

## Social norms and free-riding in influenza vaccine decisions in the UK: an online experiment

Krystal Lau, Marisa Miraldo, Matteo M Galizzi, Katharina Hauck

Department of Management and Centre for Health Economics and Policy Innovation, Imperial College Business School, London, UK (K Lau MSc, M Miraldo PhD); Department of Psychological and Behavioural Science, LSE Behavioural Science Hub, and Global Health Initiative, London School of Economics, London, UK (M M Galizzi PhD); Department of Infectious Disease Epidemiology, School of Public Health, Imperial College London, London, UK (K Hauck PhD)

Accepted in *The Lancet*.

**Background** Nudge-based social norm messages conveying high influenza vaccination coverage levels signal a strong social norm, encouraging vaccination, but also a low risk of infection, discouraging vaccination and promoting free-riding. The complex interplay between these two signals can result in ambiguous vaccination decision-making at varying coverage levels. We aimed to measure different vaccination coverage levels' (VCLs) effect on influenza vaccination intention through an online experiment.

**Methods** UK residents aged 18 years or older were eligible to participate in this online experiment and recruited via Prolific. They were stratified by gender and randomly assigned to a control group with no message (n=202) or one of seven treatment groups (n=1 163) with different messages of VCLs (ie, proportion of vaccinated people [10%, 25%, 50%, 65%, 75%, 85%, or 95%]) in the respondents' environment. Effect on respondents' vaccination intention was measured with self-reported intention and three elicited behaviour measures: opening an online map locating nearby private flu jab providers; time looking at this map; and downloading a calendar reminder to vaccinate. Linear regressions, probit, logistic, and double hurdle models were used, controlling for population behaviour perceptions, risk attitudes, and behavioural and socioeconomic characteristics collected through individual questionnaires.

### Findings

Between May 3 and August 20, 2018, 1365 participants were eligible to participate. Those treated with coverage levels at 65% or higher reported significantly greater stated vaccination intention (greater intention 13.2% [95% CI 6.32–20.08],  $p < 0.0001$  if VCL=65%; 15.82% [8.65–23],  $p < 0.0001$  if VCL=75%; 18.12% [10.45–25.79],  $p < 0.0001$  if VCL=85%; 20.22% [11.98–28.45],  $p < 0.0001$  if VCL=95%) than the control group. These participants were also more likely to look at the map of vaccination locations (increased likelihood 14.6 percentage points [3.65–25.55],  $p = 0.0090$ ; 20.81 percentage points [9.73–31.88],  $p < 0.0001$ ; 18.4 percentage points [6.57–30.23],  $p = 0.0023$ ; 14.12 percentage points [1.27–26.96],  $p = 0.031$ ), and spent longer looking at the map (longer viewing 0.52 s [0.13–0.91],  $p = 0.0094$ ; 0.74 s [0.34–1.14],  $p < 0.0001$ ; 0.65 s [0.23–1.08],  $p = 0.0025$ ; 0.5 s [0.04–0.96],  $p = 0.032$ ) than the control group. Coverage lower than 65% did not lead to any

significant differences between treatment and control groups for any of these measures. There was no significant effect of any treatment VCL on calendar download intention.

**Interpretation** Average vaccination intention was higher at lower coverage levels (potential social norm compliance) but lower at higher coverage levels (possible free-riding). Because this study examines vaccination intention rather than uptake and uses an online experimental design that might dampen generalisability, further research should be done. Still, policy makers should consider this curvilinear effect when designing vaccination interventions as using lower social norm messages might nudge vaccination better than extremely high messages.

**Funding** Imperial College Business School, National Institute for Health Research Health Protection Research Unit, UK Medical Research Council, Department for International Development, Medical Research Council Centre for Global Infectious Disease Analysis.

### **Contributors**

KL prepared and analysed the data, wrote the abstract, and contributed to the research idea and experimental design. KH, MM, and MG conceived the research idea and contributed to experimental design, data analysis, and writing of the abstract. The corresponding author had full access to all the data in the study and had final responsibility for the decision to submit for publication. All authors have seen and approved the final version of the abstract for publication.

### **Declarations of interests**

KH reports grants from National Institute for Health Research Health Protection Research Unit, UK Medical Research Council (MRC) and Department for International Development, and MRC Centre for Global Infectious Disease Analysis, during the conduct of the study; grants from National Institute of Allergy and Infectious Diseases, President's Emergency Plan for AIDS Relief, International Initiative for Impact Evaluation, Bill & Melinda Gates Foundation, National Institute on Drug Abuse, National Institute of Mental Health, and personal fees from International Decision Support Initiative and KPMG, outside the submitted work. All other authors declare no competing interests.