ but excluded the final aspect of the definition ‘*with a stocking density of 10,000 or less*’. Incorrect answers of the definition of free-range included “free to roam, move or run” (53.0% of incorrect responses, n = 387), “not cage” (16.7% of incorrect responses, n = 122), “live outside in paddocks” (6.7% of incorrect responses, n = 49), “free” or “freedom” (4.2% of incorrect responses, n = 31), “not confined or cooped up” (2.4% of incorrect responses, n = 17) or “hens are given _____” a resource not specific to free-range, for example space or sunlight (3.8% of incorrect responses, n = 28).

We found evidence that level of public knowledge about poultry welfare and management is low, in agreement with other research of other animal industries (7). This must be taken into consideration when weighting public input into decisions about the management and housing of poultry in Australia. Decisions to poultry welfare legislation that are based on assumptions or misconceptions unlikely safeguard poultry welfare and indeed may even prove detrimental. It is impetrate that education campaigns target such knowledge deficits.

Part II – Education and language

Impact of language on education

There were no differences between treatment groups in the number of correct, incorrect or unknown answers before the video intervention (Figure 5). Participants from all treatment groups attempted to answer more questions after the video intervention regardless of treatment ($C_{CA} F_{(1,550)} = 10.6, p = 0.001$; $C_{Co} F_{(1,537)} = 13.2, p < 0.001$; $E_{CA} F_{(1,548)} = 62.3, p < 0.001$; $E_{Co} F_{(1,550)} = 72.0, p < 0.001$; Figure 5). However, the percentage of total correct responses post-treatment was greater for education treatment groups than control groups (interaction between treatment and pre- and post-intervention: $F_{(3,1104)} = 18.3, p < 0.001$; Figure 5), particularly for the six questions that were targeted during the education intervention ($F_{(3,1104)} = 45.1, p < 0.001$; Figure 5). The percentage of incorrect responses of questions that were targeted during the video intervention increased post-treatment for control groups but not education groups ($C_{CA} F_{(1,550)} = 10.7, p = 0.001$; $C_{Co} F_{(1,537)} = 15.4, p < 0.001$; $E_{CA} p = 0.873$; $E_{Co} p = 0.962$; Figure 5). This data suggests that interventions may give people more perceived knowledge even when no knowledge was provided.

There was no evidence to suggest that language impacted education, as no differences were observed between education treatment groups that were informed either with the term furnished cage (E_{CA}) or furnished coop (E_{Co}) (correct, incorrect or unknown responses pre- and post-treatment and all interactions $p > 0.05$; Figure 5).

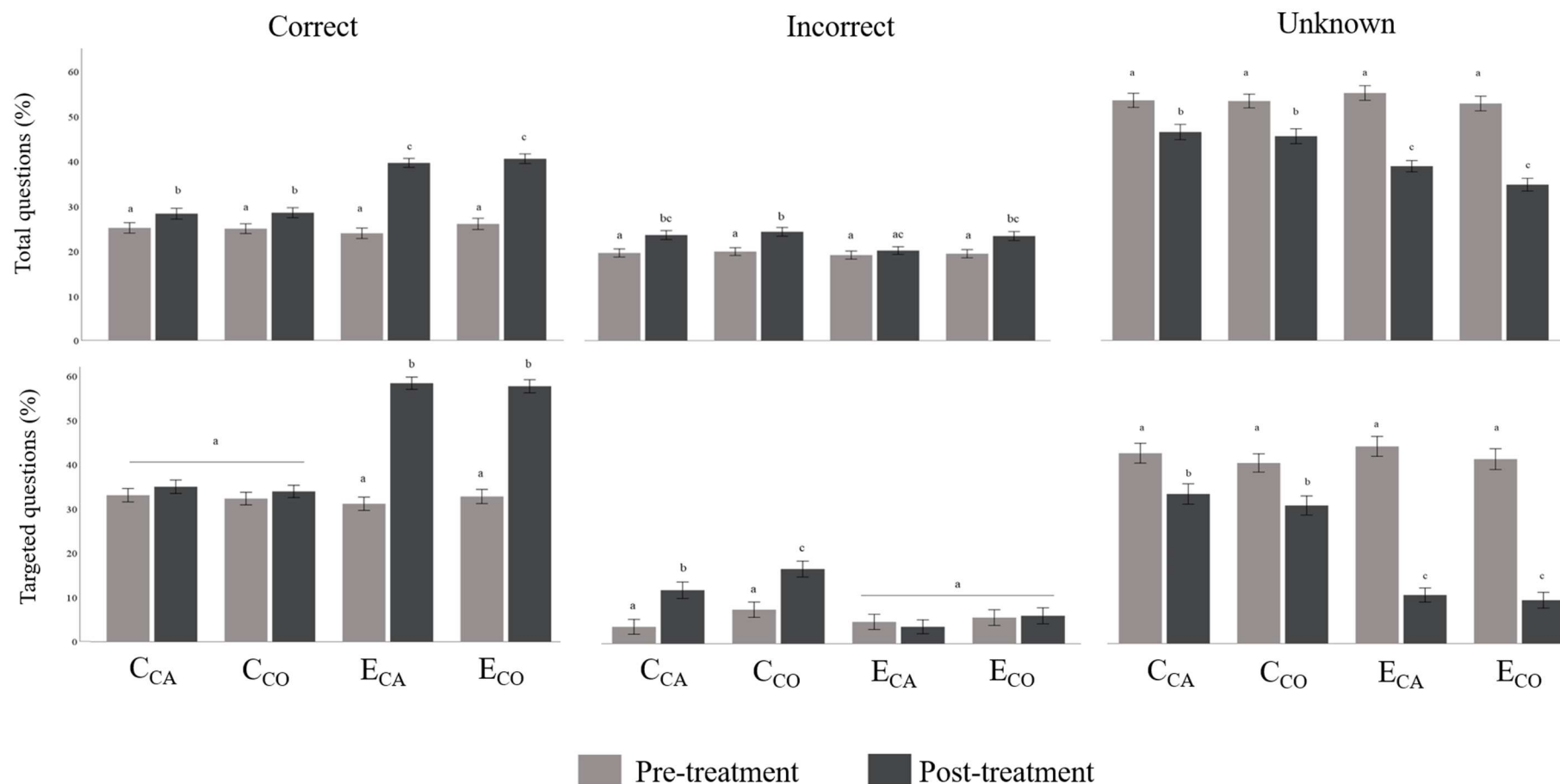


Figure 5. Correct, incorrect and unknown answers (%) for total questions asked ($n = 13$) and questions that were targeted throughout the education treatment ($n = 6$) before (light grey bars) or after (dark grey bars) participants watched a either control video clip (C_{CA} and C_{CO}) with facts about chickens that were unrelated to laying hen welfare, the Australian egg industry or furnished cages or a treatment video clip that contained information about laying hen welfare, the Australian egg industry and furnished cages (E_{CA} and E_{CO}). Furnished cages were either discussed throughout the video using the term 'furnished cage' (E_{CA}) or 'furnished coop' (E_{CO}). Bars with differing subscript denote differences at $p < 0.05$ level between pre- and post-intervention and treatment groups within each category of answer (correct, incorrect or unknown) for either total questions (top row) or questions that were targeted during the education intervention.

Impact of language and education on support for furnished cage housing systems

Support for purchasing eggs from furnished cages or furnished coops increased after the education interventions ($E_{CA} \chi^2_{(5,559)} = 155.1, p < 0.001$; $E_{CO} \chi^2_{(5,546)} = 184.7, p < 0.001$) but not the control intervention ($C_{CA} p = 0.326$; $C_{CO} p = 0.131$). More respondents from the education treatment groups were familiar with the housing system post-treatment than respondents from the control groups and were more likely to always (increase: E_{CA} 17.8% E_{CO} 19.2%) or often (increase E_{CA} 16.4%, E_{CO} 27.0%) buy eggs from hens housed in the furnished cage/coop system ($\chi^2_{(15,1090)} = 303.3, p < 0.001$; Figure 6).

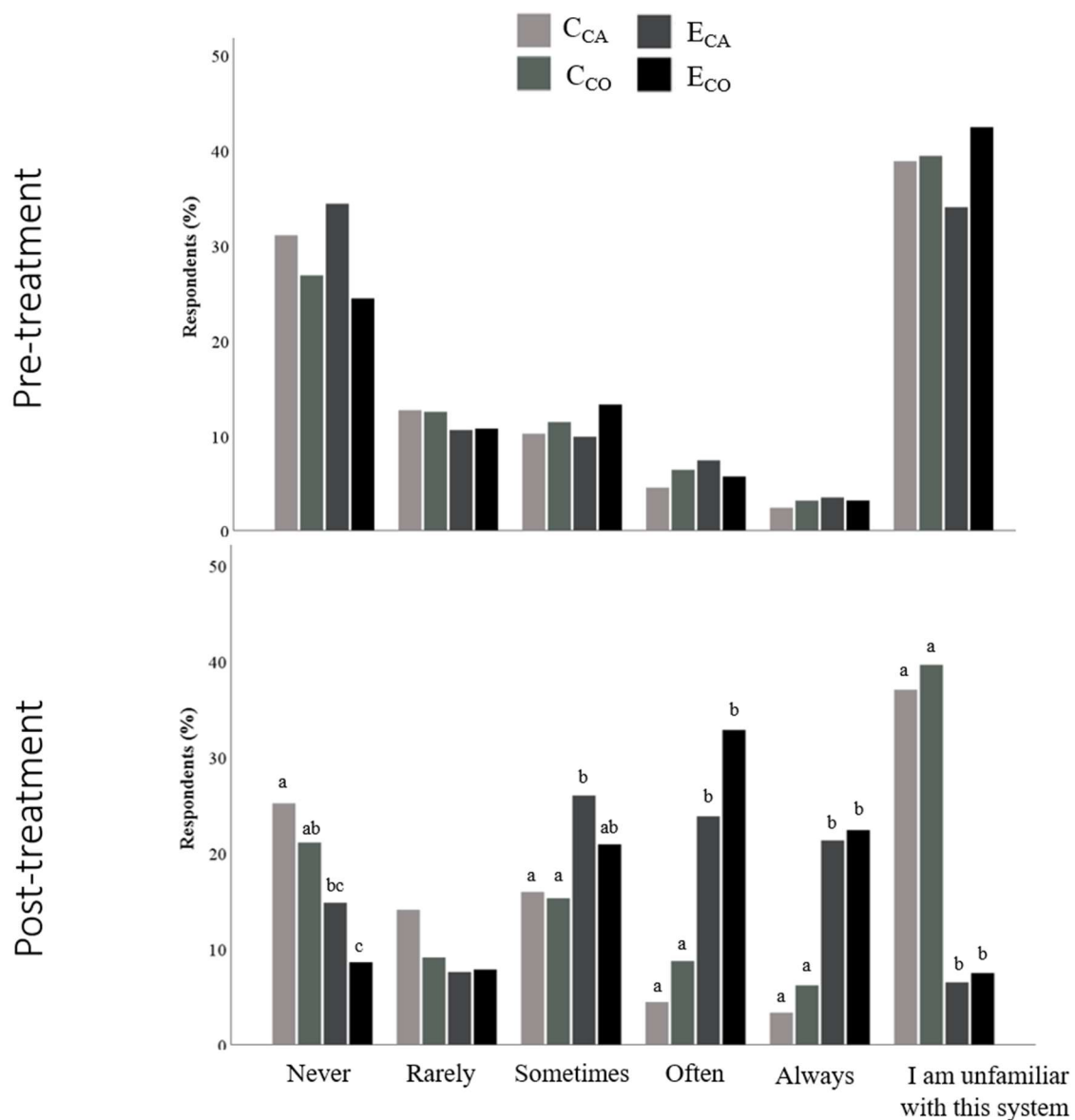


Figure 6. Support for furnished cage or furnished coop systems before (top bar graph) and after (bottom bar graph) participants watched a either control video clip (C_{CA} and C_{CO}) with facts about chickens that were unrelated to laying hen welfare, the Australian egg industry or furnished cages or a treatment video clip that contained information about laying hen welfare, the Australian egg industry and furnished cages (E_{CA} and E_{CO}). Furnished cages were either discussed throughout the video using the term 'furnished cage' (E_{CA}) or 'furnished coop' (E_{CO}). Bars with differing subscript denote differences at $p < 0.05$ level between treatment groups within survey response either before or after treatment.

The highest support score was for free-range (3.94 ± 0.02) and the lowest was for aviary (2.09 ± 0.03). Furnished cage support scores increased after the education intervention ($F_{(3,1473)} = 22.9$, $p < 0.001$; Table 8) and was higher than support scores conventional cage, but not free-range (Table 8).

One third of educated respondents (33.8% of E_{CO} and E_{CA}) indicated they would support furnished cage eggs if/because welfare was improved. This provides evidence that the Australian public are likely to support (via purchasing behaviour or social licence) furnished cage eggs if they are provided with knowledge about the system and impact on hen welfare. Some respondents said they would consider support furnished caged eggs however would depend price (17.6%), taste (4.8%) and quality of the eggs (1.6%).

Surprisingly only 3.0% of educated participants (E_{CO} and E_{CA}) stated that they wouldn't consider purchasing furnished caged eggs because it is still a cage. And 5.9% of participants indicated that they would not support furnished caged eggs because the housing system did not meet the welfare needs of the hen.

Table 8. Support scores for purchasing eggs from hens housed in various housing systems. Support scores were calculated by scoring the level of support from 1-5 (never (1) to always (5)) and was asked before (pre) and after (post) respondents were provided with a short video with facts about chickens that were unrelated to laying hen welfare, the Australian egg industry or furnished cages (C_{CA} and C_{CO}) or a treatment video clip that contained information about laying hen welfare, the Australian egg industry and furnished cages (E_{CA} and E_{CO}). Furnished cages were either discussed throughout the video using the term 'furnished cage' (E_{CA}) or 'furnished coop' (E_{CO}). P-values denote the interaction between treatment and time (pre-post intervention). Differing subscript denote differences at $p < 0.05$ level between treatment groups and within treatment group over time.

	C_{CA}		C_{CO}		E_{CA}		E_{CO}		p-value
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	
Conventional cage	2.17 ± 0.2	2.16 ± 0.2	2.21 ± 0.2	2.22 ± 0.2	2.05 ± 0.2	2.25 ± 0.2	2.13 ± 0.2	2.11 ± 0.2	0.554
Free-range	3.87 ± 0.2	3.87 ± 0.1	3.90 ± 0.1	4.03 ± 0.1	3.83 ± 0.2	3.89 ± 0.1	3.97 ± 0.11	3.98 ± 0.11	0.786
Barn	2.55 ± 0.1	2.59 ± 0.1	2.58 ± 0.1	2.75 ± 0.1	2.53 ± 0.14	2.66 ± 0.1	2.61 ± 0.1	2.72 ± 0.1	0.882
Furnished cage	1.31 ± 0.2^a	1.54 ± 0.15^a	1.56 ± 0.15^a	1.92 ± 0.2^a	1.43 ± 0.2^a	2.72 ± 0.1^b	1.56 ± 0.2^a	2.97 ± 0.1^b	< 0.001
Aviary	1.35 ± 0.2	1.66 ± 0.2	1.46 ± 0.2	1.71 ± 0.2	1.52 ± 0.2	1.65 ± 0.1	1.43 ± 0.2	1.89 ± 0.2	0.392

Implications

We provide evidence that the Australian community largely support furnished cage housing systems for egg laying hens, but education campaigns are required. It is unlikely that support for furnished cage housing system would meet or surpass the level of support for eggs from free-range housing systems despite a greater understanding of the welfare trade-offs in all housing systems. We did find some evidence of the rhetoric of a 'cage is a cage' as some respondents (< 5 %) indicated they would not support furnished cages because it is 'still a cage'. However, in general the support for furnished cage housing was greater than that of conventional cage housing despite both systems utilising cages.

We further provide evidence that knowledge of hen welfare, management practices and the Australian egg industry is relatively low, suggesting that the appropriate education campaigns are likely to improve the dialogue between the Australian community and egg industry. Few industry responses prevented further analysis into improvements for communication strategies between the industry and community members. A better understanding is required to minimise conflict that compromise the egg industry's social licence and potentially compromise hen welfare.

Education treatment groups increased knowledge of hen welfare, management and practices. Language did not impact the level of knowledge. We provide evidence that education campaigns of new housing systems can increase the level of community support, despite the use of potentially negatively loaded terms such as 'cage'. These results suggest that education campaigns are able to inform the Australian public, with little impact of terminology that may be emotively loaded.

Recommendations

Further efforts to increase industry engagement is required to obtain an understanding of the similarities' and differences in language, values and perceptions of hen welfare between industry and the community. We provide some evidence that discussions between industry and community stakeholders may be using terminology that may reflect differences in experiences, knowledge and values. However, the validity of these findings are questionable because of the low sample size of industry participants. The current industry survey could be altered to remove any questions regarding furnished cages to focus on differences in language and values about hen welfare.

The education campaign in the current study doubled knowledge performance in the short knowledge quiz, which is greater than some previous research that has focused on education interventions for poultry management and welfare (37). Additionally, the increased support for furnished cages was 2-3 times greater than other attempts in Australia (38). The reason for the improved outcome in the current study could be due to the length of video, engaging illustrations, the independence of the creators, or the scientific nature of the survey. This deserves further attention to ensure that future education campaigns regarding hen welfare are effective. However, there are clear benefits and opportunities for education campaigns that can improve the understanding and support for the Australian egg industry and hen welfare.

Furnished cage housing systems are a good compromise for the welfare trade-offs of conventional cage and free-range housing. With some evidence that the Australian

community would support this housing system, either through social licence or purchasing behaviour, there is a need to further investigate the feasibility of this market in light of economics, practicalities and other aspects of consumer concern including price and food safety. Furthermore, the optimal furnished cage design, including resource and group size, is still unknown and the practicalities for worker health and safety and hen welfare in Australian conditions is lacking. With little evidence to support industry concerns of the ‘a cage is a cage’ rhetoric negatively impacting support for furnished cage support in Australia, the industry might consider investing in appropriate RD&E into the best furnished cage housing design for industry, workers, food safety and hen welfare to ensure the industry is ready for transition should the market require.

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Media and Publications

Poster presentation at Australian Poultry Science Symposium, Sydney, Australia. February 2019.

Power– Geary J., Nolan, H.R.J., Hemsworth L., Taylor, P.S. (2019). ‘Understanding the perceptions and knowledge of laying hen welfare: industry and community stakeholder focus groups’. *Proceedings of the Australian Poultry Science Symposium*, 30. Sydney, Australia. *Poster presentation*.

Poster presentation at International Society of Applied Ethology, Bergen, Norway. August, 2019.

Nolan, H.R.J., Hemsworth L., Taylor, P.S. (2019). ‘What’s in a name? The role of education and rhetoric in improving laying hen welfare’. *Proceedings of the International Society of Applied Ethology Symposium*, 53. *Poster presentation*.

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Appendices

Appendix 1. Demographics of Australian public and survey respondents.

Demographic	Category	Australia population (39)	Part I Welfare	Part II Education			
				C _{CA}	C _{CO}	E _{CA}	E _{CO}
Total respondents		–	1200	283	279	283	279
Sex	Male	49.3	48.8	56.2	57.0	45.2	43.0
	Female	50.7	51.1	43.8	43.0	54.4	57.0
	Other	–	0.1	0.0	0.0	0.4	0.0
Age	18 – 24	10.4	13	11.0	11.8	14.0	14.0
	25– 34	14.4	17.8	16.6	14.7	20.8	20.8
	35– 44	13.5	17.3	16.6	13.3	20.1	20.1
	45– 54	13.3	16.7	18.0	17.2	16.1	16.1
	55– 65	11.8	15.3	12.7	14.0	16.1	16.1
	65+	15.8	19.9	25.1	29.0	12.9	12.9
State/Territory	ACT	1.7	2.0	2.1	1.4	2.5	1.8
	NSW	32.0	31.8	35.3	35.5	32.2	28.7
	NT	1.0	0.5	0.0	1.8	0.0	0.4
	QLD	20.1	20.3	18.0	17.2	19.4	20.4
	SA	7.2	7.4	6.7	7.2	9.5	7.2
	Tas	2.2	2.2	2.5	2.5	0.7	3.2
	Vic	25.3	24.7	24.4	24.4	26.7	22.6
	WA	10.6	11.2	11.0	10.0	8.8	15.8
Capital city	Yes	67.1	63.3	61.5	57.0	66.4	65.9
	No	32.9	36.7	38.5	43.0	33.6	34.1
Highest level of education	Less than high school diploma	56.5*	12.5	10.6	14.0	13.4	12.2
	High school diploma	15.7	31.5	31.4	29.7	32.2	30.2
	Associate degree	30.2	22.1	23.7	22.6	19.8	24.1
	Bachelor's degree	17.0	23.8	25.8	22.6	21.6	25.5
	Higher degree	4.6	8.5	8.2	8.3	11.7	6.8
Annual household income	< \$20,000	7.2	8.4	7.1	9.3	8.1	9.3
	\$20,000 – \$39,000	17.8	21.5	23.3	22.6	19.8	20.4
	\$40,000 – \$69,000	14.5	27.6	27.2	28.3	29.3	26.5
	\$70,000 – \$99,000	18.6	19.2	21.9	15.1	17.7	20.8
	\$100,000 – \$150,000	16.8	15.8	13.4	15.1	17.3	17.9
	> \$150,000	14.7	7.6	7.1	9.7	7.9	5.0

Appendix 2. Industry stakeholder survey

We wish to invite you to participate in our research project, described below. Our names are Dr Peta Taylor, Dr Lauren Hemsworth, Mr Huw Nolan and Ms Jennifer Power– Geary, we are conducting this research as part of an ongoing project in the School of Environmental and Rural Science at the University of New England.

Research Project: Australian perceptions of hen welfare

Aim of the Research: The research aims to establish an understanding of Australian stakeholder attitudes towards laying hen housing and welfare.

Online Anonymous Survey: We would like to invite you to do an online anonymous survey that should take no more than 30 minutes.

Confidentiality: Any personal details gathered in the course of the study will remain confidential. Some questions in the survey allow you to insert text responses. If you agree, we would like to quote some of these responses. This will be done in a way that ensures that you are not identifiable. Any personal details will remain confidential and no individual or company will be identified by name in any publication for the results. All names will be replaced by pseudonyms.

Participation is Voluntary: Please understand that your involvement in this study is voluntary and I respect your right to stop participating in the study at any time without consequence and without needing to provide an explanation, however, once you begin the survey your anonymous data which you have already provided cannot be withdrawn.

Questions: The survey questions will not be of a sensitive nature: rather they are general, and will enable us to increase our understanding of both industry and community knowledge of and attitudes towards layer hen housing and welfare.

Use of Information: We will potentially use information from the survey in academic journal articles, industry reports, theses and conference presentations.

Upsetting Issues: It is unlikely that this research will raise any personal or upsetting issues but if it does you may wish to contact your local Community Health organisation or Lifeline on 13 11 14.

Storage of Information: All hardcopy notes printed from the survey will be kept in a locked cabinet in an office at the University of New England. Any electronic data will be kept on cloud.une.edu.au, UNE's centrally managed cloud server managed by the research team. It will also be kept on a password protected computer in the same location. Only the research team will have access to the data.

Disposal of Information: All the data collected in this research will be kept indefinitely at UNE. However, all data will be de-identified. No data that could potentially lead to identification will be kept. At the end of the survey period all data will be deleted from the Qualtrics servers.

Approval: This project has been approved by the Human Research Ethics Committee of the University of New England (Approval No HE18– 284, Valid to 18 December 2019).

Researchers Contact Details: Feel free to contact us with any questions about this research by email at: Peta Taylor (project lead): peta.taylor@une.edu.au or by phone on 02 6773 1808 Lauren Hemsworth:

Complaints: Should you have any complaints concerning the manner in which this research is conducted, please contact: Mrs Jo– Ann Sozou Research Ethics Officer Research Services University of New England Armidale, NSW, 2351 Tel: (02) 6773 3449 Email: ethics@une.edu.au

Regards, Peta Taylor, Lauren Hemsworth, Huw Nolan and Jennifer Power– Geary

Implied Consent

Research Project: Australian perceptions of hen welfare. I have read the information contained in the Information Sheet for Participants and any questions I have asked have been answered to my satisfaction. I

agree to participate in this activity, realising that I may withdraw at any time. I agree that research data gathered for the study may be published, and my identity will be unidentifiable as explained in the information sheet.

- I agree that I may be quoted using a pseudonym.
- I am over 18 years of age.
- In preservation of anonymity, I understand that no name or signature is required of me to give consent.
- By activating the proceed button below I am agreeing to participate in this study.
 - Proceed (1)
 - Do not proceed. You will be directed away from the survey (2)

What is the year of your birth (YYYY)

Gender:

- Male (1)
- Female (2)
- Other (please explain, if you want to) (3)
- I'd rather not say (4)

What is your current postcode?

Participants and any questions I have asked have been answered to my satisfaction. I

Highest level of education completed:

- Less than a high school diploma (1)
- High school diploma (2)
- Associate degree (e.g. diploma) (3)
- Bachelor's degree (4) _____
- Master's degree (5) _____
- Professional degree (MD, DVM) (6) _____
- Doctorate (PhD) (7) _____
- I don't wish to answer (8)

What title best describes your role in the egg industry (choose all that apply)

- Farmer/ producer (1)
- Farm manager (2)
- Business manager (4)
- Veterinarian (5)
- Scientist (6)
- Other (7) _____

How long have you been working in the egg industry?

- Less than 2 years (1)
- Greater than 2 years but less than 5 years (2)
- Greater than 5 years but less than 20 years (3)
- More than 20 years (4)

Why did you become a part of the egg industry?

What laying hen housing system(s) are you affiliated with (select all that apply)?

- Conventional cage (1)
- Free-range mobile units (2)
- Free-range flat deck (3)
- Free-range aviary (4)
- Aviary (5)

- Furnished cage / enriched / pre– enriched (6)
- Organic (7)
- Barn (9)
- Other (8) _____

What is your average flock size?

- < 499 (1)
- 500 – 999 (2)
- 1000 – 9,999 (3)
- 10,000 – 49,999 (4)
- 50,000 – 99,999 (5)
- + 100,000 (6)

Are you affiliated with an animal welfare, or animal rights organisation (for example RSPCA, PETA)?

- Yes: please name the organisation(s) (2)
- I used to be, but I'm not anymore: please name the organisation(s) (1)
- No (5)

Are your eggs sold under a welfare approval labeling scheme with a welfare organisation (e.g. RSPCA approved farming scheme)?

- Yes: Please name which one (1)
- I used to be, but I'm not anymore: please name the organisation(s) (4)
- No (2)

How do you define Animal Welfare?

Indicate your level of agreement with the following descriptions of good animal welfare

	Strongly disagree (1)	Disagree (2)	Neither agree or disagree (3)	Agree (4)	Strongly agree (5)
No disease or injury (6)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Excellent growth and production (7)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Expression of natural behaviours (8)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Good mental health (9)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Being alive (10)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
No / minimal stress (11)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Freedom (12)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Which of the following are important for good hen welfare

	Not at all important (1)	Slightly important (2)	Moderately important (3)	Very important (4)	Extremely important (5)
Access to food and water (8)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Protection from disease and predators (9)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Access to natural resources (10)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Feeling good (11)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Space (12)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Sunlight (13)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Choice (14)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

I think the welfare of Australian commercial hens is:

- Very bad (1)
- Bad (2)
- OK, but room for improvement (3)
- Adequate (4)
- Good (5)
- Excellent (6)

Hen welfare is:

- Not at all important (1)
- Slightly important (2)
- Moderately important (3)
- Very important (4)
- Extremely important (5)

I think the welfare of Australian laying hens in the following housing systems is excellent.

	Strongly disagree (9)	Disagree (10)	Neither agree nor disagree (11)	Agree (12)	Strongly agree (13)
Conventional cage (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Free-range (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Furnished cage (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Avairy (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Organic (5)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Barn (6)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Where do you obtain knowledge about laying hens from?

	Never (1)	Sometimes (2)	Most of the time (3)
Radio (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Internet news sites (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Social networking sites (e.g. Facebook) (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Television (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Print media (5)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Animal welfare organisations (e.g. RSPCA) (6)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Supermarkets (7)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Industry bodies (8)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other (please explain) (9)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Indicate how much you trust the information from the following sources

	Complete distrust (1)	Some distrust (2)	Neither trust of distrust (3)	Some trust (4)	Complete trust (5)
Radio (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Internet news sites (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Social networking sites (e.g. Facebook) (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Television (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Print media (5)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Animal welfare organisations (e.g. RSPCA) (6)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Supermarkets (7)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Industry bodies (8)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Indicate how much you trust the information from the following sources

	Complete distrust (1)	Some distrust (2)	Neither trust of distrust (3)	Some trust (4)	Complete trust (5)
Radio (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Internet news sites (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Social networking sites (e.g. Facebook) (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Television (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Print media (5)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Animal welfare organisations (e.g. RSPCA) (6)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Supermarkets (7)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Industry bodies (8)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

How strongly do you agree or disagree with the following statements regarding the Australian community?

Community perceptions about the laying hen industry affects my workplace

- Strongly disagree (1)
- Disagree (2)
- Neither disagree or agree (3)
- Agree (4)
- Strongly agree (5)

Community perceptions about my housing system affects my workplace

- Strongly disagree (1)
- Disagree (2)
- Neither disagree or agree (3)
- Agree (4)
- Strongly agree (5)

Community perceptions affect hen welfare

- Strongly disagree (1)
- Disagree (2)
- Neither disagree or agree (3)
- Agree (4)
- Strongly agree (5)

Community perceptions affect legislation

- Strongly disagree (1)
- Disagree (2)
- Neither disagree or agree (3)
- Agree (4)
- Strongly agree (5)

Community perceptions affect my social license

- Strongly disagree (1)
- Disagree (2)
- Neither disagree or agree (3)
- Agree (4)
- Strongly agree (5)

Community perceptions affects the laying hen industry's sustainability

- Strongly disagree (1)
- Disagree (2)
- Neither disagree or agree (3)
- Agree (4)
- Strongly agree (5)

How strongly do you agree or disagree with the following statements regarding the Australian community?

The Australian community as a whole are well educated about laying hen production management practices

- Strongly disagree (1)
- Disagree (2)
- Neither disagree or agree (3)
- Agree (4)
- Strongly Agree (5)

Misconceptions about the laying hen industry affects my workplace

- Strongly disagree (1)
- Disagree (2)
- Neither disagree or agree (3)
- Agree (4)
- Strongly Agree (5)

Misconceptions about my housing system affects my workplace

- Strongly disagree (1)
- Disagree (2)
- Neither disagree or agree (3)
- Agree (4)
- Strongly Agree (5)

Community misconceptions affect hen welfare

- Strongly disagree (1)
- Disagree (6)
- Neither disagree or agree (3)
- Agree (4)
- Strongly Agree (5)

Community misconceptions affect legislation

- Strongly disagree (1)
- Somewhat disagree (2)
- Neither disagree or agree (3)
- Agree (4)
- Strongly Agree (5)

Community misconceptions affect my social license

- Strongly disagree (1)
- Disagree (2)
- Neither disagree or agree (3)
- Agree (4)
- Strongly Agree (5)

Community misconceptions affects the laying hen industry's sustainability

- Strongly disagree (1)
- Disagree (2)
- Neither disagree or agree (3)
- Agree (4)
- Strongly Agree (5)

Which misconception held by the Australian public is the most damaging to the egg industry?

Would you support the adoption of furnished cages in Australia?

Yes (1)

- No (2)
- Maybe (3)
- Yes, dependant on (4) _____

Please provide further comment (why, why not, only if)

How strongly do you agree or disagree with the following statements regarding furnished cage housing systems?

Furnished cages are good for laying hen welfare

- Strongly disagree (1)
- Disagree (2)
- Neither disagree or agree (3)
- Agree (4)
- Strongly disagree (5)

Furnished cages are good for laying hen health

- Strongly disagree (1)
- Disagree (2)
- Neither disagree or agree (3)
- Agree (4)
- Strongly disagree (5)

Furnished cages allows adequate expression of natural behaviours

- Strongly disagree (1)
- Disagree (2)
- Neither disagree or agree (3)
- Agree (4)
- Strongly disagree (5)

Furnished cages are good for the environment

- Strongly disagree (1)
- Disagree (2)
- Neither disagree or agree (3)
- Agree (4)
- Strongly disagree (5)

Furnished cages are designed well

- Strongly disagree (1)
- Disagree (2)
- Neither disagree or agree (3)
- Agree (4)
- Strongly disagree (5)

Eggs from furnished cages can be sold at a premium price

- Strongly disagree (1)
- Disagree (2)
- Neither disagree or agree (3)
- Agree (4)
- Strongly disagree (5)

A transition to furnished cage housing is affordable

- Strongly disagree (1)
- Disagree (2)
- Neither disagree or agree (3)
- Agree (4)
- Strongly disagree (5)

Furnished cages are good for food safety

- Strongly disagree (1)
- Disagree (2)
- Neither disagree or agree (3)
- Agree (4)
- Strongly disagree (5)

Furnished cages are good for biosecurity

- Strongly disagree (1)
- Disagree (2)
- Neither disagree or agree (3)
- Agree (4)
- Strongly disagree (5)

Furnished cages are good for laying hen safety

- Strongly disagree (1)
- Disagree (2)
- Neither disagree or agree (3)
- Agree (4)
- Strongly disagree (5)

Do you believe Australian community members would support furnished caged housing systems?

- Yes (1)
- No (2)
- Maybe (3)
- Yes, dependant on (4) _

Please provide further comment (why, why not, only if)

Is there anything you would like to contribute to research on laying hen welfare? Any comments or concerns? Remember, this survey is anonymous.

- Yes
- No thank you

Would you like be made informed about the outcomes of this study and/or be involved in any follow up surveys? If you give us your email, this might compromise your anonymity. However, we will not allow any participant to be identifiable, any names will be replaced with pseudonyms.

- Yes for both (add email)
- Yes for outcomes, but no for follow up surveys (add email)
- Yes for follow up surveys but no for outcomes (add email)
- No for both

Appendix 3. Community stakeholder survey

We wish to invite you to participate in our research project, described below. Our names are Dr Peta Taylor, Dr Lauren Hemsworth, Mr Huw Nolan and Ms Jennifer Power– Geary, we are conducting this research as part of an ongoing project in the School of Environmental and Rural Science at the University of New England.

Research Project: Australian perceptions of hen welfare

Aim of the Research: The research aims to establish an understanding of Australian stakeholder attitudes towards laying hen housing and welfare.

Online Anonymous Survey: We would like to invite you to do an online anonymous survey that should take no more than 30 minutes.

Confidentiality: Any personal details gathered in the course of the study will remain confidential. Some questions in the survey allow you to insert text responses. If you agree, we would like to quote some of these responses. This will be done in a way that ensures that you are not identifiable. Any personal details will remain confidential and no individual or company will be identified by name in any publication for the results. All names will be replaced by pseudonyms.

Participation is Voluntary: Please understand that your involvement in this study is voluntary and I respect your right to stop participating in the study at any time without consequence and without needing to provide an explanation, however, once you begin the survey your anonymous data which you have already provided cannot be withdrawn.

Questions: The survey questions will not be of a sensitive nature: rather they are general, and will enable us to increase our understanding of both industry and community knowledge of and attitudes towards layer hen housing and welfare.

Use of Information: We will potentially use information from the survey in academic journal articles, industry reports, theses and conference presentations.

Upsetting Issues: It is unlikely that this research will raise any personal or upsetting issues but if it does you may wish to contact your local Community Health organisation or Lifeline on 13 11 14.

Storage of Information: All hardcopy notes printed from the survey will be kept in a locked cabinet in an office at the University of New England. Any electronic data will be kept on cloud.une.edu.au, UNE's centrally managed cloud server managed by the research team. It will also be kept on a password protected computer in the same location. Only the research team will have access to the data.

Disposal of Information: All the data collected in this research will be kept indefinitely at UNE. However, all data will be de-identified. No data that could potentially lead to identification will be kept. At the end of the survey period all data will be deleted from the Qualtrics servers.

Approval: This project has been approved by the Human Research Ethics Committee of the University of New England (Approval No HE18– 284, Valid to 18 December 2019).

Researchers Contact Details: Feel free to contact us with any questions about this research by email at: Peta Taylor (project lead): peta.taylor@une.edu.au or by phone on 02 6773 1808 Lauren Hemsworth: lauren.hemsworth@unimelb.edu.au or by phone on 03 9035 7613 Huw Nolan: hnolan3@une.edu.au or by phone on 02 6773 5666 Jennifer Power– Geary: jpowerge@myune.edu.au

Complaints: Should you have any complaints concerning the manner in which this research is conducted, please contact: Mrs Jo– Ann Sozou Research Ethics Officer Research Services University of New England Armidale, NSW, 2351 Tel: (02) 6773 3449 Email: ethics@une.edu.au

Regards, Peta Taylor, Lauren Hemsworth, Huw Nolan and Jennifer Power– Geary

Implied Consent

Research Project: Australian perceptions of hen welfare. I have read the information contained in the Information Sheet for Participants and any questions I have asked have been answered to my satisfaction. I

agree to participate in this activity, realising that I may withdraw at any time. I agree that research data gathered for the study may be published, and my identity will be unidentifiable as explained in the information sheet.

- I agree that I may be quoted using a pseudonym.
- I am over 18 years of age.
- In preservation of anonymity, I understand that no name or signature is required of me to give consent.
- By activating the proceed button below I am agreeing to participate in this study.
 - Proceed (1)
 - Do not proceed. You will be directed away from the survey (2)

What did you hear?

- A harmonica (1)
- A whistle (2)
- A storm (3)

What is the year of your birth (YYYY)

Gender:

- Male (1)
- Female (2)
- Other (please explain, if you want to) (3)
- I'd rather not say (4)

What is your current postcode?

Highest level of education completed:

- Less than a high school diploma (1)
- High school diploma (2)
- Associate degree (e.g. diploma) (3)
- Bachelor's degree (4) _____
- Master's Degree (5) _____
- Professional degree (MD, DVM) (6)
- Doctorate (PhD) (7) _____
- I don't wish to answer (8)

Annual household income:

- Less than \$20,000 (1)
- \$20,000– \$39,999 (2)
- \$40,000– \$69,999 (3)
- \$70,000– \$99,999 (4)
- \$100,000– \$150,000 (5)
- Over \$150,000 (6)

Diet type:

- Variety of food, including white and red meat (1)
- Vegetarian, no meat consumption (including no fish consumption) (2)
- Vegan, no animal products at all (3)
- Other (please explain) (4)

Are you a member of an animal welfare, or animal rights organisation (for example RSPCA, PETA)

- No (1)
- Yes: please name the organisation(s) (2)

- I previously was but am not anymore: please name the organisation(s) (3)

How often do you consume eggs in an average week?

- Never (1)
- Once per week (2)
- 2– 3 times per week (3)
- More than 3 times per week (4)

Why you don't eat eggs? – How important are the following factors in your decision not to eat eggs?

	Unimportant (1)	Slightly important (2)	Moderately important (3)	Important (4)	Very Important (5)
Animal Welfare (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Environmental Impact (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Cost (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I don't like the taste (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other (please explain) (5)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Where do you (mostly) buy your eggs?

- I don't buy eggs (Why not?) (5)
- Supermarket (1)
- Farmers markets (2)
- Organic stores only (3)
- Other (explain) (4)

Which of the following hen housing systems would you consider buying from?

	Never (1)	Rarely (2)	Sometimes (3)	Often (4)	Always (5)	I am unfamiliar with this housing system (6)
Conventional Cage (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Free-range (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Barn (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Furnished Cage (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Aviary (5)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Rank the following factors that contribute to your decision when purchasing eggs?

Drag and drop your answers to list them from 'most important' at the top of the list to 'least important' at the bottom of the list

- _____ Hen welfare (1)
- _____ Price (2)
- _____ Environmental sustainability (3)
- _____ Food safety (4)
- _____ Locally produced (5)
- _____ Housing system (8)

How do you define Animal Welfare?

Indicate your level of agreement with the following descriptions of good animal welfare

	Strongly disagree (1)	Disagree (2)	Neither agree or disagree (3)	Agree (4)	Strongly agree (5)
No disease or injury (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Excellent growth and production (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Expression of natural behaviours (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Good mental health (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Being alive (5)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
No / minimal stress (6)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Freedom (7)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Which of the following are important for good hen welfare

	Not at all important (1)	Slightly important (2)	Moderately important (3)	Very important (4)	Extremely important (5)
Access to food and water (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Protection from disease and predators (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Access to natural resources (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Feeling good (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Space (5)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Sunlight (6)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Choice (7)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

I think the welfare of Australian commercial hens is:

- Very bad (1)
- Bad (2)
- OK, but room for improvement (3)
- Adequate (4)
- Good (5)
- Excellent (6)

Hen welfare is:

- Not at all important (1)
- Slightly important (2)
- Moderately important (3)
- Very important (4)
- Extremely important (5)

The welfare of laying hens is not an important consideration to my shopping choices

- Strongly disagree (1)
- Disagree (2)
- Neither agree nor disagree (3)
- Agree (4)
- Strongly agree (5)

I should make the effort to buy eggs that are produced with good hen welfare practices

- Strongly disagree (1)
- Disagree (2)
- Neither agree nor disagree (3)
- Agree (4)
- Strongly agree (5)

I think it is important to lobby governments to improve the welfare of laying hens

- Strongly disagree (1)
- Disagree (2)
- Neither agree nor disagree (3)
- Agree (4)
- Strongly agree (5)

The welfare of laying hens is something that my partner/family would expect me to consider when making egg shopping choices

- Strongly disagree (1)
- Disagree (2)
- Neither agree nor disagree (3)
- Agree (4)
- Strongly agree (5)

My partner/family would expect me make the effort to buy eggs that are produced with good animal welfare practices

- Strongly disagree (1)
- Disagree (2)
- Neither agree nor disagree (3)
- Agree (4)
- Strongly agree (5)

My partner/family expects me to lobby governments to improve the welfare of laying hens

- Strongly disagree (1)
- Disagree (2)
- Neither agree nor disagree (3)
- Agree (4)
- Strongly agree (5)

It is easy to take in to consideration hen welfare when making egg shopping choices

- Strongly disagree (1)
- Disagree (2)
- Neither agree nor disagree (3)
- Agree (4)
- Strongly agree (5)

I find it takes too much effort to buy eggs that are produced with good animal welfare practices

- Strongly disagree (1)
- Disagree (2)
- Neither agree nor disagree (3)
- Agree (4)
- Strongly agree (5)

I would find it too difficult to lobby the government to improve the welfare of laying hens

- Strongly disagree (1)
- Disagree (2)
- Neither agree nor disagree (3)
- Agree (4)
- Strongly agree (5)

How informed you are on the following matters?

	I don't know anything (1)	I know a little bit (2)	I know as much as anyone else (3)	I know more than the average person (4)	I consider myself an expert on the topic (5)
Animal Welfare (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Laying hen welfare (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The Australian Laying hen industry (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Management practices of laying hens (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Animal welfare legislation (5)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Where do you obtain knowledge about laying hens from?

	Never (1)	Sometimes (2)	Most of the time (3)
Radio (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Internet news sites (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Social networking sites (e.g. Facebook) (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Television (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Print media (5)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Animal welfare organisations (e.g. RSPCA) (6)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Supermarkets (7)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Industry bodies (8)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other (please explain) (9)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Indicate how much you trust the information from the following sources

	Complete distrust (1)	Some distrust (2)	Neither trust of distrust (3)	Some trust (4)	Complete trust (5)
Radio (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Internet news sites (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Social networking sites (e.g. Facebook) (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Television (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Print media (5)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Animal welfare organisations (e.g. RSPCA) (6)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Supermarkets (7)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Industry bodies (8)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Indicate how much you trust the information from the following sources

	Complete distrust (1)	Some distrust (2)	Neither trust of distrust (3)	Some trust (4)	Complete trust (5)
Radio (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Internet news sites (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Social networking sites (e.g. Facebook) (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Television (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Print media (5)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Animal welfare organisations (e.g. RSPCA) (6)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Supermarkets (7)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Industry bodies (8)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	True (1)	False (2)	I don't know (3)
Shed lights are on 24 hours a day so each hen produces two eggs every day (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Yolk colour is related to housing system (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Free-range is not a form of intensive farming (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Hens are killed between 16 – 25 weeks of age because their egg production decreases (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Chicken meat and eggs come from two different types of chickens (5)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Commercial strains of hens each produce over 300 eggs per year (6)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The current outdoor range stocking density for hens in free– ranged egg production systems is 10,000 hens/hectare (7)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Moulting is practiced in Australia (8)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Hens in free-range housing systems have no welfare problems (9)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Define the following terms: please write 'Unknown' if you don't know

- Free-range
- Beak– trimming
- Moulting
- Feed conversion ratio

Please click the link, it will take you to a [4 minute video about Chickens](https://youtu.be/xJlzo6Q7W5c). Or copy/paste the below address:
<https://youtu.be/xJlzo6Q7W5c>

Thank you for watching our video. We will now be asking similar questions as before– don't worry, the survey hasn't gone backwards.

	True (1)	False (2)	I don't know (3)
Shed lights are on 24 hours a day so each hen produces two eggs every day (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Yolk colour is related to housing system (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Free-range is not a form of intensive farming (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Hens are killed between 16 – 25 weeks of age because their egg production decreases (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Chicken meat and eggs come from two different types of chickens (5)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Commercial strains of hens each produce over 300 eggs per year (6)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The current outdoor range stocking density for hens in free– ranged egg production systems is 10,000 hens/hectare (7)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Moulting is practiced in Australia (8)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Hens in free-range housing systems have no welfare problems (9)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Define the following terms: please write 'Unknown' if you don't know

- Free– range
- Beak– trimming
- Moulting
- Feed conversion ratio

How do you define Animal Welfare?

Indicate your level of agreement with the following descriptions of good animal welfare

	Strongly disagree (1)	Disagree (2)	Neither agree or disagree (3)	Agree (4)	Strongly agree (5)
No disease or injury (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Excellent growth and production (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Expression of natural behaviours (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Good mental health (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Being alive (5)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
No / minimal stress (6)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Freedom (7)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Which of the following are important for good hen welfare

	Not at all important (1)	Slightly important (2)	Moderately important (3)	Very important (4)	Extremely important (5)
Access to food and water (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Protection from disease and predators (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Access to natural resources (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Feeling good (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Space (5)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Sunlight (6)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Choice (7)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

I think the welfare of Australian commercial hens is:

- Very bad (1)
- Bad (2)
- OK, but room for improvement (3)
- Adequate (4)
- Good (5)
- Excellent (6)

Hen welfare is:

- Not at all important (1)
- Slightly important (2)
- Moderately important (3)
- Very important (4)
- Extremely important (5)

Would you consider purchasing furnished cage eggs?

- Yes (1)
- No (2)
- Maybe (3)
- Yes, but dependent on (4)

Please provide further comment on your answer above (e.g. why, why not, only if)

Which of the following hen housing systems would you consider buying from?

	Never (1)	Rarely (2)	Sometimes (3)	Often (4)	Always (5)	I am unfamiliar with this housing system (6)
Conventional Cage (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Free-range (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Barn (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Furnished Cage (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Aviary (5)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Is there anything you would like to contribute to research on laying hen welfare? Any comments or concerns?
Remember, this survey is anonymous.

- Yes (1) _____
- No thank you (2)

Would you like be informed about the outcomes of this study and/or be involved in any follow up surveys? If you give us your email, this might compromise your anonymity. However, we will not allow any participant to be identifiable, any names will be replaced with pseudonyms.

- Yes for both (add email) (1)
- Yes for outcomes, but no for follow up surveys (add email) (2)
- Yes for follow up surveys but no for outcomes (add email) (3)
- No for both (4)

How often do you consume eggs in an average week?

- Never (1)
- Once per week (2)
- 2– 3 times per week (3)
- More than 3 times per week (4)

Appendix 4. Control group video scripts; C_{CA} control cage treatment, C_{CO} Control coop treatment

Meet the domesticated hen. Hens are descendants of Jungle Fowl that inhabited dense jungle habitats throughout Asia (40). Jungle fowl were domesticated more than 7000 years ago (41) and were originally kept and bred for cock fighting and ceremonial purposes. The red jungle fowl can still be found in the wild in countries such as India, Burma and Thailand, but the domesticated hen can be found all over the world.

There are different terms to refer to chickens depending on their age and stage of life. A chick is newly hatched and typically covered in soft fluff. When fluff is replaced with feathers around 6 weeks of age, but still sexually immature we call female's pullets and males cockerels. After sexual maturity, females are called hens and males roosters. If males are castrated, he is referred to as a capon.

Hens do not need roosters to produce an egg. But if a rooster does mate with a hen, she produces a fertilised eggs (not the ones typically sold and eaten in Australia). These fertilised eggs grow chicks in 20– 21 days (42). Chicks communicate with their mother whilst in the egg, displaying a series of vocalisations to which mother hens respond to accordingly (43). After hatching, chicks stay close to the mother hen for protection and to gain some valuable lessons, such as what is good to eat and what is potentially harmful (44).

After a relatively short period of time, chicks will become less reliant on their mother and begin to explore the world and meet new chickens.

The first encounter between two unfamiliar adult chickens will likely result in aggression. This is to determine a social structure of the group and so they both know who is higher in the pecking order (45). When these chickens meet again later in life they remember their relative rank. The more dominate hen will assert her dominance by threats and specific postures to avoid any further aggression. Chickens can recognise up to 100 individuals and their social status within that group.

Vocalisations are an important communication tool for chickens. There have been around 30 different vocalisations described although we still don't know what many of them mean (46). Roosters use vocalisations to alert hens to a nice bit of food. Roosters will vocalise whilst picking up and dropping food particles, this is called 'tid– biting' a behaviour he uses to attract a mate (47). Subordinate roosters also want find a mate, so likewise will perform tid–bitting but without the vocalisations to avoid attracting attention from a dominate rooster (48).

Nowadays, there are more chickens in the world than any other species of bird. Chickens are kept for food, as companions and therapy. The chickens are the closest living relative of dinosaurs, with hundreds of different chicken breeds, they out number humans nearly 3 to 1. So next time someone calls you chicken, think of the evolutionary success and simply reply 'thank you'

*Appendix 5. Education treatment group video scripts; E_{CA} education cage treatment, E_{CO} education coop treatment**

Meet the laying hen, **she can produce over 300 eggs each year**, and in Australia she may be housed in a conventional cage or free-range housing system. In regards to hen welfare, both housing systems have pro's and con's.

Conventional cage housing is where hens are kept inside a barn, in multitiered cages with wire mesh floors which prevents them from being in direct contact with their faeces. Hens are housed in groups, of more natural group size than in non- caged systems. This system improves the prevention of some diseases. However, the conventional cage restricts the expression of some behaviours such as wing flapping, dustbathing, perching, nesting and scratching. At the end of their production life hens are more likely to have osteoporosis and bone fractures.(21).

In free-range housing, hens have regular access to an outdoor range during the day and kept inside a shed overnight. Hens can express a broader range of behaviours in the shed and on the range than in caged systems. However, access to the outdoors increases the risk of parasites, disease (including exposure to avian influenza), predation by foxes and eagles. Also, hens are more likely to collide with object and each other which can cause injuries.

Free-range systems typically house large flocks of between **1,000 – 20,000 hens (49)**, such large group sizes can increase the incidence of severe feather pecking and cannibalism. **To minimise the damage caused by severe feather pecking, the tip of the beak of day old chicks is often removed in a process known as beak trimming.**

As you can see there are **challenges to hen welfare in both conventional cage and free-range housing systems**. As a result, industry and scientists have been working to find alternatives.

Introducing the Furnished Cage!

A furnished cage is a housing system that keeps hens in relatively small flock sizes in a cage that contains a perch, nest box and a scratchpad to increase the expression of specific behaviours that they can't express as well in conventional cages; such as roosting at night (which can improve bone strength (50)), nesting behaviour and foraging.

In furnished cage housing, hens are kept off their faeces and are not at risk of diseases associated with outdoor ranges. Consequently hens from Furnished cages are often in better health (51) and are less likely to die than in free-range systems (mortality 3% FC compared to FR 22% (52)).

Although scientists don't know the exact perfect design for FC, this alternative system reduces the welfare compromises of more traditional hen housing systems. Such that the health of the hens are improved relative to free-range housing, and the ability to perform motivated behaviour is permitted unlike conventional cages.

So, would you support the development of the furnished cage housing system in Australia?

* Information that was incorporated into questions to test knowledge before and after the video intervention is highlighted in bold blue writing in the script

Appendix 6. Participant responses to rank the factors associated with hen welfare

Factor	Not at all important	Slightly Important	Moderately Important	Important	Extremely important
Food and water	1.0 (n = 1)	1.0 (n = 12)	4.4 (n = 53)	25.3 (n = 304)	69.2 (n = 830)
Protection	0.4 (n = 5)	1.5 (n = 18)	6.2 (n = 74)	33.3 (n = 399)	58.7 (n = 704)
Disease and Injury	1.1 (n = 13)	1.6 (n = 19)	7.2 (n = 87)	35.8 (n = 430)	54.3 (n = 651)
Stress	1.4 (n = 17)	1.3 (n = 16)	6.9 (n = 83)	45.2 (n = 542)	45.2 (n = 542)
Sunlight	0.6 (n = 7)	2.3 (n = 27)	13.6 (n = 163)	38.2 (n = 458)	45.4 (n = 545)
Space	0.5 (n = 6)	3.0 (n = 36)	14.1 (n = 169)	36.6 (n = 439)	45.8 (n = 549)
Natural behaviours	1.1 (n = 13)	0.8 (n = 10)	11.6 (N = 559)	46.6 (n = 559)	39.9 (n = 479)
Freedom	1.4 (n = 17)	1.5 (n = 18)	13.0 (n = 156)	41.6 (n = 499)	42.5 (n = 510)
Alive	2.0 (n = 24)	3.4 (n = 41)	11.9 (n = 143)	37.5 (n = 450)	45.2 (n = 542)
Mental health	1.8 (n = 21)	1.4 (n = 17)	13.4 (n = 161)	45.6 (n = 547)	37.8 (n = 545)
Natural resources	0.9 (n = 11)	2.98 (n = 35)	17.1 (n = 205)	38.5 (n = 462)	40.6 (n = 487)
Feelings	1.7 (n = 20)	4.3 (n = 52)	17.3 (n = 208)	39.2 (n = 470)	37.5 (n = 450)
Growth and Production	1.7 (n = 20)	3.1 (n = 37)	15.4 (n = 185)	46.9 (n = 563)	32.9 (n = 395)
Choice	3.3 (n = 40)	5.6 (n = 67)	27.2 (n = 326)	36.9 (n = 443)	27.0 (n = 324)

Appendix 7. Publications arising from this project

1. Power– Geary J., Nolan, H.R.J., Hemsworth L., Taylor, P.S. (2019). ‘Understanding the perceptions and knowledge of laying hen welfare: industry and community stakeholder focus groups’. *Proceedings of the Australian Poultry Science Symposium*, 30. Sydney, Australia. *Poster presentation*.

UNDERSTANDING THE PERCEPTIONS AND KNOWLEDGE OF LAYING HEN WELFARE: INDUSTRY AND COMMUNITY STAKEHOLDER FOCUS GROUPS.

J. Power-Geary¹, H.R.J. Nolan¹, L. Hemsworth² and P.S. Taylor¹

Decisions that impact hen welfare may be influenced by the expectations of the community, such as development of regulations (Coleman et al., 2018). Although some research has been conducted on Australian consumer attitudes (Bray and Ankeny, 2017), wider community perceptions (for example, vegans) towards laying hen welfare remain largely unknown.

This research was approved by the University of New England’s Human research ethics committee (HE18-235). Focus groups of industry stakeholders (ISG) and community stakeholders (CSG), were held to establish an understanding of Australian poultry stakeholder knowledge of, and perceptions towards, hen housing and welfare. The CSG was held in Tamworth, NSW, (n = 7; 6 female, 1 male). The ISG was held in Brisbane, QLD (n = 6; 2 female, 4 male). Each focus group included a mixture of open- and closed-ended questions in a semi-structured discussion. Focus groups were audio recorded and later transcribed and analysed. Participants were asked what is important for hen welfare; a word count was performed (excluding irrelevant words such as ‘the’, ‘I’) and key words were grouped into themes (for example, ‘disease’ and ‘mortality’ were grouped into the theme ‘health’) and are presented as a percentage of the total words used for each group.

When asked what is important for hen welfare, ISG utilized more frequently than the CSG terms specific to health (ISG 40.0%, CSG 22.2%) and biological needs (ISG 26.7%, CSG 7.4%), but did not mention housing (ISG 0%, CSG 33.3%), behaviour (ISG 0%, CSG 12.9%), or psychological needs (ISG 0%, CSG 5.5%).

Discussions with the CSG highlighted misconceptions within the community regarding the egg industry, including the belief that beak trimming is illegal and that hens are housed under 24 light schedules to increase production. Furthermore, there was a lack of understanding of the scale of egg production in Australia evident by CSG discussion about rehoming spent hens and manual collection of eggs. Stakeholder groups were asked if they would support furnished cage housing systems (FCHS). No CSG members were aware of FCHS. However, after a briefing of the nature of the system, 100% of the CSG indicated they would support, and believed the rest of the community would support, a FCHS. However, 100% of ISG believed the adoption of FCHS is unlikely. The ISG believes that Australian consumers who do not support cage housing systems will similarly not support FCHS due to the notion that “a cage is a cage”.

The data gathered from these focus groups highlight differences between the industry and community stakeholders’ perceptions toward hen welfare. Furthermore, they highlight knowledge deficits and the potential impact of language on perceptions of hen welfare within the Australian community. This study will inform a national survey to investigate the impact of language during education on hen welfare.

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Coleman GJ, Rohlf V, Toukhsati SR & Blache D (2018) *J. Anim. Prod. Sci.* **58** (3): 416-423

Bray HJ & Ankeny RA (2017) *Anthrozoös.* **30** (2): 213-226

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2. Nolan, H.R.J., Hemsworth L., Taylor, P.S. (2019). ‘What’s in a name? The role of education and rhetoric in improving laying hen welfare’. *Proceedings of the International Society of Applied Ethology Symposium*, 53. Poster presentation.

What’s in a name? The role of education and rhetoric in improving laying hen welfare.

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The rhetoric of laying hen welfare influences people’s emotions. Terms like ‘cage-free’ and ‘caged’ connotes ‘liberty’ or ‘imprisonment’, or simply, ‘good’ or ‘bad’ for the hen. Science can determine the risk that the chicken egg industry (hereafter industry) practices pose to hen welfare, but a social license to operate will ultimately determine whether these practices are acceptable. Science and social licence do not always align and can lead to serious negative welfare consequences for hens. Furnished cages were designed as a compromise between the welfare implications of conventional cage and free-range systems, but societal concerns may still occur on the rhetoric that any cage is still a ‘cage’. Hence, we are investigating the relationship between education and social licence using the ‘furnished cage’ system as a case study. We hypothesise that support for furnished cages will not occur so long as the rhetoric of ‘cage’ persists. Furthermore, if emotive language influences the effectiveness of education campaigns then objective science will not change attitudes towards housing systems. We designed an online experiment in which a random sample of the Australian public (n=851) were assigned to one of three treatments (T1, T2 and a control, (CT)). The experiment surveyed the public’s knowledge of, and attitudes towards industry and hen welfare using a mix of open-ended questions, Likert scale responses and true/false statements. Participants were surveyed before and re-surveyed again, after an educational video intervention. T1 and T2 were shown a video containing objective facts about industry practices and welfare pros and cons of conventional cage and free-range systems before they were introduced to a compromise, i.e. the ‘furnished cage’ (T1) or the ‘furnished coop’ (T2). The Control video contained general information about chickens and no information about industry or welfare. The post-video survey then re-tested participant’s knowledge of the egg-laying industry and included a question about their support for furnished cages (T1+ 50% of CT) or furnished coops (T2 + 50% of CT). Data were analysed using Chi square comparisons within treatments (pre/post video) and between treatments (T1, T2 and CT). Preliminary results for the proportion of correct responses indicate no difference between treatments pre-video ($X^2 = 1.22$, df 4, $p = 0.87$) but a significant difference post-video ($X^2 = 260.39$, df 4, $p = <0.001$). This difference is explained by the 38% increase in correct responses in both T1 and T2 compared to 4% increase in CT. Support for furnished systems differed between treatment groups ($X^2 = 57.32$, df 6, $p = <0.001$) with 45% of T1, 46% of T2 and 21% of CT indicating they would support furnished systems post intervention. Support for furnished systems did not differ in relation to language ($X^2 = 1.47$, df 3, $p = 0.69$). This study suggests the rhetoric of ‘cage’ may not be as pervasive as previously thought and we found no evidence that emotive language had an impact on education or support for alternative housing systems.