INFLUENZA SUB-COMMITTEE OF THE JOINT COMMITTEE ON VACCINATION AND IMMUNISATION

Draft minute of the meeting held on 03 September 10:00-13:00

Members

Prof Jeremy Brown (JCVI)
Prof John Edmunds (LSHTM)
Prof Adam Finn (JCVI)
Dr Anthony Harnden (JCV Deputy)
Prof Matt Keeling (JCVI)
Dr John McCauley (Crick Institute)
Prof Andrew Pollard (JCVI Chair)
Prof Rob Read (JCVI)
Prof Anthony Scott (JCVI)
Prof Maarten Postma (JCVI)
Prof Lim Wei Shen (JCVI COVID-19 Chair)

Co-Opted Members (JCVI)

Julie Yates – England
Dr Jillian Johnston – Northern Ireland
Mrs Anne McGowan - Wales
Lorna Wilcox - Scotland

Medical Advisor

Prof Jonathan Van Tam (DCMO)

Observers

Karen Noakes (DHSC)
Joanne Yarwood (PHE)
Dr Mary Ramsay (PHE)
Julie Nugent (PHE)
Conall Watson (PHE)
Bamidele Famokunwa (DHSC)
Gbemi Babalola (DHSC)
Marianne Scholes (DHSC)
Angela Edwards (PHE)
Suzanna MacDonald (PHE)
Edwin VanLeeuwen (PHE)
Dr Jim McMenamin (PHS)
Josie Murray (PHS)
Samantha MacAllister (PHE)
Wendy Roach (NHS E)
Christopher Johnson (PH Wales)
Julie Hughes (NHS E)

Invited observers from Devolved Administrations

Stephen Thomas (Welsh Gov)
Laura Roddy (Northern Ireland)
Syed Ahmed (Scottish Gov)

Invited Experts

Dr Monique Andersson (Ox uni Hosp)
Professor Wendy Barclay (Imperial)
Professor Maria Zambon (PHE)

Secretariat

Mr Jonathan Crofts (PHE)
Mr Andrew Earnshaw (PHE)
Ms Ruth Parry (PHE)
Ms Helena Bird
Ms Jenna Gritzfeld

Apologies

Nick Andrews (PHE)
Deborah Tomlin (NHS England)
Claire Cameron (PHS)
Dr Kevin Brown (JCVI)
Dr Maggie Wearmouth (JCVI)

I. Welcome and Introduction

1. The Chair welcomed everyone to the meeting and highlighted the confidential nature of the issues under consideration and that these should not be discussed more widely outside the meeting or the documents shared. The main reason for the meeting was to agree advice for the influenza vaccines for the 2022/23 season to support operational planning around the ordering of the vaccines. This advice would then go to the main Committee for ratification.
2. The Committee were reminded that last year the JCVI had endorsed the continuation of the temporary extension of the influenza programme for 2021/22 to include all 50-64 years olds as well as extending the childhood programme to children up to year 11 in secondary school.
3. The advice for influenza vaccines in 2021/22 had been:
    - For those aged 65 and above the preference was to use the adjuvanted quadrivalent or the high dose quadrivalent influenza vaccines with the cell based quadrivalent vaccine (QIVc) or the Quadrivalent Recombinant Influenza Vaccine (QIVr) as acceptable alternatives.
    - For at risk adults under the age of 65 the preference was to use either QIVc or QIVr and the quadrivalent influenza egg-culture vaccine (QIVe) if those options were not available.
    - For those aged two to eighteen years old for whom the live attenuated influenza vaccine (LAIV) was not suitable, JCVI advised a preference for QIVc followed by QIVe.
    - for at-risk children aged less than 2 years of age in an at-risk group QIVe was the only licensed vaccine available.
4. The Committee noted that for the 2021/22season there were sufficient stocks of aQIV available in the system for the over 65s, QIV HD was not available due to cost, QIVc and QIVr were mainly available for adults under 65 plus some QIVe. DHSC had also secured a centrals stock of QIVc, QIVr and QIVe as back up supply.

II. Minute of the last meeting

5. Draft minutes of the Aug 2020 influenza subcommittee and the October 2020 JCVI meeting (influenza vaccine advice) were provided and no comments or questions received.

III. 2020/21 season update

6. The Committee noted that during the 2020/21 influenza season community and secondary care indicators showed very little Influenza activity with very low rates of GP consultations for influenza-like illness (ILI) and only 40 laboratory confirmed hospital admissions for influenza (normally 5000-10000) and 9 confirmed influenza (all influenza A) ICU admissions reported and no ECMO bed usage. RCGP sentinel swabbing surveillance confirmed 21 influenza cases of which 8 were LAIV strains and potentially 4 more. With the very low influenza activity there was not enough data with which to estimate vaccine effectiveness.

7. Influenza vaccine uptake across the UK population in 2020/21 was the highest ever. Uptake in those aged 65 years and at-risk groups under 65 years reached 81% and 53% respectively. Uptake in healthcare workers reached a record high at 77% whilst uptake in pregnant women was stable at 43.6 %. Among 50-64 year olds uptake was higher in at risk groups (66.3%) compared with those not in a clinical risk group (35.2%).
8. Experimental data collected on severe learning disability estimated uptake to be 66.4%. Uptake was significantly higher in 2020/21 compared with the 2019/20 season across all at-risk groups. Overall uptake in adults was slightly higher in females and by ethnicity was lowest in black Caribbean and mixed white and black Caribbean ethnic groups. In the childhood programme uptake from reception to year six increased by 2% to 62.5% and was 56.2 % in Year 7.
9. Where vaccine type code was recorded, 97.5 % of vaccinations in those >65 year old were with aTIV and in adult at-risk groups 64.7%, 31.6% and 3.7% of vaccinations were QIVe, QIVc and QIVr respectively.
10. The Committee received an update from John McCauley from the Crick Institute WHO collaborating reference centre on the 2021/22 northern hemisphere influenza vaccine composition and the global picture of circulating influenza strains. It was noted that:
    - the influenza A(H3N2) and A(H1N1)pdm09 vaccine strains for the northern hemisphere 2021/22 influenza vaccine had been changed from the previous year;
    - influenza activity in 2021 had been very low overall globally, but at least 40 countries had reported a minimum of 10 lab confirmed cases, the threshold for reporting. Some countries/regions had had more notable activity including Cambodia, Bangladesh, India, west Africa, and China;
    - China had mainly Influenza B viruses (Victoria lineage) in circulation over the last seven months;
    - new strains of A(H3N2) were detected in Cambodia and Bangladesh in 2020/21 and the Cambodia group was selected for the vaccine strain for the Northern hemisphere for the 2021/22 season, A/Cambodia/e0826360/2020(H3N2) - like virus;
    - The A(H1N1)pdm09 vaccine strain was changed to A/Victoria/5270/2019 – like virus due to some amino acid changes affecting antigenic properties compared with the previous vaccine strain;
    - strains of the Flu B Victoria lineage had been the main type in circulation and a new antigenically distinct strains were emerging. The vaccine strain had not been changed from B/Washington /02/2019, however, as candidate vaccine viruses had not been fully developed by February. B Yamagata Influenza viruses had virtually disappeared and,
    - activity for the 2021/2022 season remained uncertain and could be high, low or something in-between with a lot of uncertainty about how well matched the vaccine would be this season, especially for Flu B.

IV. NIHR commercial influenza vaccine studies

11. The Chair highlighted that vaccine effectiveness results generated by the UK GP sentinel surveillance network often had wide confidence intervals due to small sample sizes, making it difficult to compare vaccines. With the developments in COVID-19 surveillance there was now an opportunity to collect better data on influenza. It was noted that the Chair had written to the DCMO on the need to have timelier, informative, and adequately powered data on vaccine effectiveness.

12. The Committee agreed that it would be important to get flu vaccine records into the National Immunisation Management System (NIMS) for real time access to the data and to improve hospital surveillance to have better data on vaccine effectiveness against the more severe end of the spectrum. As demonstrated for COVID-19, hospitalisation data was also key for assessing the impact of influenza vaccination. Community surveillance was important in understanding better what is circulating and the burden of milder influenza infection, but VE might be lower against symptomatic infection than against hospitalisation as observed for COVID-19 vaccines.

13. The Committee noted that influenza surveillance was expecting to be using NIMS as the main data entry system for flu vaccination this winter. NIMS was originally designed for flu as the back-end driver for the NHS England (NHSE) call recall service and had been used last season for this and was now hosted to a bigger data warehouse. NHSE, held the contract for NIMS and would take suggestions about usage or for adding additional data fields.

14. It was noted that clinical risk factor information had not yet been transferred to NIMS and NHSE was seeking to obtain this information from NHS digital. The Committee agreed that having clinical risk data would transform the usefulness of the system. NIMS was still in development for some of the data and NHSE was working to close gap between operational data and official stats. Some data was not being captured such as private vaccinations in pharmacies as well as for vaccination in pregnancy.

15. The Committee noted that the National Institute of Health Research (NIHR) was looking to develop commercial trial platforms and attract manufacturers to test products as part of the global Britain outlook. The NIHR was looking to be manufacturer agnostic and wanted to align with JCVI in an advisory role/view on study design such as head to head comparison of products. There was strong support from JCVI for such an initiative, but a discussion was needed on how best to do this, either through the influenza subcommittee, or via a research group. The JCVI was probably not the right group in terms of advice on the details of study designs but more on the key questions that needed answering.

V. Presentations from manufacturers

16. The Committee welcomed from Sanofi Pasteur: Deborah Rudin: Global Medical Expert Influenza, US, Susan Farrow: Medical Lead Vaccines, UK, Babis Valmas: Value and Access Manager, UK. The Committee received a presentation on:

    - safety immunogenicity and efficacy of the quadrivalent recombinant influenza vaccine (QIVr) in those aged >50 years;
    - safety immunogenicity of QIVr in those age 18-49 years old;

- currently on-going studies and data timelines and,
- future vaccine developments.

17. The Committee noted that studies by Dunkle et al 2017 had demonstrated non inferior immunogenicity except against the Influenza B Victoria vaccine strain. Superior efficacy (30% rVE) had been demonstrated in a randomised control study comparing QIVr with QIVe in those aged over 50 years old, and non-inferiority immunogenicity had been demonstrated in 18-49 year olds. These results were generated during the A(H3N2)-predominant 2014–2015 influenza season, which was a particularly poor year for antigenic correspondence between the vaccine and the virus in circulation.
18. The manufacturer highlighted an observational study (Izurieta 2020) that showed during the 2019/20 season in the US, QIVr was significantly more effective in preventing influenza hospital encounters compared with QIVe in a five vaccine comparison, and influenza hospital encounters and inpatient stays in a direct comparison with QIVc.
19. The Committee noted two ongoing studies:
    - a cluster randomised observational study looking at rVE against QIVe in 50-64 year olds (18-49,18-64) run by the Kaiser Permanente Northern California health consortium. The final clinical study report was expected May 2022 and,
    - a modified cluster randomised trial in nursing home residents (Gravenstein et al) looking at hospitalisation rates comparing QIVr with QIVe.
20. The Committee noted that the manufacturer was evaluating the safety and immunogenicity of an mRNA monovalent flu vaccine candidate coding for the hemagglutinin protein of the A(H3N2) strain of the influenza virus.
21. The Committee questioned the manufacturer on the RCT study by Dunckle et al on the rVE and immunogenicity of QIVr. It was noted that:
    - although the rVE (30%) was significant the absolute VE against AH3N2 was 12% and against Flu A and B was in the low to mid 40% range for ages 50-64 and 65+ years.
    - GMTs were evaluated against vaccine like strains and not against circulating virus.
22. It was noted that the data showing superior rVE of QIVr compared with QIVc(Izurieta et al) was during an A(H1N1)pdm09 dominated season and that presumably the difference related to dose since QIVr had a 3X higher antigen content (45 µg) compared with standard dose flu vaccines including QIVc.
23. No head to head data were available comparing QIVc with QIVr or an egg adapted A(H3N2) during an A(H3N2) dominated season. In general, there was a dearth of comparison data of QIVr with other vaccines and most of the data was generated in the US and QIVr was still a fairly new product in other countries.
24. The Committee welcomed the following representatives from Seqirus: Dr. Raja Rajaram, Dr. Mansoor Ashraf and Dr. Constantina Boikos. The Committee received a presentation on:
    - an overview of aTIV data;

- an overview of QIVc data;
- QIVc in pregnancy and individuals aged 6 months plus and,
- pipeline products and licence extensions.

25. The Committee noted that that Seqirus supplies aQIV and QIVc to the UK in large quantalities. aQIV is used in the elderly to mitigate immunosenescence with a body of published evidence showing superior effectiveness compared with standard dose egg-based vaccines and non-inferiority compared with the high dose influenza vaccine.
26. The manufacture presented unpublished data from two recent studies. One using methods from the manufacturers Centre of Outcomes Research and Evaluation (CORE) using electronic medical records, presented at the European congress of clinical microbiology and infectious diseases (Imran M et al 2021). This showed superior rVE for aQIV compared with QIVe and QIV HD against influenza related medical encounters in those aged 65 years and above.
27. Another unpublished study from Seqirus's Health economics and outcomes research (HEOR) using medical claims data on hospitalisation indicated a similar effectiveness for aTIV compared with QIV HD against influenza related hospitalisation.
28. The manufacturer presented a snapshot of studies comparing QIVc with the egg-based vaccines QIVe or TIVe showing either superior or non-inferior vaccine effectiveness vaccine
29. Unpublished data presented from a CORE study in ages ≥4 years of age comparing QIVc with QIVe indicated a significantly superior VE overall and in most age groups except those aged ≥ 65 years where QIVe performed better.
30. Unpublished data presented from an HEOR study in ages 4-64 years showed QIVc performed better in preventing hospital encounters compared with QIVe.
31. The Committee noted post marketing safety data from a prospective observational cohort of pregnant women immunised with QIVc, as required by the FDA, showed no observed safety concerns.
32. The Committee noted QIVc had now been licensed from the age of 6 months in the US but in Europe and the UK the indication was from aged 2 years and the EMA had asked for efficacy as well as immunogenicity data.
33. The Committee noted data from a multi-centre randomised non inferiority trial assessing the immunogenicity and safety of QIVc compared with QIVe in children aged 6 months to 23 months and 24 to 47 months old.
34. GMT ratio results were provided which showed immunogenicity results for QIVc to be non-inferior for all vaccine strains when compared with QIVe. QIVc also had a similar safety and tolerability profile compared with QIVe with tenderness and erythema the most common local adverse events (AE) and irritability and sleepiness the most common systemic AEs.
35. The Committee noted that an adjuvanted cell-based influenza vaccine was in development (aQIVc) which had completed a phase one clinical study and had

entered phase two. A self-amplifying mRNA influenza vaccine was also in development by the manufacturer.

36. The Committee highlighted a concern in the CORE study comparing QIVc with QIVe noting higher VE overall for the cohort ≥ 4 years than when stratified by age groups. The manufacturer suggested this was due to redrawing the sample weighting and the denominators changing. These results were met with some scepticism within the committee.

37. The Committee queried why in the CORE study comparing QIVc with QIVe the rVE in >65s was negative (favouring QIVe) compared with that observed in <65s (favouring QIVc). The manufacturer agreed this was unexpected and suggested that there was an imbalance between outpatient and inpatient consultations (which tended to drive the VE estimates) due to the impact of Covid 19 measures during 2019/20. The potential role of immune senescence impacting on immunity in the >65s could not be ruled out. The potential benefit of QIVc from egg adaptation would not have been realised in what was an A(H1N1) season and the vaccine only contained the standard 15 microgram dose.

38. The Committee agreed the QIVc data above made sense in the context of the general move towards higher dose and adjuvanted vaccines in this age group and would like to see the availability of an adjuvanted QIVc vaccine. It was noted that the projected timelines for licensure as long, but the manufacturer had to follow the regulatory pathway and was investigating different antigen and adjuvant quantities for this product.

39. The Committee concluded that the data presented by the manufacturers had not moved much further on partly because an influenza season had been lost due to COVID-19. There also remained confounding issues in the statistical analyses presented by the manufactures. The Committee agreed there did seem to be a trend favouring higher dose or adjuvanted products performing better in the elderly and QIVc should theoretically be better in an A(H3N2) season when the impact of egg-adaptation on the effectiveness of egg-based vaccines might be significant.

VI. Influenza vaccine advice for 2022/23

The Committee considered advice for Influenza vaccines for the 2022/23 season:

Children aged less two years old

40. For vaccination of at-risk children aged less than 2 years of age in an at-risk group The Committee advised to stay with the current advice which was to use QIVe but that QIVc could also be considered for off label use after further review of the safety and immunogenicity data. It was noted that QIVc would also be appropriate for use in egg allergic children.

Children aged two to less than 18 years of age in an at-risk group

41. For vaccination of children aged two to less than 18 years of age in an at-risk group, the live attenuated influenza vaccine (LAIV) remained the first choice. In those for whom LAIV was not suitable, the Committee agreed the use of the

influenza vaccines in the following order of preference: QIVc followed by QIVe if QIVc was not available.

42. The Committee noted that the policy to continue to offer LAIV on a recurrent basis up to year 11 was still being decided but that the view was to continue to do so on a recurrent basis, funding permitting. The JCVI advice was that there was a good rationale for continuing to do so, especially if this seasons flu activity was not high with the potential for a resurgence in 2022/23.

At-risk adults (including pregnant women) aged less than 65 years of age

43. For this group the Committee considered there was no need to change the advice from the previous year though there was a theoretical reason that QIVr might perform better as it contained a higher dose, however, there was no preference at this stage. Price also an issue in the market and might limit availability. Therefore, the Committee was not in a position to change advice at present but agreed that there was a need to encourage head to head studies and have both QIVc and QIVr being used in the system to evaluate them properly

44. A systematic review with network meta-analysis was suggested for head to head comparisons but there was not enough QIVr data to do this currently. A similar discussion had been had last time on the high dose vaccine to have this used in the system to be properly evaluated. This had not happened due to the cost of this vaccine.

45. The Committee agreed there was a need to have a mechanism for the real-world evaluation of vaccines in the UK system as currently the planning for the programme was last minute. The Chair requested for DHSC to consider how to manage this question particularly for at risk groups who may respond less well to lower dose vaccines.

46. The Committee noted that for the coming influenza season a large proportion of QIVr had been secured by DHSC for a central stock and approximately 1.5 million doses were available to the UK. If QIVr was used in large quantities, this could generate some VE data this year. The Committee noted that a drawback was the reluctance of GPs to purchase QIVr due to costs incurred and reimbursement fees which were better for other flu vaccines. Approximately 300 000 doses of QIVr had been ordered by GPs. The Committee asked UKHSA to take up this issue with DHSC.

47. The Committee agreed the advice should for vaccination of adults aged 18 to less than 65 years of age in an at-risk group would remain with QIVr and QIVc preferred with no preference between the two. QIVe could also be considered for use in this age group if other options were not available.

Adults 65 years of age and over

48. For vaccination of those aged 65 years and the Committee advised that aQIV or QIV HD were preferred. The Committee agreed there was enough theoretical evidence to make QIVr equivalent and that it made sense to include this as also preferred as it was higher dose and covered the potential issue of egg adaptation.

49. The Committee considered how to encourage take up of QIVr because of the cost implications issues. The Committee agreed that central procurement was the only answer from a scientific and strategic view, but this would impact on GPs in terms

of the funding they receive for reimbursement. Central procurement would not be possible in time for 2022 and needed to be planned. The Committee noted that that DHSC was working on this with tripartite partners. Strong messaging about the ability to do proper evaluations on influenza vaccines was needed requiring action on both surveillance and procurement. It was suggested that the control of clinical effectiveness and evaluations should be factored into policy considerations for central procurement presented to the Secretary of State for Health. If need be the Committee could write to SoS in support of this.

VII. Modelling update (PHE)

50. The committee received a modelling update from PHE on recent and planned work. The Committee noted a publication by Wentzel et al on the impact and cost effectiveness (CE) of the childhood programme based on the model developed by PHE (Baguelin et al.; 2015) which had been used to inform JCVI's original recommendation for the childhood influenza programme in 2012.

- the model had been updated with more Influenza seasons included and looked in more detail at the paediatric programme;
- the model assumed a 50% uptake in low risk groups and a VE of 70% across all ages except for the elderly;
- results showed that all childhood vaccination strategies were incrementally cost-effective for the different age groups looked at (aged 2-4, 2-11,12-16 years old), compared with the base case of vaccinating the elderly and risk groups;
- the primary school programme had a bigger impact in terms of cases, hospitalisations and deaths averted compared with vaccination in secondary schools and had a lower cost per QALY and,
- in terms of CE the ordering would be: 5-11, 5-16 and 2-16-years age groups and these were CE at 30%, 55% and 70% uptake but higher uptake resulted in lower CE per dose.

51. Using the original model developed by Baguelin, PHE had looked at the impact of high uptake scenarios for the paediatric, high risk, elderly and 50-64 target groups to inform uptake ambitions for the 2021/22 season based on the 2020/21 uptake:

- caveats included not accounting for uncertainty in vaccine efficacy and burden, epidemiological and social data were now quite old and the mortality estimates used hospitalisation data only which would likely be an underestimate especially in the elderly;
- willingness to pay for vaccine was highest in the childhood programme followed by high risk groups aged18-64, adults aged 50-64 and the elderly, and
- results showed higher uptake was likely to be cost effective for all programmes going from 55% to 75% to 95% uptake except in the elderly which was already at 80% and VE was low in this group. Increasing uptake to 90% in the elderly the willingness to pay threshold was below a realistic price per dose for vaccination and borderline for 50-64 year olds. Therefore, the best way to provide additional protection for the elderly group was by the

additional indirect protection afforded by increasing uptake in the other groups especially the childhood programme;

- results therefore indicated that increased uptake in paediatric and high-risk groups to be the highest priority.

52. The Committee noted that the pandemic had delayed the plans to update the PHE model but that these were now resuming. This would include:
    - adding more recent clinical, virological and uptake data;
    - accounting for vaccine efficacy uncertainty;
    - updating the contact model, and
    - using all cause excess mortality as a data source to estimate mortality data.
53. The Committee noted that PHE planned to develop a multiyear/ multi subtype model which would treat influenza seasons and subtypes completely independently. This would be able to explicitly model boosting and waning of immunity. The new model would have some advantages over the current model including more power for assessing the vaccination programme and to look at the long-term impact of this.
54. The Committee noted that the VE estimates used for the current model in the elderly which were 24%, 60%, 79%, for A(H3N2) A(H1N1) and B, respectively, would have been based on the standard egg-based vaccines and did not account for the newer vaccines now being used (aQIV, QIVr and QIVc) .
55. The Committee noted Warwick university had developed a model which incorporated immunity and waning and could be used to make projections for future seasons. (Hill et al). Warwick had modelled projections for the 2021/22 influenza season based on the result of the impact of the non-pharmaceutical intervention (NPIs) due to COVID-19 which had heavily curtailed influenza activity during 2020/21. Results indicated the 2021/22 season could potentially be between 25%-75% larger in terms of hospitalisations and mortality than what might be expected without the NPIs in 2020/21. The reproduction number (R) could be higher due the presence of more susceptibles in the population.
56. Caveats noted included some level of precautionary behaviour might still be in place reducing the number of contacts, greater uncertainty over vaccine efficacy which might be less typical due to the limited data to select the vaccine strains, and a missing influenza season has not been modelled before and there was no previous example of this in the real world.
57. Questions were noted on what the immunity gap might be and impact on this of the vaccine programme compared with that generated by natural infection. The question was also raised of what might happen with a combination of waning immunity and the circulation of antigenically drifted influenza strains circulating. There was also the potential that if the behaviour change was enough then this might reduce influenza activity this coming season (2021/22) and lead to the next season (2022/23) being more intense.
58. The Committee noted an interim WHO systematic review paper prepared for the WHO SAGE Working Group on Influenza Vaccines on the influence of prior

season vaccination on current season VE. This indicated a residual 30% VE in the unvaccinated if they had been vaccinated in the prior season.

VIII. Policy update (DHSC)

59. The Committee received an update from DHSC noting that the priority was to extend the schools programme on a recurrent basis as well as whether to maintain the extension of vaccination to 50-64 year olds if COVID-19 remained a concern in 2022/23. DHSC planned to work with the secretariat and UKSHA on data requirements for the future to inform the programme, how the COVID-19 programme and flu programme might work in the future and the potential for the alignment of risk groups..

60. The Chair confirmed that JCVI was supportive of fully extending the childhood programme on a routine basis which is highly cost effective whilst the decision on 50-64s, which was borderline from a CE perspective, would be more a policy decision based on available funding and the circumstances concerning COVID-19 cocirculation. The Committee noted that, for NHSE operational planning, a decision would be needed early about any additional cohorts that might be added because of the timelines on ordering vaccine and their delivery.

IX. AOB

61. There was no AOB

Selected references

Dunkle LM, Izikson R, Patriarca P *et al*. Efficacy of recombinant influenza vaccine in adults 50 years of age or older. *New England Journal of Medicine*. 2017;376(25):2427-36.

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Hill EM, Petrou S, de Lusignan S *et a*l. Seasonal influenza: Modelling approaches to capture immunity propagation. *PLoS Comput Biol* 2019;15(10): e1007096. https://doi.org/10.1371/journal.pcbi.1007096

Hill EM, Petrou S, Forster H *et a*l.Optimising age coverage of seasonal influenza vaccination in England: A mathematical and health economic evaluation. *PLoS Comput Biol* 2020; 16(10): e1008278. https://doi.org/10.1371/journal.pcbi.1008278

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Declarations– (Conflicts of interest specific to COVID-19 vaccines)

Prof Sir Andrew Pollard (Chair)
Professor Pollard receives no personal payments from the manufacturers of vaccines He leads academic trials and publicly funded research on vaccines, where the research is not funded by vaccine companies: Non-commercial: Grants from Wellcome and Bill & Melinda Gates Found'n on typhoid vaccines (Tybar-CV, Bharat Biotech, 2013-current); from MRC on paratyphoid vaccine (U. Maryland; from 2018-)); Grant from the Gavi on pneumococcal vaccines in Nepal (2013-current). European Commission (EC): EC IMI grants (EBOVAC), on Ebola vaccine (Janssen; 2015-current); (PERISCOPE) on pertussis vaccines (2016-current); (RESCEU and PROMISE) on RSV biomarkers (2016-Current). EC H2020 grant (PERFORM/DIAMONSD) on fever in children and pneumonia (2016-current). Grants from Innovate UK to develop plague, zika, Q fever vaccines (2016-current). Grant from Meningitis Res Found'n on a booster of Bexsero in teens (2018-current), from BMA on RSV, and MRC on novel meningococcal vaccine; Grant from Bill & Melinda Gates Found'n on evaluating infant schedules (2019 – current). The University of Oxford has entered a partnership with AstraZeneca for the development of a coronavrius vaccine. He chaired the scientific advisory group on vaccines for the European Medicines Agency until March 2020 and is a member of the World Health Organization's SAGE. He chaired the scientific advisory group on vaccines for the European Medicines Agency until March 2020 and is a member of WHO's SAGE. Other investigators in the Department conduct research funded by vaccine manufacturers and the Department has received unrestricted educational grant funding for a one-day course on infection and immunity in children from Seqirus, and MSD in July 2021. Professor Pollard is a lead investigator on studies involving the ChAdOx1 SARS-CoV-2 (COVID-19) vaccine. Professor Pollard does not attend any discussions at the Committee regarding SARS-CoV-2 vaccination.
Prof Anthony Harnden (Deputy Chair)
Professor Harnden has no registered conflicts of interest.

Prof Adam Finn

Professor Adam Finn receives no personal payments from the manufacturers of vaccines.

Professor Finn undertakes unpaid advisory work for Astellas on a klebsiella-pseudomonas vaccine.

Professor Finn's Department receives funding for consultancy work from VBI vaccines on a developmental Hep B vaccine, and Bionet on a developmental pertussis toxin vaccine.

The University of Bristol conducts research funded by GSK on meningococcal carriage, by Pfizer on pneumococcal carriage and transmission.

Professor Finn is the local Principle Investigator at Bristol for trials of the University of Oxford ChAdOx vaccine.

Professor Finn is also chief investigator for trials for Valneva and Sanofi Pasteur on their respective COVID-19 vaccines

Prof Matt Keeling

Professor Matt Keeling has no registered conflicts of interest.

Professor Matt Keeling is a member of SPI-M and occasionally sits on SAGE

Prof Wei Shen Lim (JCVI Chair COVID-19)

Professor Lim has no registered conflicts of interest

Other information

Professor Lim's institution has received unrestricted investigator-initiated research funding from Pfizer for a study in pneumonia in which Professor Lim is the Chief Investigator (non-vaccine related), and from NIHR HTA for clinical trials in which Professor Lim is the Chief Investigator.

Professor Lim is:
Co-investigator of the NIHR-funded (COVID19) RECOVERY Trial.
Co-investigator of the UKRI/NIHR funded PROTECT-CH (PROphylactic TrEatment of COVID in Care Homes) Platform Trial

Expert Panel Member: NICE COVID19RapidGuidelines
Member of the New and Emerging Respiratory Viral Threats Advisory Group (NERVTAG) and occasionally sits on SAGE.
Member of UK-CTAP anti-virals sub-group
Member of UK Specialist Commissioning Group – Remdesivir, Tocilizumab
National Lead, NCEPOD Pneumonia
National Lead, National CQUIN in Community Acquired Pneumonia
National Lead, British Thoracic Society Community Acquired Pneumonia Audit Programme

Prof Jeremy Brown
Professor Brown has received payment for consultancy work from ImmunoBio on a novel pneumococcal vaccine. Professor Brown's Department has undertaken work for Novartis on the effects of monoclonal antibodies on vaccine responses. Other information Professor Brown has/is: MRC and Wellcome research funding not related to COVID-19 vaccines University College London (UCL) and University College London Hospital (UCLH) BRC and Rosetrees charity funding for work on COVID-19 serological responses and post-COVID lung damage Local principle investigator for the multicentre PHOSP COVID study phenotyping patients after being hospitalized with COVID-19 pneumonia Working on UCL / UCLH clinical studies of the longer-term effects of COVID-19 pneumonia
Dr Martin Williams
Professor Martin Williams has no registered conflicts of interest. Professor Williams holds a contract for work with Public Health England.
Ms Alison Lawrence
Ms Alison Lawrence has no registered conflicts of interest
Prof Maarten Postma
Professor Postma has received honoraria from SP (health economics) MSD (health economics) and is an advisor to companies on Rotateq and Rotarix vaccines. Professor Postma works for the University of Groningen which receives grants from SP, Seqirus, AstraZeneca and GSK for work related to influenza vaccines. Professor Postma attends advisory boards unrelated to vaccines or vaccine industry Professor Postma organized a conference which was financially supported by Pfizer relating to Health Economics. Professor Postma works for the University of Groningen which has an external PhD student who is employee at Sanofi Pasteur working on a thesis on high dose influenza vaccine.

Prof Robert Read
Professor Read has no registered conflicts of interest Professor Read receives no payments from the manufacturers of vaccines. The University of Southampton receives CASE studentship awards from Novartis and GSK
Prof Anthony Scott
Professor Scott has no registered conflicts of interest Professor Scott receives no payments from the manufacturers of vaccines. Professor Scott is Director of the Health Protection Research Unit at the London School of Hygiene and Tropical Medicine. He receives research funding from the National Institute for Health Research, the Medical Research Council, the Wellcome Trust and Gavi, The Vaccine Alliance, and the Bill & Melinda Gates Foundation.
Dr Maggie Wearmouth
Dr Wearmouth has no registered conflicts of interest
Professor Simon Kroll
Professor Kroll has no registered conflicts of interest Professor Kroll received research funding from Meningitis Now, to investigate carriage of meningococci and non-pathogenic Neisseria in infants. The funding period ended in 2018. He is the Honorary Medical Director of Meningitis Now
Dr Rebecca Cordery
Dr Cordery has no registered conflicts of interest Dr Cordery works for Public Health England
Dr Kevin Brown
Dr Brown has no registered conflicts of interest Dr Brown works for Public Health England
Dr Jillian Johnston (co-opted member)
Dr Jillian Johnston has no registered conflicts of interest

Mrs Anne McGowan (co-opted member)
Mrs McGowan receives no payments from the manufacturers of vaccines Mrs McGowan's employer Public Health Wales develop educational materials with funding from Pfizer, Sanofi Pasteur MSD, Novartis, Astra Zeneca and Wyeth.
Dr Lorna Willocks (co-opted member)
Dr Lorna Willocks has no registered conflicts of interest
Ms Julie Yates (co-opted member)
Ms Julie Yates has no registered conflicts of interest
Dr John McCauley (Crick Worldwide Influenza Centre)
Dr John McCauley has no registered conflicts of interest
Prof Wendy Barclay (invited expert)
Prof Wendy Barclay has received honoraria for advice given concerning seasonal influenza vaccine from Seqirus, Astra Zeneca and Sanofi Pasteur
Professor John Edmunds OBE
Personal/non-specific, partner worked for GSK until May 2020.