



Original Research

Co-producing public health advice for people working on premises infected with highly pathogenic avian influenza

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ABSTRACT

Objectives: Uptake of protective measures to prevent bird-to-human transmission of avian influenza (AI) (correct use of personal protective equipment [PPE], taking antivirals if recommended) and to increase the timely detection of AI in humans (prompt reporting of symptoms after exposure) is imperfect. The aim of this project was to co-produce public health advice for AI with people who work on infected premises.

Study design: Co-production following the Agile Co-production and Evaluation (ACE) framework for developing messaging and guidance.

Methods: We co-produced five factsheets in simple English (1. avian influenza, 2. PPE, 3. Tamiflu® (oseltamivir), 4a. Reporting symptoms and active follow-up, 4b. Reporting symptoms and passive follow-up), with accompanying infographics based on theory, previous literature, behavioural science principles, and stakeholder input. Seventeen people who worked on infected premises including two people who did not speak English gave feedback on sheets and shared their lived experience of working on infected premises.

Results: Co-producers generally preferred infographics to factsheets and suggested how sheets could be displayed on farms and disseminated within the poultry farming community. Suggested changes included that phrases should be shortened, amendments made to language and images to align with terms and items used on site, and that images in infographics were sometimes ambiguous if accompanying text was not understood. Co-producers also suggested creating videos to accompany the sheets.

Conclusions: The co-production process helped to develop good working relationships with people who work on infected premises and gave practical insight into their experiences.

1. Introduction

Since October 2021, there has been an outbreak of highly pathogenic avian influenza (HPAI) subtype H5N1. The virus has mostly affected wild birds, but also farmed and captive poultry, resulting in many infected premises and an increased human exposure to avian influenza (AI).¹ The detection of HPAI H5N1 in various mammal species, including a widespread outbreak among dairy herds in the United States

of America (USA),² has increased concerns that the virus could adapt to infect humans,^{3,4} as mammals are biologically closer to humans than birds.³ Between January 2022 to July 2025, there have been two symptomatic detections of H5N1 and five asymptomatic detections of H5N1 in humans in the United Kingdom (UK).^{5–8} Concerns about the potential public health risk from H5N1 have increased further following the detection of fifteen human infections in the USA (four following exposure to dairy cows, ten following exposure to poultry, and one with

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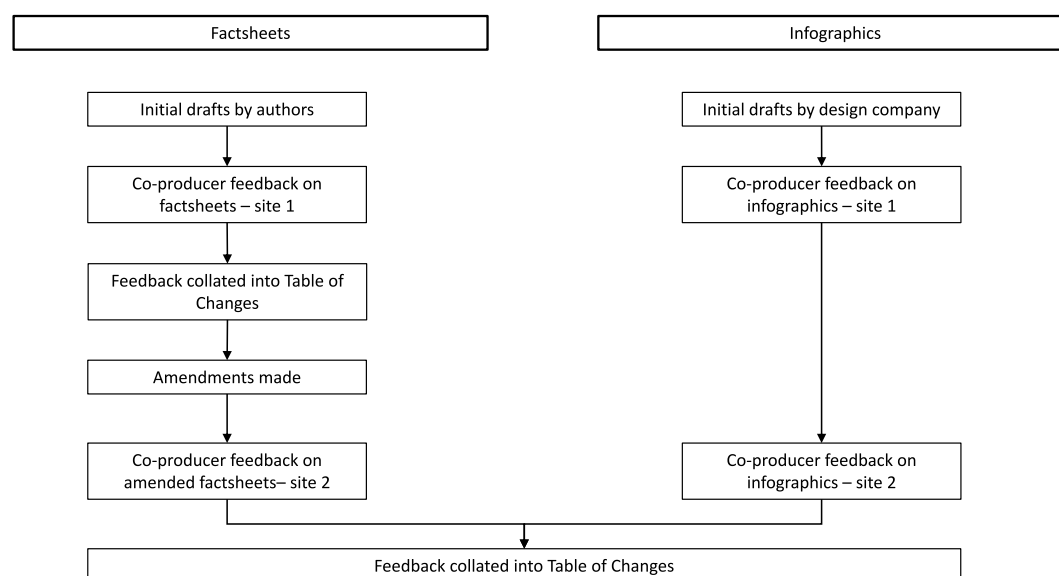


Fig. 1. Flowchart showing the co-production process.

no immediately known animal exposure).^{9–11}

In the UK, the UK Health Security Agency (UKHSA) recommend several protective behaviours that people who are exposed to AI should enact to prevent bird-to-human transmission of AI and to enable timely detection of AI in humans.^{1,12} First, full personal protective equipment (PPE) should be worn by people who work on infected premises, have direct contact with infected birds, or who are involved in the culling, disposal and clean-up operations at infected premises or rendering facilities.¹³ Second, people who were exposed to AI may be recommended antivirals (depending on the strain of the virus and the appropriate use of PPE^f). Third, people who have been exposed to AI are asked to report to their local health protection team (HPT) any influenza-like-illness or conjunctivitis symptoms developed within ten days of exposure, so that they can be tested and given appropriate health follow-up. To facilitate this, individuals are followed up for ten days after their last exposure by daily text message or telephone call from their HPT (active follow-up) or given information about symptoms and instructions on how to contact the HPT if they develop symptoms (passive follow-up).

Evidence suggested that uptake of recommended interventions in the UK was low,^{14,15} and that a lack of knowledge and trust in authorities were associated with decreased uptake of biosecurity measures.¹⁶ The need for tailored guidance has been highlighted.¹⁷ The aim of this project was to co-produce communications about AI to help increase uptake of, and informed consent for, protective behaviours using the Agile Co-production and Evaluation (ACE) Framework.¹⁸ We co-produced a simple English factsheet and infographic for.

1. Avian influenza,
2. Personal protective equipment and respiratory protective equipment (factsheet; two infographics produced, one each for donning and doffing PPE)
3. Antivirals (oseltamivir, Tamiflu®),
- 4a Monitoring and reporting respiratory symptoms and active follow-up,

- 4b Monitoring and reporting respiratory symptoms and passive follow-up.

2. Methods

2.1. Design

Our co-production was an iterative process of development, adaptation and optimisation, including the decision to develop factsheets and infographics, the initial drafting, mode of presentation, and refinement of materials. At each stage, we engaged with stakeholders including: epidemiological and subject-matter experts in AI; people involved in the public health response to AI (HPTs at UKHSA, who provide public health advice to exposed persons, conduct public health risk assessment and coordinate the public health response, including liaising with local authorities and the National Health Service [NHS] where further action is required by those agencies; the Programme Delivery Unit at UKHSA, who undertake projects to support the delivery of a consistent response across the different regions; the Acute Respiratory Infections lead and the Zoonotic Influenza Operational Group at UKHSA; and the Animal and Plant Health Agency [APHA]).

2.2. Co-producers

We invited people who had worked on infected premises, had direct contact with infected birds or who had been involved in the culling, disposal and clean-up operations at the premises or rendering facilities to help co-production. We contacted these people through a biosecurity agency and a catching company.

2.3. Procedure

The co-production process is depicted in Fig. 1. As materials were required rapidly, the project team (authors) drafted the first version of the factsheets. Materials were based on theories of health behaviours and the existing literature on supporting uptake of antivirals, wearing full PPE, symptom experience (including the nocebo effect), and messaging in different contexts and outbreaks (see Appendix 1). We attempted to incorporate all information into factsheets; infographics were intended to be a shorter and more accessible presentation of information.

People who have worked on infected premises gave feedback on

^f Under the strict approach in UKHSA guidance, people exposed to AI were recommended to take antivirals (up to 10 days after last exposure) even if they were wearing full PPE. New guidance was introduced in 2022/23 AI season specifically for A(H5N1). Under this strict modified approach people are only recommended to take antivirals if they are not wearing appropriate PPE or had a breach of PPE.

factsheets and infographics. LS and RP visited co-producers’ places of work in March 2024 and worked with co-producers to elicit feedback through survey questions delivered via a bespoke app (a format which is increasingly being used on site), and encouraging open conversation about the sheets and their experience of working on infected premises.

The order of presentation (factsheet or infographic first) was counter-balanced. We used seven survey questions to elicit feedback, including two scales (1–10) asking people to rate the sheet from worst to best, and to rate how much they felt they knew what to do from the sheet (‘not sure what to do’ to ‘know what to do’). We also included five open-ended questions asking what co-producers liked and disliked about the sheet, how they would make the sheet better and if there was anything missing, if the sheet was a sensible way to give instructions, if it would work for most people that they worked with, and if there was anything else they would like to tell us about the sheet. Finally, co-producers were asked whether they liked the factsheet or infographic best and why. Co-producers were asked for their feedback on both infographics for PPE (donning and doffing). Due to the similarity between sheets for monitoring symptoms and active and passive follow-up, co-producers were only asked about the sheets for monitoring symptoms and active follow-up. Co-producers could give feedback on up to two topics and were given a £12.50 Amazon voucher per topic.¹⁹ Co-producers who did not speak English gave feedback with the help of an informal interpreter. There were two co-production sessions with different co-producers in each session. Factsheets were updated after the first session, with an amended iteration being shown to co-producers in the second session. Infographics were not amended in the time between sessions. Each factsheet and infographic was co-produced with five to seven people.

2.4. Ethics

This work was conducted as part of a service evaluation of the UK Health Security’s standard operating procedures and guidance, with elements of patient and public involvement and engagement (PPIE) and did not require ethical approval. This was confirmed by a Research Ethics Facilitator at King’s College London.

2.5. Analysis

We iteratively amended the factsheets and infographics using the Person Based Approach Table of Changes to systematically collate all feedback and decide and record which changes were needed and why (Appendix 2).²⁰ Survey responses were collated, and responses to quantitative questions were investigated numerically (mean, median). Open-ended responses were collated by sheet (separating topic and factsheet/infographic), and themes within responses were identified. Notes from both co-production sessions were systematically collated and themes identified. Decisions to make changes were based on the importance of the change to enabling higher uptake of protective behaviours, repetition of a theme by multiple co-producers, and ease of making the change.

3. Results

3.1. Co-producers

Seventeen co-producers gave feedback (eight in the first session, and nine in the second session). Co-producers were predominantly male,

Table 1
Personal characteristics of co-producers.

Characteristic	Level	N (%)
Gender	Male	13 (76.5)
	Female	4 (23.5)
Age	16–34 years	7 (41.2)
	35–54 years	5 (29.4)
	55+ years	5 (29.4)
		5 (29.4)
Role	Biosecurity	3 (17.6)
	Catcher	6 (35.3)
	Operations/knowledge hub	3 (17.6)
	Other	5 (29.4)
		5 (29.4)
First language	English	12 (70.6)
	Bulgarian	3 (17.6)
	Polish	2 (11.8)

If percentages do not add to 100 %, this is due to a rounding error.

aged 16–34 years, most spoke English as a first language and all were white (Table 1).

3.2. Feasibility of factsheets and infographics

Generally, co-producers preferred the infographics to the factsheets (Table 2). Reasons included that they were easier to understand, more concise, showed you what to do, were more suited to busy people, were better for people who did not speak English as their first language, and were more visually appealing.

It was repeatedly stated that factsheets and infographics would need to be translated into the native languages of the sub-contractors. Co-producers thought that the sheets (factsheets and infographics) were a sensible way to give people instructions, as long as they were translated. Sheets could be distributed to all farms, with infographics permanently displayed on their Health and Safety board, biosecurity boards, or in changing rooms, and additional copies and factsheets kept in the farm office for people who would like more information. These could be distributed through the First Aider (mandatory for each site). The suggestion was that this should happen routinely because “in an outbreak there is too much going on, so they won’t put anything up. They need to have the resources there in peacetime, so that in a crisis, they can refer back to it”. While having a paper copy was preferable to email – as some people may not have internet access – it was also suggested that if the sheets were “on your phone, [they] would be easier and quicker to get to”. If paper copies of sheets were to be displayed, they would need to be laminated. Infographics on donning and doffing PPE could also be displayed in the portal (a dedicated area for transitioning from the clean to dirty side of infected premises, and vice versa).

Co-producers indicated that sub-contractors tend to live together in shared accommodation and do not have access to their own transportation, so the copies of the information could also be stored in vehicles used by the contracting companies to transport people between the infected premises and their accommodation.

There were repeated suggestions that a series of short videos accompanying each of the topics would work well, in particular for donning and doffing PPE, as long as they were translated. There was a preference for these to include “real footage” of people on infected premises, as these would be perceived as more credible. This came from the sense that guidance for the management of AI had been written by people working in an office for those on the ground for “ideal cases, but nothing is ideal in practice on a site”. A QR code linking to the video

Table 2

Numerical feedback on factsheets and infographics.

		Preferred format	What would you score this sheet? “1 -☹” to “10 -☺”		How much do you feel like you know what to do from this sheet? “1 -☹, I’m not sure what to do” to “10 -☺, I know what to do”	
			Mean	Median	Mean	Median
Avian influenza	Factsheet (n = 6)	0 (0.0)	6.7	6.5	7.8	8.5
	Infographic (n = 6)	5 (83.3)	7.8	8	8.5	8.5
	No preference	1 (16.7)	–	–	–	–
PPE	Factsheet (n = 5)	0 (0.0)	6.8	7	8.8	9
	Infographic (n = 7)	4 (80.0)	7.9	8	8.3	9
	No preference	1 (20.0)	–	–	–	–
Antivirals	Factsheet (n = 6)	0 (0.0)	8.0	8.5	9.3	10
	Infographic (n = 7)	5 (83.3)	8.7	9	9.0	9
	No preference	1 (16.7)	–	–	–	–
Monitoring and reporting symptoms	Factsheet (n = 6)	0 (0.0)	8.2	8.5	8.2	8.5
	Infographic (n = 7)	4 (57.1)	8.6	9	9.1	9
	No preference	3 (42.9)	–	–	–	–

could be included on the sheets.

There was the sense that people understood the sheets, but it was acknowledged by co-producers that this may have in part been due to prior knowledge and experience of working on infected premises. They stated that new starters “may not understand”, but that all new starters would receive an induction before starting the job. On-site briefings are also conducted at the start of each job, covering related topics, so sheets could be introduced and discussed at these.

Co-producers thought the information was clear, but expressed that “it may not be visible for everyone else, e.g., where will farmers see this ... how are you going to get this information out to that community?”. Suggestions for further dissemination of materials included through farming associations, farming magazines and newspapers, vet practices, big- and medium-level industry and enterprises (eggs and meat), membership groups, and biosecurity companies known in the industry, as well as on the GOV.UK website.

Perceived barriers and facilitators to enacting individual protective behaviours are reported in [Appendix 2](#).

3.3. Suggested changes to factsheets and infographics

Major suggested changes for factsheets and infographics have been narratively described (see [Appendix 2](#) for full table of changes).

Suggested changes for all sheets included: amending phrasing to remove repetition and to make sheets shorter, changing language to more closely match that used by workers on infected premises, amending sheets to ensure that all advice follows guidance (especially items of PPE and order of donning and doffing), making mental health support more prominent, and standardising how additional resources were presented (resources tailored to individual sheets). Co-producers felt that the risk of AI was overstated in the sheets. As an unintended consequence of this could be that people may start to reject the information in the sheets as being misleading, this could be amended so that there is less emphasis on severe illness. The statement about anticipated regret should be removed from the factsheet about antivirals.²¹ For infographics, some images were not immediately understandable if the reader could not read the accompanying English caption; these should be replaced. For example, it was not clear in infographics that experiencing symptoms of AI should trigger actions (self-isolating and calling the local HPT). Arrows could be added to make this clearer. There were some questions around whether it is the person’s duty to get in touch with the local HPT if symptomatic, or whether it is the HPT’s duty to be in touch with the person (as part of active follow-up). Sheets should clarify that people are followed up by HPTs because they are at high risk of developing symptoms, and that they should report symptoms in daily messages, but that they should contact the local HPT as soon as symptoms developed and not wait until their next check-in.

4. Discussion

This is a case study of how public health advice can be co-produced using the ACE Framework,¹⁸ to promote uptake of protective behaviour on premises infected with AI. Taking the time to visit co-producers’ places of work, and highlighting the importance of learning from their knowledge of working on site helped to develop a good working relationship.

4.1. Optimising guidance

The importance of co-production in increasing adherence to protective measures has been highlighted by other work investigating biosecurity on poultry farms,²² and in smallscale (‘backyard’) poultry keepers.¹⁷ Co-producers identified issues with factsheets and infographics, for example where to don and doff PPE and incorrect kit shown for disinfecting dirty boots, and added detailed insight into the practicalities of working on infected premises. Including co-producers who did not speak English showed us that some images used in infographics were ambiguous and could be misinterpreted if you could not read the accompanying text or if you were a new catcher and did not have prior knowledge of procedure. This highlighted the importance of translating materials to languages commonly spoken by the workforce. Some co-producers expressed the view that guidance for working on infected premises was an ‘ideal’ written by people who did not have experience of the reality of working on infected premises. Co-producing public health advice should help build the relationship between public health agencies and workers on infected premises, and promote credible information, thereby improving adherence to protective measures and reducing the risk of outbreaks of AI and other infections.

Factsheets and infographics were deemed an acceptable way to provide public health advice by co-producers, with many suggestions for how to operationalise this. Co-producers suggested that this should be done routinely ‘at peace time’, because in an emergency where AI is detected, there is no time to put up sheets or for people to process and understand new information. This should also help promote social norms for good practice. However, co-producers mentioned that this focus on infected premises would miss ‘backyard farmers’, who may not know about AI or have access to PPE if they came across a bird infected with AI. While this group is out of scope of the current project, materials could be circulated to people registered as bird owners.²³

It was repeatedly mentioned that videos would also be a good way to disseminate public health information, with QR codes linking to the videos. Previous literature has found that video training can lead to better donning and doffing procedure.²⁴ Co-producers stated that videos should be dubbed – not subtitled – so that they can be understood by people who do not read in their first language.²³

4.2. Identifying barriers to implementation

The co-production process helped optimise messaging, but also highlighted important barriers to implementation of guidance that messaging alone is unlikely to overcome. Low perceived susceptibility to and severity of AI was a barrier to uptake of all protective behaviours (wearing PPE correctly, taking antivirals, reporting symptoms).¹⁵ Even with imperfect adherence to PPE and where people were not taking antivirals, co-producers had never seen a case of AI among people working on infected premises, which further lowered perceived susceptibility to AI. Different strains of AI viruses are more or less severe to humans.²⁵ Public health measures are intended to protect people from severe disease and to reduce the risk of reassortment of the virus (where a host is infected with two types of influenza virus at the same time – e. g., seasonal and avian influenza – and the influenza viruses swap gene segments to create a new virus²⁶), minimising the possibility of a virus that adapts to become easily transmissible between humans.

Encouraging good practice and social norms of uptake of protective behaviours in all those present on infected premises may help promote adherence.^{15,27} Analysis of two H7N3 cases during the 2004 Canadian outbreak of H7N3 both presenting with symptoms of conjunctivitis found that neither had followed guidance.²⁸ Co-producers mentioned that where AI had been found, the infection had been “on” them (i.e., in their eyes or nose), rather than having been infected and shedding the virus. This is consistent with evidence from surveillance in England where detection of at least one case was likely to represent contamination of the respiratory tract, rather than infection.⁶ Emphasising the pandemic potential of AI may help improve adherence to public health advice.

A major barrier to wearing full PPE was the tough working conditions on infected premises.²⁹ Co-producers talked at length about high temperatures, dusty, and dark conditions (as birds go to sleep which makes them easier to catch) in sheds, fork-lifts driving in the shed, and birds sometimes being in states of decay. While it is better to prevent exposure using PPE, than to prevent the consequences of exposure using antivirals, wearing PPE is difficult and exacerbates already difficult working conditions. The importance of maintaining good adherence to PPE in the avoidance of AI cases should be emphasised.

While we did not measure uptake of Tamiflu® in this study, previous research has found varying rates of acceptance in poultry workers.^{28,30} More recently conducted qualitative research in the UK with people potentially exposed to AI found that workers generally took antivirals in a novel situation, but that side effects were the biggest barrier to uptake.¹⁵ Co-producers echoed these sentiments, saying that antivirals were prescribed in previous outbreaks but not routinely in more recent outbreaks, and that while they were “useful” they caused side effects. They suggested that Tamiflu® be available on site for those who wished to take it.

Exposed persons who develop flu-like symptoms within ten days from last exposure are recommended to self isolate until they have had a clinical review (and a negative test, if swabbed). Though not prompted, co-producers stated that sub-contractors often live in shared accommodation and so would be unable to isolate effectively from others within the household. Providing practical support for isolation may encourage adherence.³¹

In addition to affecting understanding of materials, language also presented a barrier to being able to report symptoms to HPTs if experienced, or engage with resources signposted in sheets. Previous work-arounds used by co-producers involved a bilingual team leader collating information about whether each team member had symptoms and feeding back on the health status of all team members to the HPT. Not wanting to divulge health information to supervisors or an interpreter may be a barrier to symptom reporting for some. For translated versions of sheets, signposting could be to materials developed by health departments or charities in workers’ home countries, as they may already be a trusted source of information.

4.3. Strengths and limitations

A particular strength of this co-production project was the richness of the insight given by people who had worked on infected premises and were experienced in procedures. They gave practical insight into how public health advice is operationalised, which is an important starting point for changing implementation with the ultimate aim of increasing uptake of protective behaviours. While we were aiming to rapidly co-produce this guidance, it took approximately 8 months from conception of the project to co-production sessions. This was due to the need to get input from multiple stakeholders, and to build a working relationship with people who work on infected premises. Establishing a “working group” of stakeholders early on in the project may help facilitate rapidity. Future projects on AI can build on these working relationships and should be carried out in quicker time. Co-producers were predominantly young males, and all were white. We are unaware of any official description of the make-up of this workforce, so cannot be certain of the generalisability of findings. However, sub-contractors tend to be temporary workers (particularly males) from other countries (co-producers indicated that these have often been countries in Eastern Europe in recent years), dependent on being able to secure a visa to work in the UK. We were unable to evaluate the co-produced sheets. This is an important next step to see if the sheets are acceptable, feasible, and ultimately, help increase uptake of protective behaviours.

4.4. Conclusions

We co-produced factsheets and infographics on AI, PPE, antivirals, and monitoring and reporting symptoms (active and passive follow-up) with people who work on premises infected with AI. These sheets were clear to most co-producers, but would need to be translated for people who do not speak English. Co-producers gave us practical information on ways of disseminating the information as ‘business as usual’ so that they were available in an emergency if a case of AI was detected. Recommendations are summarised in [Box 1](#). They suggested using videos filmed on site to reflect the reality of working on these jobs – which should also be dubbed – as a better way of delivering public health advice. Conversations with co-producers also gave valuable insight into working on infected premises, the practical application of public health advice, and how implementation could be supported.

Box 1

Summary of recommendations from findings.

Recommendations from findings.

- Using co-production can help tailor messaging to different audiences, fostering trust, and building a working relationship with different groups. This should decrease the perception that guidance and rules are written by people who do not understand the reality of the working context.
- Materials should be translated to languages commonly spoken by the target audience.
- Materials could also signpost to materials developed by health departments or charities in workers' home countries, as they may already be a trusted source of information.
- Developing video materials that are translated (dubbed, not subtitled) is an effective way of communicating with people who do not read in their first language.
- Information about biosecurity measures should be provided routinely, as people do not have the time or headspace to understand new information in an emergency.
- Co-produced materials could be circulated to others working with poultry (i.e., registered bird owners).
- Communication materials should promote an accurate understanding of the risk of avian influenza.
- Further work is needed to co-produce messages about the potential reassortment of avian influenza and its pandemic potential.
- Good practice and social norms of uptake of protective behaviours should be encouraged.
- The importance of maintaining good adherence to protective behaviours should be emphasised.

Author statements*Ethical approval*

This work was conducted as part of a service evaluation of the UK Health Security's standard operating procedures and guidance, with elements of patient and public involvement and engagement (PPIE) and did not require ethical approval. This was confirmed by a Research Ethics Facilitator at King's College London.

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Competing interests

LS, RP, CH, DW, and RA are employees of the UK Health Security Agency (UKHSA). IO is the Chief Medical Officer for Wales. There are no other financial relationships with any organisations that might have an interest in the submitted work in the previous three years and no other relationships or activities that could appear to have influenced the submitted work.

Availability of data and materials

Data sharing is not applicable to this article as no datasets were generated or analysed during the current study. This project used co-production and therefore was not a research study that generated data.

Author contributions

LS, AM, RP, SD, CH, DW, RA, IO, LY and GJR conceptualised the study. LS drafted the first set of factsheets and infographics with help from AM. LS and RP visited co-producers. LS put together the Table of Changes and made changes to the factsheets and infographics with guidance from AM, RP, SD, CH, DW, RA, IO, LY and GJR. LS wrote the original draft of the manuscript. AM, RP, SD, CH, DW, RA, IO, LY and GJR reviewed and edited the manuscript.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.puhe.2025.105976>.

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