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Original Research

Comparing public knowledge around value of hand and respiratory hygiene, vaccination, and pre- and post-national COVID-19 lockdown in England

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ABSTRACT

Objectives: The COVID-19 pandemic spotlighted the importance of infection prevention and control (IPC) measures. Existing literature focuses on healthcare professionals, whereas this article explores changes in public knowledge of IPC, where knowledge is comparably sparse.

Study design: National surveys were conducted before (March 2020) and after (March 2021) the COVID-19 lockdown across England.

Methods: A telephone survey of 1676 adults (2021) and a face-to-face survey of 2202 adults (2020) across England were conducted. Key demographics were representative of the population. Weighted logistic regression with composite Wald P-values was used to investigate knowledge change from 2020 to 2021.

Results: Compared with 2020, significantly more respondents correctly stated that infections can spread by shaking hands (86% post vs 79% pre; P < .001) and that microbes are transferred through touching surfaces (90% vs 80%; P < .001). More knew that hand gel is effective at removing microbes if water and soap are unavailable (94% vs 92%; P = .015); that when you cough, you may infect other people near you in a room (90% vs 80%; P < .001). Knowledge that vaccination protects others from infection also increased (63% post vs 50% pre; P < .001). There was also significant increase in those confident in their answers.

Conclusion: Knowledge of IPC measures was higher in 2021 than before the pandemic. Future public health hygiene campaigns should capitalise on this and emphasise that continuing hygiene behaviours, and vaccination can help prevent acquisition and illnesses with other non-COVID-19 infections, thus reducing the strain on the national health service.

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Introduction

In the 19th century, Semmelweis, ‘father of infection control’, noted the importance of good hygiene in the prevention of spreading infections. To this day, hand washing remains one of the most effective methods for infection prevention and control (IPC) and thus featured in Government guidelines to help to curb the risk of infection transmission during the COVID-19 pandemic. The pandemic wreaked destruction worldwide, and the United Kingdom was one of the hardest hit countries, with almost 23 million cases, resulting in more than 180,000 deaths. It is feared the pandemic may have had caused greater morbidity and mortality had these hygiene guidelines not been issued to the public.

Existing studies have explored public understanding of COVID-19 as well as behaviour change in response to the pandemic, such as social distancing and frequency of hand washing. There is also a plethora of literature reporting handwashing techniques and adherence in a healthcare setting, especially in-light of COVID-19; however, it cannot be assumed that the knowledge of trained professionals is comparable to that of the general public. This article seeks to address this gap by assessing public understanding of IPC.

Public Health England regularly conducts surveys of the English population to determine health-seeking and self-care behaviours for common infections and understanding of antibiotics. In
in 2020, nine IPC questions were introduced. Given the recent COVID-19 pandemic, and the abundance of UK Government messaging and recommendations relating to IPC, including the slogan ‘hands, face, space,’ it is important to monitor changes in public understanding of IPC, so to indirectly assess the impact of public health messaging, and to ensure the public are equipped with the knowledge needed to keep themselves and others safe. To this end, the survey was repeated in 2021, with the results from early March 2020 (presented herein) serving as a prepandemic baseline from which to investigate changes in public understanding of IPC.

Methods

The market research company Ipsos MORI conducted interviews as part of routine surveys across England. The baseline survey,13 carried out between January 24 and February 24, 2020 (before the COVID-19-related lockdown in England) was performed face-to-face in the interviewees’ own home via computer-aided personal interviews. Because of national lockdown restrictions, the 2021 survey, carried out between 26 February and 2 March, could only be conducted remotely and therefore was undertaken via computer-aided telephone interviews. Partially completed interviews (i.e., if the participant terminated the interview) were excluded. Representativeness of the sample was ensured (in 2020) by two-stage random sampling,13 where interviewees were given age, gender, household tenure, and working status quotas of respondents; and (in 2021) by random digit dialling, and publicly available targeted data (see the appendix for more details).

Questionnaire

Questions were developed in collaboration with researchers, general practitioners, non-healthcare advisors, and the Ipsos MORI’s health questionnaire team. Computer-assisted interviewing ensured that the questionnaire was followed correctly for all respondents; partially completed interviews (if participants terminated the interview) were excluded. Nine IPC statements, incorporating hand and respiratory hygiene, were asked (see Box 1). Participants were asked to give a single response for each statement, indicating whether they thought statements were definitely true, probably true, probably not true, definitely not true, or don’t know. The use of this 5-point scale provides insight into confidence of respondents’ answers and encourages participants to provide an answer, rather than responding ‘don’t know’. Statements were randomly ordered, the response scale was reversed for half the respondents, and interviewers were asked not to prompt.

Data analysis

To ensure the results are broadly representative of the population, Capibus uses a random iterative weighting system to correct for known selection biases, which weights survey data to the latest set of census data or mid-year estimates and national readership survey profiles for age, social grade, region and working status, within gender and additional profiles on tenure and ethnicity. Pearson’s Chi-squared test, corrected for survey design,15 was used to test for differences in proportions across levels of categorical variables and between each statement in the 2020 and 2021 surveys. Weighted logistic regression was performed on each outcome separately. Wald (composite) P-values were quoted, with the odds ratio (OR) and 95% confidence intervals (CIs). A series of models were fitted for each outcome and all explanatory variables. Each model consisted of an interaction between survey year (2020/2021) and explanatory variable under consideration together with their main effects, and the remaining explanatory variables as main effects only. The P-value was for the interaction, with 5% taken as the significance level. Stata was used for all analyses (StataCorp. 2017. Stata Statistical Software: Release 15. College Station, TX: StataCorp LLC).

Explanatory variables

Table 1 details the explanatory variables of the multivariable analysis. Social grade of the household is determined by the occupation of the chief income earner. Social grade AB comprises high or intermediate managerial, administrative, or professional workers; C1 Supervisory, clerical and junior managerial, administrative or professional workers; C2 skilled manual workers; D semi/unskilled manual workers; E State pensioners, casual or lowest grade workers, unemployed with state benefits only. A respondent’s highest level of educational attainment was classified according to general certificate of secondary education: further education (A level or equivalent) and higher education (degree or equivalents). Ethnicity was dichotomized, and the results from non-White respondents were collapsed into the category termed BAME (Black, Asian and minority ethnic) respondents, with data compared against that from White respondents. The authors would like to address that the use of the phrase BAME refers to any respondent who did not self-identify as White (which accounts for ~15% of the population in England16). The implications of dichotomising ethnicity are discussed in the limitations. In the larger survey, of which this forms part,13 respondents were asked

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Box 1

New questions asked in 2020 about infection prevention (correct answer)

| Infection prevention and control statements asked of respondents. Statements were presented in a random order Possible responses: definitely true, probably true, probably false, definitely false, don’t know. Next you will see a series of statements about preventing infections. For each statement, please tell me whether you think it is true or false. |
| Hand hygiene |
| 1. Washing your hands with soap and water removes more microbes than just water True |
| 2. Using hand gel can help stop the spread of infection if soap and water is not available True |
| 3. Infections do not spread from you to others by shaking hands False |
| 4. We do not pick up microbes on our hands from surfaces (such as tables and chairs) False |
| Respiratory hygiene |
| 5. Bacteria and viruses get on your hands when you sneeze into a tissue True |
| 6. People don’t need to clean their hands after sneezing into a tissue False |
| 7. You do not infect other people around you when you cough False |
| 8. Microbes in sneezes can travel the length of a bus True |
| Vaccination |
| 9. Vaccination of one person also protects other people from infection True |

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whether, in the last 12 months, they had an infection or visited a healthcare professional.

Ethics approval

The Ipsos MORI surveys and interviews were undertaken outside the national health service (NHS) setting, and NHS Research Ethics Committee review is not required for healthcare market research conducted by professional market researchers. This ethical position was confirmed by the Head of Research Governance, Research Translation & Innovation Division at Public Health England. Ipsos MORI is an independent research agency bound by the rules of the Market Research Society. The surveys are regular household ‘consumer’ surveys into which clients of Ipsos MORI can insert sets of questions. Consent for personal responses to be used by Ipsos-MORI clients for research purposes is indicated by verbal agreement and by the member of the household voluntarily completing the survey questionnaire/interview. There were no financial or other incentives, and participants were free to withdraw their participation during the interview. All data processing and storage comply with the General Data Protection Regulation and UK Data Protection Act 2018.

Results

Responses were obtained from 2022 in 2020 and 1676 in 2021. Table 1 provides demographic breakdown of respondents and how this compares to the general population.

Compared with 2020, more knew that soap and water removes more microbes than just water (97% vs 94%; P < .001). Twenty-four percent more knew this was definitely true than in 2020 (P < .001), and this did not differ according to demographic group.

In 2021, 95% of people knew that if soap and water is not available, hand gel can stop the spread of infection; a 3% increase from 2020 (P = .015). In 2020, females had a lower OR (OR = 0.53, CI 0.35–0.79; correct responses 90%) of answering correctly than males; yet, in 2021, females had a higher OR (OR = 1.29, CI 0.79–2.13; correct responses 95%) than males (OR = 1.10, CI 0.65–1.87; correct responses 94%). Thus, from 2020, females improved their knowledge to a greater extent than males (P = .03).

Significantly more respondents correctly answered ‘false’ to the statement infections do not spread from you to others by shaking hands in 2021 than 2020 (86% vs 80%; P < .001). Knowledge change for this statement differed according to social grade (P < .001). Those in social grades AB, C1 and C2 had similar knowledge improvement over the year; DE did not. Social grades DE had a lower odds ratio of answering correctly in both 2020 (OR = 0.60, CI 0.40–0.92; correct responses 72%) and 2021 (OR = 0.60, CI 0.40–0.93; correct responses 70%), with no change in knowledge over the year. Knowledge gain also differed according to educational attainment (P = .01). There were significant differences in knowledge improvements between those reporting and not reporting an infection in the previous year (P = .03), where the former had no knowledge change and the latter significant knowledge improvement.

Similarly, 9% more people correctly answered ‘false’ to the statement we cannot pick up microbes on our hands from surfaces in 2021 than in 2020 (90% vs 81%; P < .001). Knowledge change varied according to age groups (P = .01). Knowledge in under 25-year-olds...
improved the most (OR = 3.70, CI 1.41–9.01; correct responses 96%) from 2020 (correct responses 84%). Improvements generally decreased with age, such that over 65-year-olds had no significant knowledge change from 2020 (OR = 0.70, CI 0.43–1.12; correct responses 79%) in 2021 (OR = 0.88, 0.66–1.64; correct responses 80%). Knowledge for this statement also differed according to educational attainment (P = .03). (Fig. 1)

In both 2020 and 2021, 9 of 10 respondents knew that microbes get on your hands when you sneeze into a tissue (90% 2020 vs 91% 2021, n.s.). However, in 2021, there was a significant increase in the percentage who knew this was ‘definitely true’ compared with 2020 (54% vs 44%; P < .001). There is some evidence to suggest that change in knowledge from 2020 to 2021 may have differed according to age (P = .06; see able 4).

In 2021, knowledge that when a person sneezes, microbes can travel the length of the bus decreased by 8% from 83% in 2020 to 75% in 2021 (P < .001). Significantly more respondents in 2021 correctly answered ‘false’ to the statement people don’t need to clean their hands after sneezing into a tissue compared with 2020 (85% vs 83%, P < .001). Knowledge improvements from 2020 differed according to age (P = .03). In 2021, the odds of answering this statement correctly more than doubled for under 25-year-olds (OR = 2.33, CI 1.01–5.26; correct responses 92%), whereas the odds remained relatively unchanged for over 65-year-olds from 2020 (OR = 0.89, CI 0.56–1.45; correct responses 81%) to 2021 (OR = 1.19, CI 0.71–1.96; correct responses 81%). Knowledge improvements differed according to social grade (P = .02); DE showed little change in their odds for answering the statement correctly from 2020 (OR = 0.62, CI 0.40–0.96; correct responses 78%) to 2021 (OR = 0.72, CI 0.46–2.44; correct responses 79%). Conversely, social grades AB almost doubled their odds in 2021, but the greatest increase was in social grade C1 from 2020 (OR = 0.79, CI 0.53–1.18; correct responses 87%) to 2021 (OR = 2.22, CI 1.37–3.57; correct responses 93%). Knowledge improvements also differed according to ethnicity (P = .02) and education (P = .04; see table 4 (appendix)) and ‘see table 5 (appendix)).

Ten percent more respondents correctly answered ‘false’ to the statement when you cough, you do not infect other people who are near you in a room in 2021 compared with 2020 (90% vs 80%, P < .001). Knowledge improvements varied according to ethnicity (P = .008). In 2020, the OR for BAME respondents answering this question correctly was less than half of that of White respondents (OR = 0.39, CI 0.29–0.52; correct responses 65%), yet in 2021, the odds for White (OR = 2.27, CI 1.72–2.94; correct responses 90%) and BAME respondents (OR = 2.27, CI 1.19–4.35; correct responses 90%) were comparable. (Fig. 2)

Compared with 2020, significantly more people knew that vaccination of one person also protects other people from infection (63% vs 50%, P < .001). Of note, there was a 14% increase in respondents answering definitely true for this statement, which is a significant increase from 21% in 2020 (P < .001). Knowledge gain varied according to age (P = .02). Generally, knowledge improvements increased with age, such that in 2021, 55- to 64-year-olds had the largest knowledge improvement with odds answering correctly (OR = 2.16, CI 1.46–3.20; correct responses 68%) compared with 2020 (OR = 0.73, CI 0.51–1.04; correct responses 53%). There was some evidence to suggest that differences in knowledge improvements were observed according to ethnicity (P = .051); however, in 2021, the odds of answering correctly was comparable between White (OR = 1.89, CI 1.58–2.25; correct responses 49%) and BAME respondents (OR = 1.60, CI 1.09–2.33; correct responses 55%). (Fig. 3)

**Hand Hygiene Statements**

**Comparing knowledge of hand hygiene from pre to post lockdown**

| True Statements |
|-----------------|
| **A** Washing your hands with soap and water removes more microbes than just water |
| 2021* | 82% a | 15% |
| 2020 | 58% | 36% |
| **B** If soap and water is not available, using hand gel can stop the spread of infection |
| 2021* | 65% a | 30% |
| 2020 | 48% | 44% |

| False Statements |
|------------------|
| **C** Infections do not spread to you from others by shaking hands |
| 2021* | 7% | 19% | 67% d |
| 2020 | 15% | 30% | 50% |
| **D** We cannot pick up microbes (e.g., germs) on our hands from surfaces (such as tables and chairs) |
| 2021* | 13% | | 76% d |
| 2020 | 12% | 24% | 58% |

*Fig. 1. Response to the four hand hygiene statements for 2020 (bottom) and 2021 (top). Asterisks denote significant differences (P < .05) in the proportion of net correct answers (definitely true/true for parts A and B; false/definitely false for parts C and D) between 2020 and 2021. Letters represent significant differences (P < .05) in the percentage of: definitely true (a), true (b), false (c), and definitely false (d) responses within each statement between 2020 and 2021. Icons represent significant changes (P < .05) in the explanatory variable on the outcome variable between 2020 and 2021.*
Discussion

Despite reasonably high baseline public knowledge, compared with 2020, public knowledge in 2021 improved in eight of nine infection prevention control statements. Whilst some areas reflect only modest net improvement in correct responses, it is particularly encouraging to note that there is significant growth in those correctly responding definitely true or definitely false, as appropriate, suggesting the public are more confident in their knowledge of IPC compared with before the pandemic.

Hand hygiene played a pivotal role in COVID-19 preventative strategies; on 4 March 2020, the UK government initiated a handwashing campaign to emphasise the necessity of handwashing with soap and water or hand sanitiser for at least 20 s.3 Alcohol hand gels/sanitisers were provided in public places to encourage said behaviour. This messaging was reinforced on 9 September 2020 with the new government strapline ‘hands, face, space’. Other preventative strategies included enforced social distancing and replacing the handshake, fundamental to social interactions,17 with elbow-bumps or foot taps, where the risk of spreading infection is substantially lower.

Atchinson et al.18 revealed that during the week before lockdown restrictions in England (23 March 2020), 86% of the English population reported washing their hands with soap more frequently. This coincides with a large UK study of over 28,000 participants, which found that handwashing was the most frequently reported IPC behaviour during May 2020.8 Such behaviour change was also observed during the 2009 Swine Flu pandemic.19 There are several studies suggesting greater hand hygiene knowledge and behaviours in females.20,21 Our results revealed that some hand hygiene knowledge improvements varied according to gender with some evidence that males improved their knowledge to a greater extent with regard to microbial transmission through touch and females improving their knowledge of hand gel/sanitisers to a greater extent than males. However, from our results, it remains unknown whether improved hand hygiene behaviours transpired from associated knowledge improvements.

A continuous cough was one of the main symptoms of COVID-19, heightened knowledge around cough etiquette was expected. There was a 10% improvement in knowledge that when you cough, you may infect others nearby, coinciding with UK Government recommendations to encourage socialising outside and to ensure good ventilation indoors.22 However, there was a decrease in knowledge regarding how far microbes can travel compared with prepandemic. This may be due to the heightened focus on SARS-CoV-2 and evidence available at the time of this survey suggesting that the virus spreads mainly between people in close proximity.23 The UK Government also issued varying advice on face coverings, and social distancing – changing recommendations from 2 m to 1 m + safe distance24 contributing to public confusion in the latter part of 2021 whereby more than half of the public were unclear on government rules people should follow around COVID.25 Furthermore, the public were recommended to avoid public transport,26 which may have added confusion to the ‘length of a bus’, which was used as a frame of reference for the distance a microbe can travel. That said, others report the UK public considered ‘covering sneezes’ as a highly effective strategy to prevent the spread of COVID-19, more so than social distancing measures.18 This could be attributed, in part, to the success of the 2013 ‘Catch it. Bin it. Kill it.’ Campaign, which conveyed the importance of covering sneezes, binning tissues, and washing hands after using a tissue.27 Overall, BAME respondents observed substantial improvements in
respiratory hygiene knowledge compared with prepandemic. This is encouraging, especially considering the greater acquisition and morbidity for some BAME groups from COVID-19\textsuperscript{28–30} and non-COVID-19 respiratory infections.\textsuperscript{31,32}

Knowledge improvements was greatest for the statement vaccination of one person protects others from infection. Although asked of vaccines in general, at the time of the 2021 survey, there was much discussion of a COVID-19 vaccine, with several COVID-19 vaccines in the process of development.\textsuperscript{33} There were many media reports of the positive lifeline that a COVID-19 could serve,\textsuperscript{34,35} which may have contributed to improved knowledge of vaccine protection. However, despite the reduction in hospitalisation rates of those who have received maximum doses of a COVID-19 vaccination,\textsuperscript{36} there remained some opposition to the COVID-19 vaccine roll-out across the United Kingdom, as well as vaccine hesitancy.\textsuperscript{37} There was particular concern around lower vaccine uptake among BAME groups;\textsuperscript{38} however, our results revealed that knowledge of vaccine protection was lower in BAME than White participants in 2020, but comparable in 2021. Older adults, who were also identified as vulnerable from COVID-19,\textsuperscript{39} saw greater improvements in their knowledge about vaccine protection than their younger counterparts. More recently, campaigns have successfully targeted demographics with low vaccine uptake,\textsuperscript{40} such as south Asian and young adults by improving trust, reducing misinformation and increasing knowledge.

Strengths and limitations

Through weighting the data, these results are broadly representative of the English population and provide insights into understanding of IPC measures of the general public and how these have been altered by the pandemic. The 2021 telephone interview data have been compared with the data collected in March 2020 through face-to-face household interviews and due to different sampling techniques are not directly comparable. However, both data collection methods are interviewer assisted, with data recorded on a computer during the interview: telephone interviews were deemed more comparable with face-to-face sampling than online surveys whilst considering Government restrictions. Whilst there is some evidence that respondents may give more socially desirable responses via telephone, this is not thought to apply to knowledge-based questions.\textsuperscript{41} These IPC statements were introduced in 2020, before the first COVID-19 outbreak, and as such, are not specific to other IPC measures such as social distancing or mask wearing that were pertinent during the COVID-19 pandemic; furthermore, it did not explore opportunity or motivations for behaviourally implementing IPC measures. Finally, grouping ethnicity into only two variables is crude and assumes heterogeneity amongst all non-White groups. Future surveys must oversample across all BAME groups to allow adequate power to more appropriately analyse ethnicity to reflect the diversity of the United Kingdom.

Implications and actions

Public campaigns such as ‘Catch it. Bin it. Kill it.’\textsuperscript{27} and ‘Keep Antibiotics Working’\textsuperscript{42} have previously been used to improve knowledge and behaviours of the public,\textsuperscript{43} and thus, public health bodies may wish to capitalise on increased knowledge reported herein to iterate the importance of IPC measures (i.e. handwashing, social distancing, mask wearing and vaccinations) among adults to prevent the spread of infections, especially in the lead up to the winter flu season. The e-Bug programme\textsuperscript{44} provides free educational resources for children aged 3–16 years covering a range of topics including hand and respiratory hygiene, vaccinations, antibiotic use and antimicrobial resistance, all of which are pertinent to IPC. These

Fig. 3. Response to the vaccination statement for 2020 (bottom) and 2021 (top). Asterisks denote significant differences ($P < .05$) in the proportion of net correct answers (definitely true/true for parts A and B; false/definitely false for parts C and D) between 2020 and 2021. Letters represent significant differences ($P < .05$) in the percentage of: definitely true (a), true (b), false (c), and definitely false (d) responses within each statement between 2020 and 2021. Icons represent significant changes ($P < .05$) in the explanatory variable on the outcome variable between 2020 and 2021.

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resources were posted to all maintained schools and academies across England in January 2022 to support efforts to reinforce these messages among children, families and communities.

Conclusion

Knowledge of IPC has significantly improved following the pandemic, particularly regarding vaccinations, where base knowledge was lower, but has also improved for hand and respiratory hygiene where base knowledge was much higher.

During the COVID-19 pandemic across England, many national and regional restrictions were enforced, alongside frequently updated government advice and guidelines disseminated through daily COVID-19 briefings, online news, social media and billboards. These results capture changes in knowledge of IPC immediately before (March 2020) and 12 months after national lockdown restrictions were first imposed in England, providing insight into the effectiveness of said communications and the receptiveness of the public to IPC information. Knowledge alone does not drive behaviour change; however, the empowering, preventative messaging linked to the public’s own goals and interests is likely to have played a part in improving public knowledge around IPC and vaccinations. The challenges moving forward will be maintaining these positive behaviour changes when the perceived threat of COVID-19 reduces. Future work should seek to understand this relationship and the role of messaging on sustained behaviours to enable continued encouragement of hand washing as one of the single most effective forms of IPC, which will serve to alleviate strain on the NHS, especially as the United Kingdom moves towards the next stage of living with COVID-19, and non-COVID-19 community infections.

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Competing interests

None declared.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.puhe.2022.08.015.

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