A protocol for a meta-analysis of consumers' and citizens willingness-to-pay for farm animal welfare and disease prevention.

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Abstract

This article outlines a protocol for a meta-analysis into willingness-to-pay (WTP) for farm animal welfare. The analysis seeks to establish the publics' WTP for farm animal welfare and whether there is evidence to support niche markets for products produced to designated, and usually higher, welfare standards. A number of secondary objectives will also be explored in relation to the heterogeneity within the data relating to a number of variables known to vary within existing data including; animal species, welfare measures, socio-demographic and socio-economic characteristics.

The protocol outlines the rationale, objectives, inclusion criteria, search strategy and screening processes for the meta-analysis, and the plans for data extraction, risk of bias and data synthesis.

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1. Protocol

1.1. Background

Farm animal welfare is of increasing ethical concern to both European citizens and consumers (European Commission, 2007; Shaw, Shui & Clarke, 2000), relating to either altruistic or utilitarian ethical concerns (Johansson-Stenman, 2006).

Willingness-to-pay (WTP) is a measure of value to an individual (Hanley *et al,* 2011) and is defined as the price premium or maximum price an individual is willing to sacrifice for a good (Breidert, Hahsler & Reutterer, 2006). Typically WTP studies have tried to quantify consumers concerns in relation to the value placed on animal lives, their welfare conditions (Lagerkvist & Hess, 2011) and the higher expected benefits including product quality, that consumers generally associate with improved welfare (Verbeke, 2009).

Numerous studies have aimed to establish the public's WTP for animal products produced to a designated welfare standard, and their findings provide evidence to support a WTP for a variety of different products across a number of different countries (Napolitano *et al,* 2008; Carlsson, Frykblom & Lagerkvist*,* 2007; Bennett, 1996). These findings highlight a niche market for products produced to a designated, and usually higher than minimum standard of production (Wathes *et al*, 2013), where consumers derive value from the improved welfare conditions used.

Many such WTP studies have been synthesised into a meta-analysis by Lagerkvist & Hess (2011) which attempted to address a number of aspects in relation to data heterogeneity including; labelling, law changes, animal species, nationality, WTP method, and participant socio-economic and socio-demographic factors.

The review thereby acknowledges the large number of moderator variables that need to be explored in relation to WTP for farm animal welfare, a number of which have been found to have varying effects of explaining heterogeneity including different animal welfare aspects (Napolitano *et al*, 2008), socio-demographic variables (Bernard & Bernard, 2009; Bennett, 1996) and socio-economic characteristics (Carlsson, Frykblom & Lagerkvist*,* 2007), the latter two being important segmentation variables. There is also evidence that WTP differs between animal species (Cicia &Colantuoni, 2010; Carlsson, Frykblom & Lagerkvist, 2007), which is an important aspect to explore due to the implications it could have for producers of different animal species.

However, publication bias remains in the meta-analysis with the author's grey literature search being limited to the searching of reference lists and Google searching for key author websites, with the authors acknowledging that their review was not as comprehensive as it could have been. This study aims to take additional steps to limit publication bias by searching different databases, Google Scholar and consulting experts in the field in an attempt to retrieve additional sources of grey literature.

The previous meta-analysis also failed to distinguish between citizens, consumers and those that were vegetarian or non-vegetarian. Although these population characteristics may not be highlighted by all studies, they are potentially important moderator variables of WTP that warrant further exploration, particularly in relation to policy implications concerning the wider acceptability of farm animal welfare standards.

This systematic review will update and extend the work done by Lagerkvist & Hess (2011) to establish consumer WTP for farm animal welfare, incorporating more recent studies to provide producers and policy makers with the best available current information to aid decision making in relation to production systems and legislation. By further exploring heterogeneity in the included data more detailed findings can also be presented to stakeholders that will enable these stakeholders to make more informed decisions.

The findings and recommendations from the review will aid producers with the identification of potentially profitable niche marketing opportunities (Breidert, Hahsler & Reutterer, 2006). Also, far less is known about the value of the benefits accrued from improvements to animal production systems compared to the economic costs incurred as a result of improving the production systems, which are relatively well understood (Bennett *et al*, 2012). Therefore this research will aid in the cost-benefit evaluations of these in relation to the adoption of higher welfare systems (Cicia & Colantuoni, 2010).

Additionally the findings may provide information as to the acceptability of interventions to reduce and prevent production diseases, which form an important part of welfare strategies going forward (PROHEALTH, 2013).

Policy makers will benefit from a greater understanding of the public's positioning in relation to farm animal welfare enabling them to construct the most appropriate procedures to facilitate and monitor the implementation of designated farm animal welfare standards and interventions to prevent production diseases going forward. The findings of the review will also provide recommendations for future research into WTP for farm animal welfare, relating to gaps in the current literature and aspects of heterogeneity that warrant further investigation.

1.2.Objectives

1.2.1. Primary objectives

As outlined in section 1.1 there is a need to identify, critically appraise and summarise the public's WTP for farm animal welfare. This will be determined by the primary objectives which aim to establish:

1. What are the public WTP for production animal welfare?
2. What are the public WTP for interventions to reduce production diseases?
3. Is there evidence to support niche markets for products produced to higher animal welfare standards?

1.2.2. Secondary objectives

A number of secondary objectives will also be addressed and will be used to examine the fungibility of the data in relation to the primary objectives. These will help explore heterogeneity in the data and aid in the provision of more in-depth recommendations from the meta-analysis. The secondary outcomes are as follows:

4. Does animal species affect the public's WTP for farm animal welfare?
5. Do socio-demographic characteristics such as nationality, age and gender affect the public's WTP for farm animal welfare?

6. Do socio-economic characteristics such as income, education and occupation affect the public's WTP for farm animal welfare?
7. Does being vegetarian affect the public's WTP for farm animal welfare?
8. Is there a difference between consumers and citizens WTP for farm animal welfare?
9. Do choice set characteristics, such as number of attributes or options affect the public's WTP for farm animal welfare?

2. Interpretation of the effect of magnitude

A positive WTP is expected from consumers for farm animal welfare ranging from a few pence to several pounds, with the magnitude of their WTP depending on several factors including age, gender and animal species as discussed in the secondary objectives.

It is likely that a proportion of respondents of included studies will exhibit a higher WTP than average. This will provide evidence of niche markets for products produced to higher standards of animal welfare, with socio-economic and socio-demographic variables explaining heterogeneity in the data likely to be important segmentation variables.

Additionally, the proportion of individuals of WTP for farm animal welfare is likely to have increased over time, reflecting and increased media coverage and subsequent retailer response given to animal welfare over recent years

3. Criteria for considering studies for the review

3.1. Types of study to be included

Empirical studies of a quantitative design are to be included in the review, specifically those that examine consumer and citizens WTP for animal welfare and so provide data to address the primary objectives. Both stated and revealed preference measures of WTP will be considered. This includes, but is not limited to; market data, conjoint analysis, auctions, contingent valuation, choice experiments, dichotomous choice studies and existing review articles of WTP for animal welfare, as highlighted in table 1. Only studies written in English will be included.

3.2. Types of participants

The study population for the review will be consumers of animal products, and wider citizens of the EU (table 1). Studies focusing on specific subgroups of the population and non-EU citizens will be included but variation in population characteristics will be considered in relation to the overall strength of evidence.

3.3. Types of outcome measures

WTP is defined as the maximum amount of money an individual is willing to give up in order to obtain a certain benefit or to avoid a certain factor (Hanley, Shogren & White, 2001), and for the review will be considered as the price premium expressed by participants to purchase products to defined farm animal welfare standards. This price premium will be expressed in Euros, as standardised by the exchange rate at the time of study publication, and as the proportion of participants WTP across specific price thresholds.

Secondary outcomes will be measured as mean ± standard deviation, confidence intervals, or as the percentage of participants who meet a certain criteria e.g. vegetarian.

Table 1: Eligibility criteria

Study design	English, quantitative empirical; conjoint analysis, auction dichotomous choice, contingent valuation, choice experiments, additional methods of willingness to pay and intention to purchase
Population	Consumers and/ or citizens
Outcome	Willingness-to-pay, intention-to-purchase, price premium

4. Search strategy for the identification of studies

4.1. Search strategy

A number of subject specific electronic databases will be searched; Scopus, AgEcon Search and ISI Web of Knowledge, and will include all studies published over the past 15 years. Google Scholar will also be searched as a source of grey literature.

In order to further reduce publication bias two further sources of grey literature will be examined. Firstly key authors in the field will be consulted to check for any unpublished findings and additional sources of information (Higgins & Green, 2011), and secondly reference lists of included studies will be checked for any further references not returned from the database searches.

Search terms will be refined after several trial searches to ensure the most successful search strategies are used. Face validity of the searches will be addressed by checking returned searches for key authors and articles, including the 24 studies included in the Lagerkvist & Hess (2011) meta-analysis.

Search strategies will be tailored for each database searched, with the specific search strategies to be reported in an Appendix in the final review. The core list of search terms for the review can be found in table 2. All search terms were included in the topic, keyword, title and abstract sections of each individual database searched and used in conjunction with the Boolean operator AND as highlighted.

Where search sensitivity is low species related terms will be used to increase specificity, as highlighted in italics in table 2.

Table 2: Keywords considered for search

Type of Study and Outcome	valu*OR intention*OR behav*OR purchas*OR WTP OR willingness to pay OR willingness to buy OR ITP OR buy OR pref*OR economic OR reject* OR consumer
AND	
Animal Species[1]	farm animal OR production animal *pig* OR swine* OR sow* OR hog* OR broiler* OR chick* OR fowl OR turkey* OR hen* OR egg* OR meat OR pork OR piglet OR weaner OR*

	poult OR cattle*OR bovine*OR cow*OR beef OR horse*OR fish*OR ovine*OR sheep*OR caprin*OR lamb*OR mutton OR milk OR goat OR duck* OR turkey OR goose OR meat OR dairy OR beef*
AND	
Animal Welfare	animal welfare OR health OR disease OR welfare OR production disease

[1] Where search sensitivity is low species related terms will be used to increase specificity

4.2.Search screening

EndNote libraries will be constructed, with the principle researcher removing all duplicates before the results are sifted according to the eligibility criteria in table 1. An overview of the search process will be included in a PRISMA flow chart (Moher *et al*, 2009) for ease of reference.

The search results will then be filtered in a two stage process as outlined below. Decisions of whether to include and exclude the articles will be noted in the EndNote entry for each result.

1) **Title and abstract search:** In addition to the full title the abstract of these studies will also be read by the primary researcher so as to minimise the risk of error (Higgins & Green, 2011). A second reviewer will then review at least 10% of the studies. Any differences between the two researchers will be resolved through discussion. Again if there is any doubt at this stage then the study will be included for stage two. If abstracts are not available at this stage then they will be included for stage two.
2) **Full text search:** the full text of all included studies will be read and assessed for relevance by the primary researcher. A second researcher will then again review at least 10% of the studies. Any differences in decisions related to study eligibility will be discussed by the review authors.

Details of excluded studies will be provided at the full text stage only, listing the primary reason for exclusion in relation to the hierarchy of exclusion. Details of excluded studies at stage one can be obtained by contacting the corresponding author.

5. Methods of the review

5.1.Inclusion criteria

The eligibility of studies will be base on the inclusion criteria in table 1 and the search screening process outlined in section 4.2.

5.2.Assessment of risk of bias

The validity and the impact of bias will be addressed by use of a critical appraisal document that will examine a number of quality criteria that has the potential to impact on the results of the study. The document will assess the; construct validity, internal and external validity and reliability of studies, as described by Yin (2009).

The quality appraisal tool (under development) will meet the guidelines in the Cochrane Handbook for Systematic Reviews of Interventions (Higgins & Green, 2011), Campbell Collaboration (2001) guidelines and recommendations provided by the Centre for Reviews and Dissemination (2009), to provide a document not based in a healthcare context.

No studies will be excluded based on the quality assessment tool, but the findings will be taken into account during the evidence synthesis. Quality appraisal will inform the overall assessment of strength of evidence and may inform sensitivity analysis. Any differences in decisions related to study quality will be discussed by the review authors.

5.3.Data management and extraction

Data will be extracted from the included studies using a data extraction form to allow for efficient meta-analysis and meta-regression, and will be designed in relation to both the primary and secondary objectives of the study. All WTP data will be extracted and expressed in relation to the base prices provided in the study so as to provide a price premium and values will be converted into Euros, so as to provide a consistent valuation unit. Inflation will be accounted for by the use of the purchasing power parity indices in relation to WTP values, and the consumer price index for income. Information in relation to the following variables will be extracted: participant characteristics, focus (animal type, product and welfare aspects), study methodology and design, outcome measures, results and implications will also be extracted. Additionally sample sizes will be recorded in order to provide weight for the meta-analysis.

Free text fields will be minimised as much as possible, although the option to comment on each section will be provided to ensure that any additional details or researcher comments are taken into consideration. The form will be trialled by two independent researchers on five papers from the Lagerkvist & Hess (2011) meta-analysis, to check that it extracts all relevant information.

All data will be extracted by the primary and a secondary researcher independently, to again check for potential errors. Where information is missing efforts will be made to contact the authors to obtain further details (Higgins & Green, 2011).

5.4.Data synthesis

Descriptive results of the review will first be presented, detailing the study characteristics and findings. A cumulative meta-analysis will also be undertaken to establish if any changes in WTP over time are apparent.

Random effects meta-analysis and meta-regressions will be conducted (further details to be provided at a later date). Simulation procedures will be used to derive variances for weighting based on the sample sizes of the studies. AIC will be used to minimise over fitting when exploring heterogeneity (Koricheva, Gurevitch & Mengersen, 2013). Sensitivity analyses will be conducted to explore the risk of bias where appropriate. Similarly, funnel plots and tests of funnel plot asymmetry will be used to assess potential publication bias despite their known limitations.

If excessive heterogeneity is detected in the data then a narrative synthesis will instead be conducted. Effects will still be generated for comparative reasons with the pooled effect considered meaningless. The narrative analysis of the information extracted which will follow guidance laid out in the ESRC Narrative Synthesis Guidance document (Popay *et al*, 2006), and will explore the variations and commonalities in the data.

The adaptive grade framework (Meader *et al*, 2013) will be used to assess the strength of evidence, and again will be adapted to reflect the non-healthcare setting. Finally the implications of the review

will be discussed in relation to the context of the objectives and wider policy and production implications.

6. Acknowledgements

The author would like to thank the advisory group for consultation of the protocol and associated quality appraisal documents.

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8. Supplementary Information

8.1.Feedback

Feedback on the protocol from the advisory team was obtained and gratefully received.

8.2.Plans for updating the protocol

Section 5.4 relating to data synthesis will be confirmed after critical appraisal, but prior to the extraction of outcomes, once the nature of the data has become apparent. Data finalisation of the critical appraisal tool will also be reported

9. About the Article

9.1.Anticipated contributions of authors

Protocol development: BC, GS
Run search: BC
Identification relevant titles: BC
Identification relevant titles and abstracts: BC
Identification relevant studies: BC

Obtain relevant studies: BC
Data extraction: BC
Quality appraisal: BC, GS
Data analysis and interpretation: BC, GS, LP, LF
Draft review: BC, GS, LP, LF

9.2. Advisory group

The advisory group consisted of Richard Bennett, Richard Tranter, Philip Jones (University of Reading), Jarkko Niemi and Latvala Terhi (MTT Agrifood Research Finland).

9.3.Declarations of interest

Gavin Stewart is an associate editor of Peer J. Lynn Frewer has previous publications relating to animal welfare and the Theory of Planned Behaviour.

9.4.Sources of support

This review was funded by the FP7 PROHEALTH EU project.

9.5.Preliminary timeframe

Protocol development: October - November 2014
Database searching: December 2014
Data sifting: December 2014 – January 2015
Data extraction: January – February 2015
Quality appraisal: February- March 2015
Data analysis: March –May 2015
Key conclusions: May 2015