Re-Liv-E: Events Research Programme at Liverpool

14th May 2021

Purpose

This is a statement of works from the University of Liverpool (UoL) prepared in April 2021 in response to the Department for Digital, Culture, Media and Sport's (DCMS) request to evaluate the Events Research Programme (ERP) in Liverpool in April/May 2021. The evaluation is to inform national COVID-19 risk-mitigation policies for reopening a variety of indoor and outdoor events with audiences of between 50 and 7000 attendees.

Background

The ERP seeks to reopen events and venues with minimal risk of SARS-CoV-2 transmission, and to pilot risk-mitigation measures in concert with the Government's Roadmap for COVID-19 recovery.

Sports, entertainment, social and business functions that are currently restricted carry unknown risks of SARS-CoV-2 transmission, particularly regarding the latest variants. So, there is a need to mitigate the likely increases in transmission due to social mixing at such events/venues. Non-seated venues such as nightclubs preclude the greater physical distancing that can be applied elsewhere, relying instead on screening out likely infectious individuals with testing and improving ventilation.

Liverpool successfully piloted City-wide community open-access rapid lateral flow testing for SARS-CoV-2 antigen from November 2020 for people without COVID-19 symptoms. The City continues to have high utilisation of this service, with over half of new cases currently identified by lateral flow, and over two million tests have been deployed in the wider Liverpool City Region.

To pilot asymptomatic community testing, Liverpool used combined intelligence (www.cipha.nhs.uk) with data from NHS, local government and public health systems, including 30-minute updated flows of Pillar 2 test result data, extending to the 2.6m population of Cheshire and Merseyside. The City also leveraged strong communications, public involvement and public health research.

Half of Liverpool's economy relies on hospitality, events and visitors. The events team in Liverpool are already working closely with the University of Liverpool on evaluating community testing, therefore, the City is well-prepared for piloting ERP at a range of venues. DCMS and the Encore project team therefore approached Liverpool to pilot events' reopening as part of the wider ERP.

Aim and objectives

The aim is to provide evidence on the feasibility and utility of risk mitigations for reopening events and venues in England, in support of the Government's Roadmap for COVID-19 recovery.

The objectives are to:

1. Develop and pilot a digital workflow and logistical process between event ticketing and SARS-CoV-2 testing, venue admittance and post-event follow-up.
2. Assess the adequacy of data collected around events and venues for responding to potential outbreaks and for varying measures according to background epidemic status.
3. Measure the uptake of tickets and explore attitudes to, and acceptability of the overall ticketing, testing, surveying workflows for accessing events.

Research questions

The research questions are:

1. Is the piloted digital solution for linking ticketing with health screening usable for a wide range of events and public health / community contexts?
2. How can local authority asymptomatic testing centres be (re)deployed to handle pre-event testing for medium sized events (up to 7000 attendees)?
3. What proportion of those expressing interest in attending an event, and with how much variation across socio-demographic groups,
    a. answer pre-event screening questions,
    b. undergo pre-event testing, and
    c. return a follow-up home-test PCR kit if they attend the event?
4. Are any transmissions detected?

The research question on evaluating incentives has been removed.

Design and population

Re-Liv-E has a prospective population cohort design, with a public health service intervention among a targeted but self-defining sub-population of eventgoers, and with a naturalistic synthetic control population of residents who did not attend the events.

The study population is the 1.5m resident population of Liverpool City Region in NW England, which has community-wide asymptomatic SARS-CoV-2 testing centres deployed.

The intervention is reopening (ahead of national changes to current restrictions) 4-5 indoor and outdoor events, with and without alcohol, seated and non-seated, vaccinated and non-vaccinated attendees, with numbers of attendees ranging from several hundred to several thousand.

Re-Liv-E will focus on integrating public health surveillance and interventions into the digital workflows around events.

Biological evaluation will focus on the utility of testing for outbreak management and forward events planning under different epidemic state scenarios. The prevalence of SARS-CoV-2 infections in Liverpool in April may be too low to afford the statistical power to show non-inferiority of transmission rates between event attendees and non-attendees in their communities.

Re-Liv-E will incorporate questionnaires for behavioural studies into the ticket-test-survey workflow. Some of the behaviours of eventgoers and non-eventgoers in the population will be studied using a combination of questionnaires, focus groups and social media analytics. The communications channels around the existing asymptomatic testing centres could be used to help behavioural studies to recruit participants provided they are sufficiently resourced to do so.

Re-Liv-E will compare different incentives (if deployed) for completing post-event surveys and for taking the follow-up PCR test that is posted to the eventgoers home after the event. Incentive groups may include: no-incentive; prize draw; partial refund of ticket price; vouchers; tickets for future events. Repeated events would ideally use different incentive groups. The inequalities impact of any incentives deployed will be assessed.

Systems analysis will involve organisers, operators and regulators of events and venues in evaluation of the end-to-end COVID-19 risk mitigation process, its feasibility, acceptability and sustainability.

Ticket-test-survey digital workflow

Re-Liv-E will be enabled using an existing ticket vendor and CIPHA (www.cipha.nhs.uk: a person-level integrated data/intelligence system with feeds from NHS, local authorities, and public health (testing and vaccination). Elements of CIPHA that could be deployed nationally will be used, as well as offering the CIPHA platform to evaluate deployment of future national digital solutions.

There are four main data stores:

- The study survey app and Event website, set up and managed by the Liverpool City Council (LCC) with support from UoL, will collect survey data pre- and post-event.
- Ticket Quarter (TQ): The ticket vendor application, used to purchase tickets and collect basic demographic information to be used to be shared with CIPHA, which will match test results based on the demographic information.
- CIPHA: The local integrated intelligence system established for COVID monitoring and intelligence, which will collect information on test results and link to ticket purchases.
- Asymptomatic Testing Service: Test results data flowing via NHS Test and Trace into CIPHA.

The data flow between these is described in Figure 1.

The user journey for the subjects who attend events will be:

1. The user receives an email with a link to the Event website. User visits website and can view details about the event, the details about the study and data flows / data sharing and the need to have either one or two tests before specific indoor and outdoor events, with negative test results required for attendance. In the case that a ticket is cancelled because of a missed test result, a negative or void result, or self-reported symptoms it should also be clear that ticket costs will be refunded in full.
2. The user answers a set of study questions and provides mobile phone number (for linkage). The user records consent to the data flows and participation in the study. On submission of the data the user is sent a SMS text message confirming that their data has been saved and views a page with a code (unique id) and link to the TQ page to purchase a ticket. Those who consent but do not complete the screening questions may be invited to participate in a separate survey or focus group.
3. On the TQ website the user enters the code, along with name, date of birth and address (with postcode) and can purchase a ticket. The user can only purchase a single ticket for their own use. Event seating will be open, so groups should not have any difficulty sitting together and no seat booking is being done.
4. Required user data is sent to CIPHA to match to a record. If no match is found, then TQ will be notified and asked to contact the user to confirm their details.
5. (Indoor Event) The user will receive a text message and/or email reminding them to go to an asymptomatic testing centre for either a single or double lateral flow test. A further reminder will be sent if they do not attend on time, warning that their ticket could be cancelled if they do not have a valid test. If the test is positive this will be recorded in CIPHA, a notification will be sent to TQ, their ticket cancelled and refunded, and communications sent to the user. If negative the result will be recorded in CIPHA. If the result is void the user is notified that the test will need to be repeated.
6. If the user responds yes to questions about any COVID-19 symptoms in the 72 hours before attending the asymptomatic testing centre they will be declined for a ticket issue and referred for a PCR test.
7. (Both types of event) Two days before the event the user will receive a reminder to get a lateral flow test at an asymptomatic testing centre. The process is as (5.)

8. A whitelist of audience members clearing testing/screening will be sent to the ticketing company/venue at a specified time before the event to enable issue of an activated ticket or digital admittance.

9. On the day of the event users will be reminded that they should not attend and should get tested if symptomatic, and that they are still eligible for full refund. The user will be admitted to the venue if in possession of a valid ticket.

10. After the event, the user will receive a PCR at-home test kit and an SMS and / or email reminder to take the test and send the kit back five days after the event. They will also receive a link to complete the second survey questions. Entry into a prize lottery, a voucher for discount on future events or a refund of a 'public health deposit' part of the ticket price might be offered to incentivise completion (external permissions required).

Once the event has been completed the study data package will be created in linked, anonymised form. This will be a de-identified version of the study survey data linked to agreed CIPHA variables, including test results. This data package will be stored in a secure research environment for access by named researchers to undertake the analysis of the data.

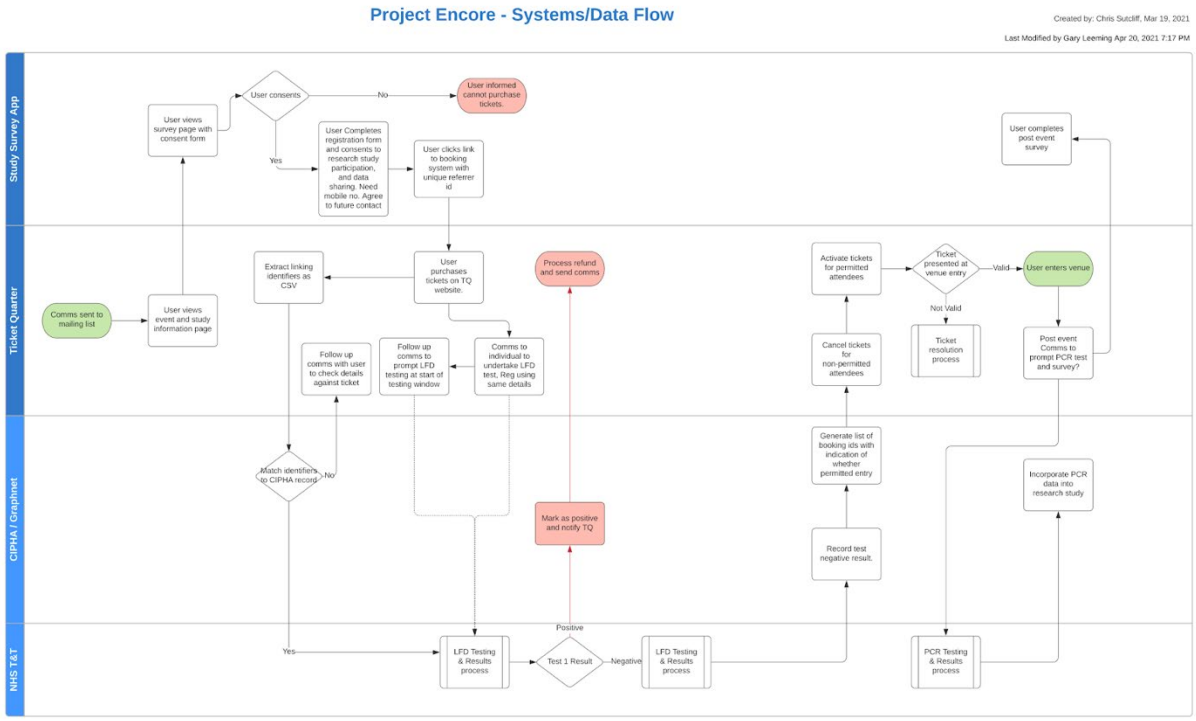


Figure 1 Data workflow for Re-Liv-E

Data Items

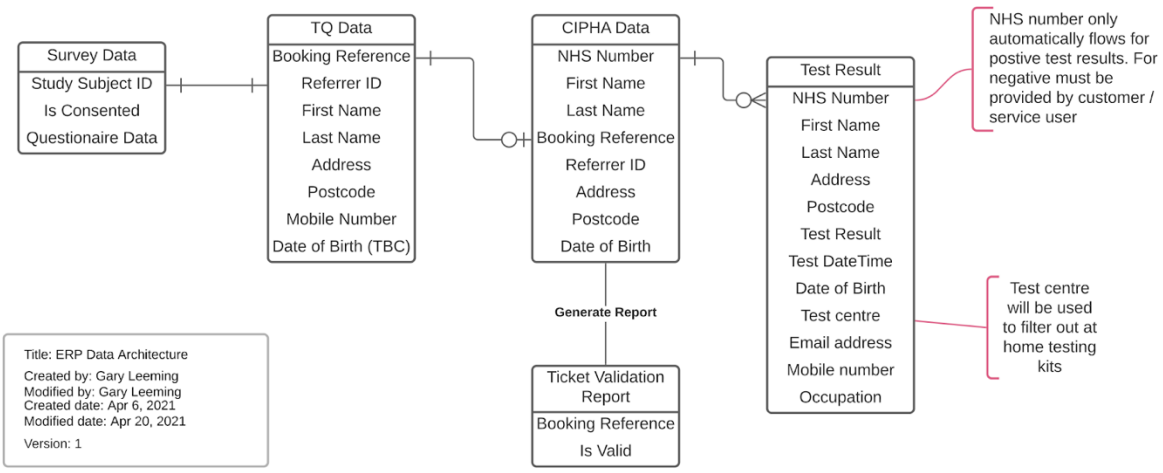


Figure 2 Entity Relationship diagram for Re-Liv-E

Surveys, focus groups and social media analysis

In parallel, we will be running several activity strands focused on capturing public reactions to the communication campaign over digital media as well as behavioural reflections from those participating in the events. This may include members of the public attending individual events as well as staff working at specific venues. Re-Liv-E's will support the delivery of questionnaires in the digital workflow. We will also support design and interpretation by providing local contextual understanding, aiming to support partners in a coherent and comprehensive approach to evaluate people's experience and perceptions of these events. The teams running qualitative evaluation of community testing in Liverpool will work with PHE and ONS to help deliver a coherent and comprehensive approach to evaluate people's experience and perceptions of the events and their risk-mitigations. Taking into consideration their characteristics, using a mixture of quantitative and qualitative data collection methods, the team will look to gain insights based on analysis of digital and social media content, self-reporting using online surveys, follow-up interviews and focus groups.

Official communications announcing, advertising and commenting upon the events will be collected and monitored across a set of digital media together with associated public sentiment and opinions.

At the event registration stage, attendees can be invited to complete an online questionnaire, looking at their expectations, while after the event they will be asked about their experience of the event. Similarly, this invitation will be extended to members of the public willing to attend individual interviews as well as focus group session after the event. Details of potential participants to include in focus groups and interviews will be collected via TQ so that appropriate distribution of demographic factors can be considered.

See Appendix for further details.

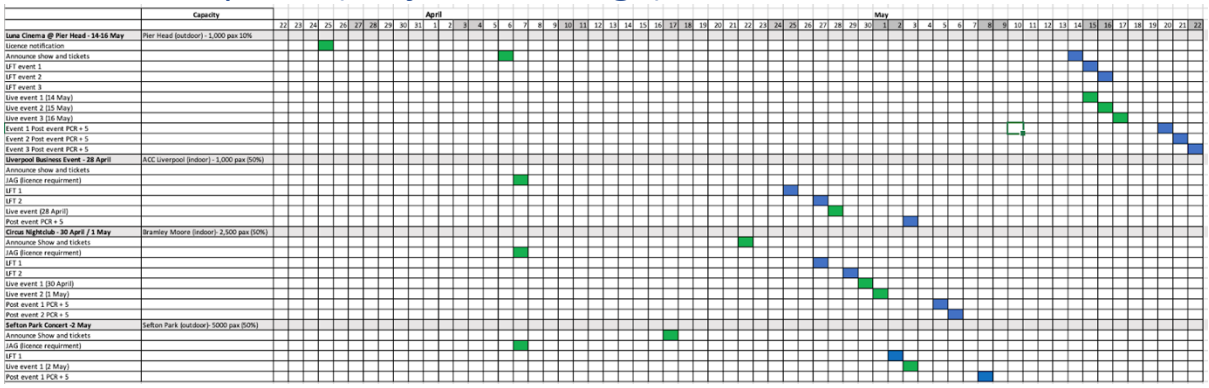
Deliverables and milestones

The deliverables {milestones} and [owners] are:

1. Study protocol (agreed version of this document after input from the Science Board)
   {29/3/21} [UoL]
2. Contract in place between DCMS and UoL to proceed
   {2/4/21} [DCMS]
3. National approval to proceed with service evaluation not requiring research ethics approval for the intervention
   {2/4/21} [DCMS]

4. Research ethics submission to allow research reports from the evaluation
   {5/4/21} [UoL and Public Health England, PHE]
5. Data sharing and information governance approvals in place
   {5/4/21} [UoL and DHSC (testing data controller)]
6. Outbreak control plans in place
   {5/4/21} [LCC Public Health with PHE]
7. Events advertised
   {6/4/21} [Liverpool City Council, LCC]
8. Digital 'ticket-test-survey' system working
   {8/4/21} [UoL and LCC]
9. Pre-event community focus groups and survey
   {10/4/21} [UoL with ONS as required]
10. Events run – within event interviews
    {From 14/4/21} [LCC with Trivandi / Loughborough (to be confirmed)]
11. Post-event community, attendee and venue/organiser focus groups and survey
    {From 16/6/21} [UoL with ONS as required]
12. Data collated and handed to analysis teams
    {5/21} [UoL and PHE]
13. Interim report of the Liverpool Re-Live-E component of ERP
    {6/21} [UoL with PHE and LCC]
14. Extended report of the Liverpool Re-Live-E component of ERP
    {7/21} [UoL with PHE and LCC]

Events anticipated (subject to change)



Note the Comedy Club event has been cancelled and replaced with Sefton Park open air concert. To allow for better advertising and ticket sales the Luna Cinema event has been cancelled and other events are being planned.

Management and reporting

Re-Liv-E has a tight timescale, which cannot be met without employing an existing team studying this area. We will constitute Re-Liv-E as a project nested within the DHSC-sponsored Liverpool COVID-SMART community testing evaluation, meeting weekly with existing national stakeholders from PHE, JBC, ONS, DHSC and adding DCMS.

This Liverpool Combined Evaluation Team (L-CET) will report weekly to the national Science Board, and to the LCC Health Protection Board, chaired by Liverpool's Director of Public Health and attended by members of the Evaluation Team, and through the LCC Gold arrangements, chaired by the Chief Executive. L-CET will work under the direction of the Liverpool Director of Public Health, subject to a contract with DCMS.

Ethics, consent and governance

Re-Liv-E is an evaluation of a public health service intervention to mitigate the COVID-19 risks of reopening events and venues.

Participants will attend an event approved by DCMS and governed locally by LCC. UoL is the evaluator of this LCC governed service and only interacts with participants under LCC instruction.

Participants consent to answer questions, to get tested for SARS-CoV-2 and to share their data as a condition of the risk mitigation needed for LCC governed organisations to run the event.

All the risk mitigation process is owned by DCMS with DHSC and PHE and executed through LCC's Gold arrangements, of which the DPH and PHE are members. UoL-led analyses have no direct influence over this process.

UoL researchers analyse data only after they have been anonymised. All testing data are linked and anonymised by the NHS-led CIPHA system.

The University of Liverpool Central Research Ethics Committee (REC) has approved Re-Liv-E. This REC has governance over UoL staff activities in Re-Liv-E. These will include a small number of questions asked on the ticketing website at the time of booking and additional evaluation activities after the events. People will be asked if they want to participate in further behavioural evaluations, such as an online survey, focus groups and one-to-one interviews. These will be advertised on the ticketing website, and a link provided for people to find out more and participate. Participants will be provided with a participant information sheet and give consent. These additional evaluation activities will be voluntary. The PHE REC will do the same for PHE inputs to the evaluation. Separate ethics applications will be submitted by external research groups, including linked studies that the Science Board / SPI-M / SPI-B / SAGE may require – UoL is not responsible for these.

Risks and mitigations

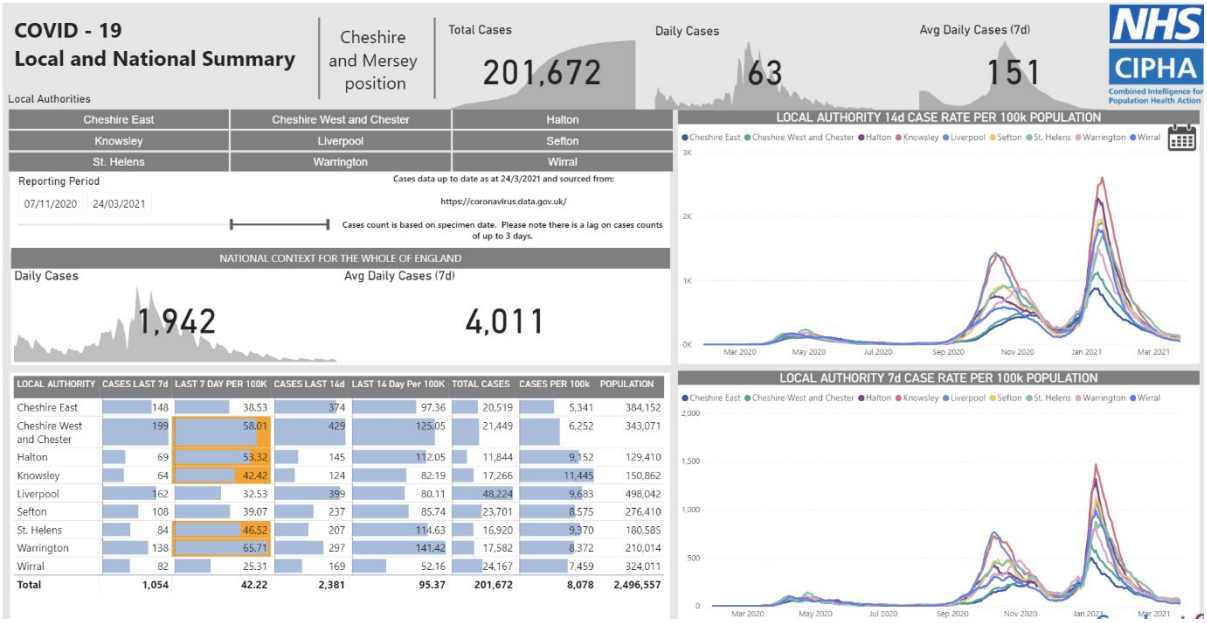
The evaluation is closely linked to, and dependant on, the timely delivery of a series of interconnected activities relating to the communication, sale of tickets, uptake of testing and other factors which will influence the successful coordination of the events. The University has undertaken a high-level analysis of the risks which may affect the deliverables outlined earlier in this document. The ownership of many of these risks lies out with the University and therefore the mitigations are linked to the wider project hitting key milestones in the events programme timeline.

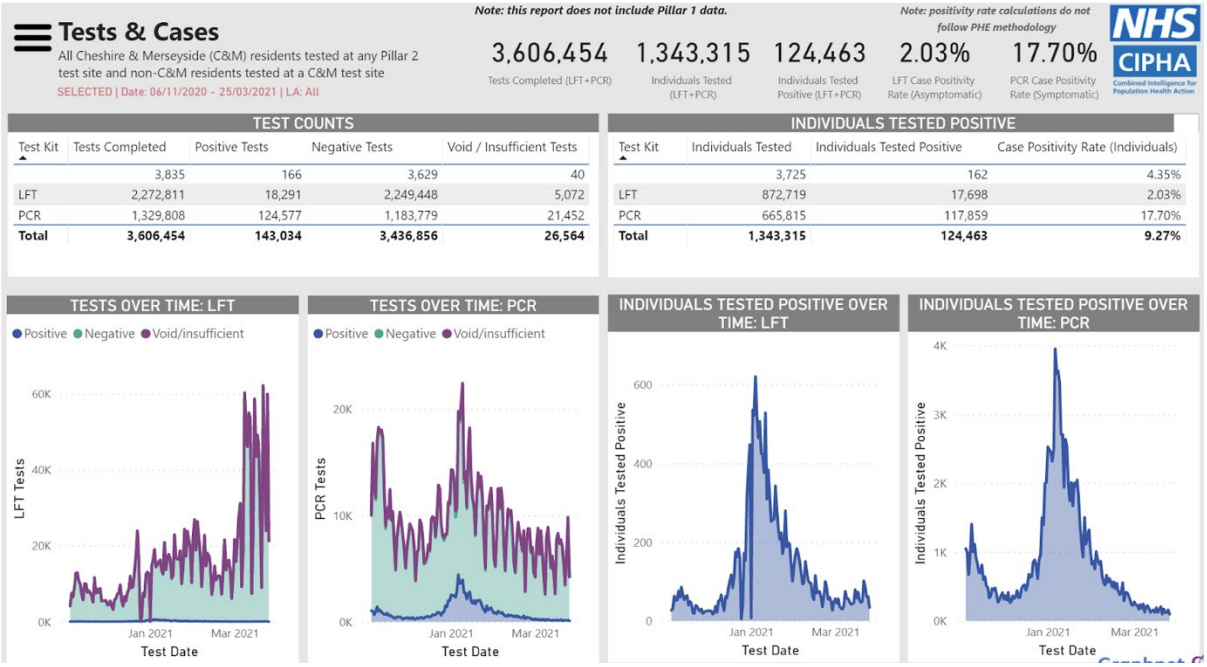
A risk register (supplied separately) will be updated as the project progresses.

Public health intelligence

Operations will proceed under emergency planning arrangements with a Gold, Silver, Bronze command structure that is in place for COVID-19 rapid responses and currently coordinates community testing. DCMS (Martyn Henderson) has attended Gold Command. Public Health intelligence for the wider Cheshire and Merseyside region is updated in near real-time for an established network of Directors of Public Health via shared dashboards.

Prevalence is currently low but fluid across the region:





The field epidemiology underpinning the national pilot of community testing in the region forms the basis of a cohort study. The cluster of events in April/May will form an interrupted time series in social mixing with no substantial effects anticipated on transmission if the risk mitigations are effective. The post-event follow-up PCR results should provide an indication of transmission associated with the event. As some post-infectious individuals will test negative with lateral flow then positive with PCR, due to lingering genetic material from dead virus, it will be necessary to use cycle threshold (Ct) values to categorise the PCR results into transmission relevant and irrelevant.

The population not attending events but attending asymptomatic testing centres over April/May form a control group from which synthetic matching may be done. We will also monitor small-area-based patterns of case rates versus event attendance density.

In addition, we will consider the postcode-linked socioeconomic inequalities of events uptake with the risk mitigation in place compared to historical audience profiles for these kinds of events. Dropout rates at each stage of event booking, questioning and testing will be compared across socio-economic groups. Particular attention will be paid to the effect of any incentives deployed (prize draws, partial ticket price refunds) on inequalities in uptake.

The possibility of risk mitigations becoming a surcharge on ticket prices, with potentially greater impacts on those from disadvantaged areas will be explored.

Out of scope

1. Pre-post event testing.
2. Ticketing.
3. Events operations.
4. Public health service activities including outbreak plan writing and surveillance to monitor community transmission.
5. Seeking permissions from national agencies.
6. Externally led behavioural studies.
7. Environmental studies.
8. Economic/sustainability studies.

External dependencies

1. DHSC permission to use Pillar 2 testing data.
2. NHS CIPHA data support.
3. Events and ticketing logistics.
4. Local Public Health Service oversight/lead.
5. Public Health England linked behavioural studies.
6. Public Health England health protection oversight and outbreak planning.
7. Loughborough led environmental studies.
8. Edinburgh led economic studies.
9. LCC communications.
10. ONS support of extended / expanded surveys as required.
11. TQ and System C components of the digital solution.

Science Framework Statement

Re-Liv-E will contribute to the high priority evidence identified by the Science Board (SB) for the Events Research Programme as follows:

SB question 1: "*Given a pre-specified set of mitigation measures, is there evidence of an increased risk of transmission of SARS-CoV-2 from attendance at (a) outdoor and (b) indoor events?*"

Re-Liv-E will generate data essential for understanding SARS-CoV-2 transmission linked to a variety of indoor/outdoor, seated/non-seated events reflecting local visitor economies realistically. The main data are from pre/post-event testing and questioning of residents from a defined population attending: three shows (one without a bar) of an outdoor cinema ~1000 people at 10% capacity; a seated indoor comedy club show ~300 people at 25% capacity; an indoor business event ~1000 people at 50% capacity; and a nightclub ~2500 people at 50% capacity. The events are set in the wider context of asymptomatic community testing of non-eventgoers from the same general population. Re-Liv-E will embed the national policy evidence generation in local public health operations to mitigate risks around events in a real-world context of licensed and unlicensed venues due to reopen in Government's Roadmap. The digital ticketing-testing-surveying solution that Re-Liv-E will develop and test can be used to generate expanded and extended policy evidence and operational public health intelligence.

SB question 2 "*Which characteristics of events and venues and behaviours likely contribute most to transmission?*"

Re-Liv-E will test the feasibility of an end-to-end workflow for events booking and attendance that can be managed by ticketing agencies and venues as usual but involving local public health teams with near-real-time intelligence for prompt control measures. Piloting a flexible framework for ticketing-testing-surveying will surface the fuller characteristics of events, venues and behaviours by having event organisers, venue staff, eventgoers and public health teams define and feedback on the risk-mitigation workflow for each event. This will create a learning system rather than just deliver static evidence.

Appendix: Behavioural Studies

Several activity strands focus on capturing behavioural reflections from those participating in the events. These include members of the public attending individual events as well as staff working at specific venues, and component looking at the organisers and coordinators across all of these.

With Liverpool scheduled to host 4 individual events, the goal will be to use a coherent and comprehensive approach to evaluate people's experience and perceptions of these. Taking into consideration the characteristics, using a mixture of quantitative and qualitative data collection methods, the team will look to gain insights into some of the following questions:

1. How do communities feel about the launch of events?
2. What are their expectations?
3. How do they perceive the risk of these and what are their main concerns?

While all of these will be based on self-reporting, they will serve to provide a reflection of views and attitudes, which will complement the biological and system strands of the evaluation.

Digital and social media analysis

To evaluate and inform the communication campaign about the events in view of citizens' perceptions a dataset will be collected including:

- All public Tweets containing a list of keywords provided by social media officers at the council level and retrieved through the Twitter's Premium API
- Facebook posts and popularity/sentiment indicators (e.g. Likes, emojis, resharing) from the official' council pages as well as events venues pages retrieved using the platform CrowdTangle
- Articles and related users' comments from the local news websites of 'Liverpool Echo', 'The Warrington Guardian', 'Wirral Globe', 'Merseyside Daily Post', 'Scottie Press', 'St Helens Star', 'InYourArea', 'MerseyReporter'; data are scraped through the RISJbot (Nicholls 2018) which allows to crawl both texts and metadata.
- Articles in UK news websites ('The Guardian', 'The Independent', 'The Evening Standard', 'The Metro', and 'The Sun')
- Articles and related messages from Public Health websites (Liverpool and England).

Sentiment Analysis, Topic Modelling, Lexical Clustering and Argumentation Mining will be performed over the entire dataset to respectively account for: i) citizens' positive and negative attitudes; ii) controversial issues; iv) reasons behind citizens' decision-making choices (taking part/not taking part in the event). A sample of the analysis will undergo in depth qualitative analysis to inform interpretation of the qualitative results. To speed up the analysis we will leverage the Multimodal Analytics Platform developed by Prof. O'Halloran (O'Halloran, Pal and Jin 2021) to analyse the text, images and videos in the dataset.

Surveys

As part of the event registration process attendees will be invited to complete an online questionnaire, looking at their expectations, attitudes and reflections of the event. They will be asked to complete a pre-event and a post-event one, allowing them to consider any changes in perceptions and attitudes.

Interviews & Focus Groups

Invitation to be extended to those members of the public who attended to participate in follow-up interviews or focus groups, to reflect on their experience and share some of their views. When registering to attend the event, they will be invited to provide their contact details (i.e., name & email), if they are willing to be contacted by the evaluation team.

Pre-Event Survey

A. What are the main reasons you decided to join the Liverpool Re-Opening Events Programme?

B. How did you hear about the event?

- Social media: -Facebook, -Instagram, -Tik Tok, -Twitter, -Other
- News media: -Local, -National
- Other

B) How worried are you about attending the event?

- Not at all worried
- Slightly worried
- Moderately worried
- Very worried

C) How likely do you think you are to catch coronavirus at the event?

- I have no risk
- I have a low risk
- I have an average risk
- I have a high risk
- Don't know

C.1) Why do you think there is a lower/heightened risk?

D) Based on your recent negative test result, which statement below best describes what it means to you?

- I am definitely not infectious
- I am probably not infectious
- I am probably infectious
- I am definitely infectious
- Don't know

E) How concerned are you about potentially infecting others after attending the event?

- Not at all concerned
- Slightly concerned
- Moderately concerned
- Very concerned

F) How important do you think it is to resume these kinds of events as soon as possible?

- Not at all important
- Slightly important
- Moderately important
- Very important

G) Considering your current adherence with guidance, how would you rate your compliance with "Hands, Face, Space, Fresh Air"?

1. On average, how often have you followed government guidance on social distance?

    - Not at all
    - Some of the time
    - Most of the time
    - All of the time

2. On average, how often have you washed your hands with soap and water or sanitiser?

    - Not at all
    - Some of the time
    - Most of the time
    - All of the time

3. On average, how often have you worn face coverings or mask?

    - Not at all
    - Some of the time
    - Most of the time
    - All of the time

Demographics

- Gender: Non-binary/Man/Woman/Other/Prefer not to say
- Age
- Ethnicity
- Have you previously been diagnosed with Covid? Yes / No / Don't know
- Have you received your vaccination? 1st dose / 2nd dose / None

Follow-up

Colleagues are carrying out some more in-depth research and would be looking to contact volunteers from this study.

Would you be prepared to speak to one of their team in a little more detail about your experience today after you have received your test result?

If so, then please provide a name and email address below so the team can contact you.

Post-Event Survey

A) How would you describe your experience of the Liverpool Re-Opening Events Programme?

B) How satisfied were you with the event organisation?

- Not at all satisfied
- Slightly satisfied
- Moderately satisfied
- Very satisfied

B.1) Please provide more details for your assessment.

C) Thinking back to the event, please rate your experience and observation of the following behaviours:

- Physical distancing: Maintained Throughout / Somewhat / Not at all
- Wearing face-coverings: Used Throughout / Somewhat / Not at all
- Hygiene arrangements: Maintained Throughout / Somewhat / Not at all
- Singing, chanting, shouting: Witnessed Throughout / Seen Occasionally / Not at all / NA

C.1) Any additional comments or reflections?

D) Looking back at the event and your experience, how likely is it that you caught the coronavirus at the event?

- I have no risk
- I have a low risk
- I have an average risk
- I have a high risk
- Don't know

D.1) Why do you think there is a lower/heightened risk?

E) How concerned are you about potentially infecting others after attending the event?

- Not at all concerned
- Slightly concerned
- Moderately concerned
- Very concerned

F) Looking back at the event and your experience, how confident are you about the prospect of safely resuming these kinds of events as soon as possible?

- Not at all confident
- Slightly confident
- Moderately confident
- Very confident

G) Did you comment about the event on social media? If so which one(s)?

Event Behaviour

1. How did you travel to the event?

- Public Transport
- Drove own Vehicle
- Dropped off by Friend/Family
- Taxi
- Walk

2. How did you travel from the event?

- Public Transport
- Drove own Vehicle
- Picked up by Friend/Family
- Taxi
- Walk

3. To the best of your recollection, how much alcohol did you consume prior to and during the event? *1 unit is typically: Half-pint of regular beer, lager or cider; 1 small glass of low ABV wine (9%); 1 single measure of spirits (25ml)*

- None at all
- 1-2
- 3-4
- 5-6
- 7-9
- 10+

4. Did you come as part of a group? Yes/No
4.1 If yes, how many people in your party? 2/3/4/5/6 or more

5. Did you scan the NHS App at the event?

Demographics

- Gender: Non-binary/Man/Woman/Other/Prefer not to say
- Age
- Ethnicity
- Have you previously been diagnosed with Covid? Yes / No / Don't know
- Have you received your vaccination? 1st dose / 2nd dose / None

Follow-up

Colleagues are carrying out some more in-depth research and would be looking to contact volunteers from this study. Would you be prepared to speak to one of their team in a little more detail about your experience today after you have received your test result? If so, then please provide a name and email address below so the team can contact you.

Appendix: Digital and Social Media Analysis

The communication campaign about the ERP and citizens' reactions to the programme as expressed through online comments and social media posts will be analysed to investigate:

1. Citizens' positive and negative attitudes towards the ERP.
2. The reasons behind citizens' decision-making choices about participating or not in the events.
3. Communications about falsification of test results ("gaming") to gain access to i. events; ii. school; iii. international travel and any other contexts or activities (e.g. employment).
4. Controversial (potential) issues such as: perceived risk of infection; miscommunication over "vaccine passports" (not used but mentioned in a press briefing); levels of trust in authorities; and attitudes towards future events.

The text, image and videos posted on the following digital platforms will be collected and analysed:

- Articles and messages on the ERP events websites.
- Public Tweets containing keywords tailored to the ERP.

- Facebook posts and popularity/sentiment indicators (e.g. likes, emojis, resharing) retrieved using the platform CrowdTangle.
- Articles and related users' comments from the local news websites relevant to ERP pilots in Liverpool: 'Liverpool Echo', 'The Warrington Guardian', 'Wirral Globe', 'Merseyside Daily Post', 'Scottie Press', 'St Helens Star', 'InYourArea', 'MerseyReporter'.
- Articles in UK news websites ('The Guardian', 'The Independent', 'The Evening Standard', 'The Metro', and 'The Sun')

Methods

The analysis will be undertaken using the Multimodal Analytics Platform (MAP) (O'Halloran, Pal and Jin 2021). The Multimodal Analytics Platform (MAP) is a cloud-based analytics platform for real-time data collection, big data analytics, and interactive reporting. Media trends are tracked in digital media and social media for impact analysis of one media platform on another.

The key functionalities are:

1. *Social and News Media Data Generation.* Real-time data collection from Twitter and online news sources are undertaken. For Twitter, the user collects historical data through a real-time Twitter search using a keyword or user profile names. Reports are created by combining multiple search results from several keywords and profile names on different topics, date range and eliminating noisy unrelated topics. Searches based on profile name can collect user's profile related information such as followers, following, favourites, timeline, retweets etc. Data from online news media are generated at scheduled intervals by an automated process.

2. *Indexing and Semantic Annotation***:** The data collection process generates a number of JSON formatted files that are subsequently indexed to improve search performance. Image and video data are semantically annotated using image and video analysis tools.

3. *Search and Interactive Reports***:** Multiple search results are combined at the data collection step through a web-based interface. The aggregation is applied across Twitter and newspapers and online sources for text, image, and video using appropriate options in the inter- face. Any unrelated data is filtered using the advanced Structured Query Language (SQL) and a date range. The resultant charts and tables can be exported in PDF, CSV, JSON, or XML formats.

An embedding space is created so text, image, and videos can be combined. The resultant data can be jointly analysed through NLP techniques like n-grams, parts of speech, lemmatisation, sentiment classification, similarity, etc., and computer vision tools. These tools include general models for identifying objects, themes, moods, and demographics of persons (for age, gender, and cultural appearance) in the images.

The core functionalities include the aggregation of multiple Twitter searches, news articles, ERP related websites, and COVID related websites and the removal of unwanted noisy data. Insights which aggregate temporal modalities between social media and other news media are provided. That is, MAP creates an embedded space to combine the modalities between text, image, and videos across social and news media, batch data, and real-time data with multiple time-series properties. Analytical techniques include classification, lexical clustering, topic modelling and sentiment analysis. For example, news articles can be clustered and classified in interactive 3D scatterplot visualisations.

The data analytics methods include:

1. *Topic Modeling and Entity Correlation:* Named Entity Recognition (NER) and Parts of Speech (POS) are used to establish meaningful connections by the term co-occurrence to understand the

context in which words are used. Using NER and POS, MAP identifies the context and themes of the corpus with an objective to derive insights on the following five questions: *who* is the person speaking and when? *What* is the topic s/he is speaking about and *where*? *How* does s/he feel about the topic? Why did s/he feel that way? The analysis will help to track the reasons behind citizens' decision-making choices (e.g. taking part/not taking part in an event) and knowledge and reactions to falsification of test results for different purposes (for example, to take part in events, travel, attend school, and undertake work).

2. *Sentiment Analysis*: Citizens' positive and negative attitudes will be tracked using the overall sentiment score as the collection of all the records which can be further drilled down to each record and to each word level sentiment score.

3. *Lexical Clustering*: Clustering at the word level groups similar topics together which can detect the most prominent topics and identify controversial topics as the "gaming" of lateral flow tests, levels of perceived risk, vaccination passports and so forth.

4. *Document Classification:* Supervised learning uses pretrained machine learning models that classify dataset into more than 35 categories as document classifications such as wellness, science, sports, politics etc. Document-level classification along with word-level clustering identifies relevant topics from the noisy unwanted records that are not useful for the current analysis.

To identify the public reasons behind sentiments across different topics, claims as well as supporting and attacking arguments across all the subsets will be extracted using state-of-the art **Argumentation Mining** techniques. Specifically, *BERT* embeddings technique which outperform traditional approaches Arguments (pro and con) will be used. The results will be then clustered depending on lexical similarities to shed light on their content. The analytics will show what topics are most controversial since talked about the most within and across platforms and what are the reasons (arguments) supporting those stances. The accuracy of the results will be checked through manual qualitative coding. The results will be used to build recommendations to improve the communication campaigns accounting for citizens' risks and anticipating risk behaviours.