Int1: Welcome everyone, it is so good to see so many of you here. That makes me very pleased. We have a good representation across a range of different disciplinary backgrounds, which is exactly what this project is all about. For those of you who are meeting me for the first time, I am H, and I'm the lead of the ME-NET project. And the purpose of these series of stakeholder meetings that were running over the next year, is to get the input from yourselves as lived experience experts in your field. Everybody here works with other people. The point is that we are a team who is developing this project, and we want it to be the most useful as it can be for a range of stakeholders who might want support with their health around respiratory health and mental health, but to do that, we need the input of people like yourselves who work with environmental data. This is about the effects of air pollution on health, as well as people who work within the NHS, within community groups, a real range of people to feed into this project. That's what this is all about. Today I want to start with some introductions and then I'll recap on the project. Most people here I have spoken to, some I haven't in depth about the research itself. So I'll go over what the project is about. And then we have been working this fantastic web development and design team called Common Knowledge, and they have very kindly prepared some prototype material for us today which will be part of the application that we are developing for health protection. The very first bit of code development and design we are doing is in this meeting, and I am presenting some of the work that they have done, and it's really about part of the remit of the project is educational, helping people understand what ozone is and where it comes from. So that is the next component. And then we have a little feedback and evaluation opportunity, and then we might have time to discuss future meetings. <Discusses survey for Ethics and Consent> We will get on to introductions. What I was just thinking is your name, and the institution, but maybe also the kind of lived experience expert that you consider yourself to be. So what is your area of expertise. And then I just decided this little thing to kind of understand people's perspectives, but what comes to mind for you when you think of methane? I thought I would start, obviously my name is HM, and I am representing the university, but I'm also a mental health lived experience expert, both myself with my own experiences, but also with the community groups that I work within. For me, for some reason when I think about methane, I just think bright orange, and I haven't been able to shift that out of my head. I even asked our design team to put some orange into our presentation because that just stuck for me. So I will turn to P first just because I realised we only have 5 or 6 minutes with you, and then I will read down the list and just ask people to introduce themselves, so go for it P?

Res1: Hi everybody, I am PA, I work at the Met Office where I manage the air quality monitoring team. My team and I are responsible for the Met Office air quality forecast. So I am a physicist by training, but in this job I need to know atmosphere chemistry, and I guess that's how I first made contact with H, we started talking about methane and its role as a precursor of ozone in the atmosphere. But to be honest, the first thing that comes to my mind when I think about methane is my gas cooker, it being powered by natural gas which is mostly methane.

Int1: I didn't even know that. Thank you. I will move over to A?

Res2: Hi everyone, my name is AW, I'm a partner of the Wellness Network CIC with J, who you will hear from shortly. I would say my expertise is in mental health being a support and carer for my youngest daughter, but also through the 18 week programme that we actually deliver within the Wellness Network and how we educate people, around how they can improve their mental health, and actually acknowledge that physical and emotional health plays a role in that as well. When I think of methane, I think of not feeling very well! Just a bit woozy and dizzy and not good.

Int1: Thank you. AM?

Res3: Hi everyone, my name is AMS, I am an assistant director at Lincolnshire County Council. I am based in the public health team. But my professional background before moving into public health, was in environmental health and environmental management. So that was that in District Council, so heavily involved in air quality management in particular, and also contaminated land and other environmentally related factors, but also, from a person perspective, in terms of nuisance and people's impacts from air pollution various other pollutants. When I think of methane, I think of cows and agriculture. Obvious reasons why: I think we all know that cows are quite heavy producers of methane combat and so is agriculture, so good to meet you all and go through part of this group.

Int1: Thank you AM, and what a fantastic world to be in giving your background as well. That's really interesting. C?

Res4: I am CS, I am a health research scientist at the Met office with P. So I represent the interface between meteorology, climate and health impacts. So my role within the Met Office is looking at health impacts from climate and weather, including air quality. So what I think of when thinking of methane, I'm thinking about cattle, and also climate change, it is a significant greenhouse gas.

Int1: Wonderful. Thank you. Moving onto S?

Res5: Hi I'm SC, I am a children young people programme lead at the NHSICB. I'm working with the system around children's and young people's asthma. I'm not a trained asthma expert by any stretch of the imagination, but a lot of my time is spent working with colleagues who are. That is where my link in is with that. Like AM, the first thing that I think is cows when we talk about methane.

Int1: Interesting that a few people have though that. L?

Res6: Hi I am an assistant psychologist at CMHT. I have a background in psychology, and hope one day to be a clinical psychologist. When I think of methane, I think of greenhouse gases and climate change.

Int1: Thank you very much. S?

Res7: Hi, I am S, I am a GP, but also the ICB medical director, so lots of interest in the particular area that I work in around air pollution effects on particularly respiratory illness, but others. Me fame for me, like others, apart from the greenhouse gases on the cattle link, is an unpleasant substance. There is the connotation of it not being very nice, but we'll see.

Int1: Not being very nice, I like that. J?

Res8: I’m JT, I am the other half of the Wellness Network CIC with A. The only thing to add to what she says is obviously as we are dealing in the community with people who are suffering, not just mentally, but physically and emotionally as well, health is of interest to us. So I'm really looking forward to seeing what today is going to bring. What comes to mind when I think of methane? Yes, unfortunately it is cows for me. And I suppose an unpleasant, smelly gas, I guess is the best way of putting that.

Int1: Thank you. J, I would ask you to introduce yourself briefly, J is with us for all these meetings, so just a very brief thing what you think about me then otherwise you will be repeating yourself many times!

Int2: My name is J, I have a background in medicine and public health. I work with H at the university of Lincoln. When I think of methane, I think about pollution and climate change.

Int1: M?

Res9: MG, Lincoln Institute for Rural and Coastal health at the University of Lincoln. I have some experience around respiratory problems, I had asthma as a child living in a very low-income family in poor housing, poor social housing, that I have experience of. The effect of that on my respiratory health. So air pollution is just another layer of challenge that we can actually experience alongside those other disadvantages that make us more vulnerable to those sorts of problems. So that's sort of an experience that I have had. I don't have asthma anymore, which is fantastic, but it was quite challenging for me as a child. When I think of methane, I think of an evil gas, that possibly could be used in very bad ways. It has no good connotations, although P clearly benefits from using it for his cooking. I’m interested to learn more about me thing as well.

Int1: Thank you. N?

Res10: Hi NR, I am from Lincolnshire County Council, I am in the Play team and I cover the coast looking at deprivation and issues around coastal communities. And nationally, I lead the Coastal Communities Alliance which is a partnership around social economic deprivation in coastal areas, and we've been talking to H about potentially how pilot schemes can be rolled out nationally around the country on this side of things. Methane wise, I also cover agriculture, and I've just had a discussion about cows and methane, so I suppose that I'm in the agricultural cows field on the methane discussions. I'm just interested here how we can add best practice to roll this out into other coastal communities, if relevant, as this work goes forward.

Int1: R?

Res11: I'm from the university of Lincoln. The area that I work in is often having community conversations and facilitating those within co-production. I suppose they lived experience, I grew up in rural Lincolnshire in a little village called Scamblesby, and when I think about air pollution and stuff like that, I remember in the late 70s there would be a crop plane that would go over to, I presume, spray pesticides on the corn, and it was very exciting, so I would go out and dance in it, because it was fun and raining from the sky, and I always wonder what effect that might have had on me. That kind of rural air pollution that you got growing up. Methane though, I'm quite keen gardener, I'm not so good at getting my cooking waste and peelings down to my allotment, so I put it in black bags, and every time I open those black bags, an absolute stink it's mean, which I think is methane, at least I've always thought it's me pain. I find that really positive: the stinkier the compost, the better my potatoes and tomatoes are going to be.

Int1: That is such a contrasting view, thank you very much, G?

Res12: Hi everyone, my name is GS, I'm a research and evaluation manager at East Midlands ambulance service, NHS trust, my current role is all things pre-hospital research, so looking at what happens pre-hospital wise. When I think of anything, it is very similar to what others have said, the first thing that came to my mind was cows, and an unpleasant gas. Thanks, nice to meet you all.

Inte1: <K joins> Hi K, can I give you an opportunity to introduce yourself briefly?

Res13: I’m KH, I'm the Chief Intelligence Analytics Officer for the ICB for the Lincolnshire system.

Int1: Thanks to everyone for those introductions. In that pre meeting survey, I did ask you once to connect with who down the line, so I think it's quite important that everybody knows who everybody is, we can for opportunities later in this project to have split off groups, for anyone that wants to work together and that sort of thing. Now we all know who we are, which is wonderful. The next part that I want to dive into was just to give a little refresher, or some people, probably the first in depth rundown about what this project is all about.

<Begins presentation and covers the following topics>

- Welcome Trust funded project.

- Brief Develop a dashboard to understand the impact that methane has on health.

- Prototype project for running 12 months (July 1st, 2024 – June 30th, 2025).

- Multi sector collaboration.

- A first step towards understanding the role that methane plays in health. Also improving access to health outcomes, improving access to health services for adaption, and providing opportunities to support research ecosystems in data scarce regions.

- Aims: the pilot an integrated data platform (ME-NET) for regions with varying environmental and health data availability and quality, and with varying sources of methane emitters and super emitters for a) developing data synthesis approaches that are globally applicable, and b) training methane ‘early warning’ models that are robust to regional contexts.

- Outputs: 1. Machine learning algorithms showing the links between methane, ozone and health outcomes. 2. Phone/web app for Health Protection, tracking the impact of zone on mental health and respiratory symptoms, and education in the UK and Ghana, and (including coastal sites).

- Research Questions - To what extent can deep learning be used to develop an ozone early warning system that incorporates health data into regions of the world with a) higher and, b) lower/middle income, reflecting wider global variation in data availability and quality? - What are the most relevant health measures for exploring physical and mental health emergencies associated with methane and ozone concentrations in the two regions, and is it viable to use DL to predict great server emergencies associated with air quality? - What user functions would improve the visibility of climate change impacts, and how deliverables are these, given data availability and quality in regions?

- Four Main functions 1. Alert Me, 2. Explore and Learn, 3. Our Data, 4. My Profile.

Int1: As we go through, please think about, and take notes on potential red flags. What are the unintended negative consequences that could emerge out of a project like this? I will go through some of the main functions, and then there is an opportunity for feedback. It's not just the images, but also the visual kind of component of this, the flyers that I've been presenting from here on in have been co designed with the wonderful group that we're working with - Common Knowledge. So this is partly helping them prototype and trial what some of the content might actually physically look like in the application. Their process is around design justice, which is about iterative design, so day presenters with some images and we take them to our stakeholder group who can then tell us how appropriate you will think that is, if it is understandable.

<Displays Explore and Learn function slide and describes function>

<Displays mobilising citizen science for global social and ecological justice slide>

< Displays My profile and Alert Me slide and describes function>

< Displays methane early warning network slide and describes function>

Int1: This is the point where I will invite you to think about the material presented so far, and if there are any questions do raise hands, but also consider the people in your life, so that could be your personal life, as well as your work life, and who might actually benefit from an application like this? What are the red flags? Take a couple of minutes to use the QR code on your phone and type the feedback. I can see the incoming responses on another screen. What I've done is look at the first bunch of comments that have come through, and not surprisingly, probably the most common is around a concern that we could cause panic and fear for people using this app. I just want to open up the discussion for everybody here. Considering that that is a real concern come out what can we do about that? Stop other things that we could do with this application? AM?

Res3: I'm not sure if it's about the application itself, I think most people are familiar with the concept of air pollution, traffic, and other sources. I'm not sure if people are even particularly aware of the impacts of methane on them. I think there's something there around the educational aspect in the beginning - Why would you want to do this and why is it relevant to me? I think for a lot of people, this isn't even on their radar, this is something that could be affected by.

Int1: Really interesting points. R?

Res11: That's certainly one thing that I wrote that it could scare people, and I think in a sense that's necessary as well because it's scary stuff. One thing it got me thinking about, which probably isn't particularly useful because this isn't what you've been tasked to focus on, but what it got me thinking about is an app on my phone that when I go into it, it gives me a whole bunch of readings about that particular environment that I'm in. I'm still at the beach, the air is full of methane, the sea is full of sewage, something that gives me a full picture of all the things that I actually should be worrying about. I also wonder whether or not with that fear, the fear and worry that comes with that is one thing. But I think the feeling of helplessness is problematic, and I wonder whether or not there is something that can be done with this, this is me getting clearly political, but something that leads to direct action so that if you do look at it, and you realised that you are entering an area where there is methane that you might want to consider wearing a mask, if you want to raise this as an issue. If you want to flag it up or something that needs to be addressed, that there's a way that you can do that and get involved to start to put pressure on the government to change their regulations. But rather than just going – Oh god, the methane level is really high, this is awful, I need to wear a mask. That there is some kind of direct action that people can get involved in following that discovery, if that makes sense?

Int1: That's interesting that point about helplessness, and I wonder, you mentioned the political components of that, might also be a health component that - What do I do about my health? I'm sure this must be something that comes up. Patients must have responses like fear and helplessness, to even learning that they have health conditions. What do we do about that? What do you think S?

Res7: I think it comes back to patient education. I wonder whether you said this is an app, web-based, is there a link that says - If you report this, click on here and they will tell you what you can do. So for example, you are walking into an area, even let it is in the past that your respiratory symptoms get worse, mask wearing is one thing, but you might want to consider increasing your inhaler use as your preventer. You might want to think about using antihistamines or whatever it is. So that health message that is linked to the reported alert, or at least the signpost to where you could do that. The more self-help that we can educationally put into the app, the better. Be a little mindful of being true to the purpose. If we start politically lobbying, we will go down all sorts of rabbit holes, I think will just detract from the great work. For me, it is the educational element built into the process, would be great. And also, the predictive value of this, we really struggle with when do we expect a peak in demand, whereas this could really help us because this could say that we have now seen a specific change in our pattern, ozone and others, you can expect a potential increase in level of need for these patients. That on the service level, becomes really useful for us to use. I think we have to be clear about cause and effect, purpose, and then building in some messaging around, not just where you are accessing help, but what you can do for yourself.

Int1: Thank you, that is absolutely something that we will be looking to our stakeholders like yourself to help us with. The alerts or the updates will definitely have some sort of recommendations - You might want to consider XYZ for today. It's what that XYZ looks like that's quite interesting. So something that came up in another meeting was - Would you tell a child with severe asthma to consider exercising indoors today rather than outdoors? And then what might the implications be for spending more time indoors than outdoors? So there were all these sorts of complications. Interesting to hear you say about the asthma inhaler, we will come back to that. The other thing was around service demand. So this is a prototype. When we actually went to the welcome trust, we presented a prototype for a much wider application, and one of the things was linking to local health services to inform demand. As hopefully down the track that's something we might be able to work towards. A?

Res2: Just in response to R and S, so masks a fine but quite often they cause anxiety and fear themselves. And also, histamines and inhalers are great, but they only mask the symptoms. So I think education is absolutely key but maybe there could be something around that way you could educate people around nutrition, and keeping themselves hydrated, so they are helping to reduce inflammation around their lungs or whatever it is that is their issue, which helps to reduce the symptoms in the first place, so they're not necessarily having to rely on things that are going to mask the symptoms I'm not actually help them support their body properly.

Int1: We thought about ‘find out more's ‘or ‘did you knows’ relating to immediate service access, but actually, preventative information, finding out about preventative measures or something like that would be fantastic. We will send up a follow up survey after this probably or maybe tomorrow, and if you do have ideas for things like - Did you know, or find out more, something around Health Protection or prevention, that certainly is something that we're looking at. So there were these issues around fear and panic, also mentioned were things about not understanding the data, I will come back to that one because I will next present some of the content that Common Knowledge have prepared for us, and you might be able to see what some of that looks like and have some suggestions around that. Someone did say about risk around political lobbying which is a really interesting one to think about down the track. Inhaler use for prevention, yes. And that is a really important distinction for prevention. OK

Res14: <R enters group> sorry I am late.

Int1: Hey R, we did introductions at the very beginning, which we missed out on hearing from you, do you want to just introduce yourself to everybody?

Res14: I am R. I don't spend much time in Lincoln because I have a home in Spain and at Atlanta in the States, but when I do, I do become very much aware of the pollution that we have. When H asked me if I would get involved, I'm more than happy to do so.

Int1: Thanks for making me aware that you joined. So the first educational module. Common Knowledge prepared for is a set of prototype images that could go into a final educational module starting with runaround ozone and how ozone is created. I'm just going to show you the type of approach that they have had so far, and then give you the opportunity to feedback. After that, we're going to present a bit of an evidence space the links between ozone and health and ask you to suggest which bits of the evidence base it's important for you to understand. This is our attempt to identify what we think is important for people to know about ozone production, and we would just be interested to see what people think. The ozone educational module we have called the perfect storm.

<Presents on Education Modules> as follows

* The Perfect Storm
* Ozone and Health

Int1: First, we will discuss the evidence based, secondary will discuss Common Knowledge content, and then third we will ask you to evaluate the content that Common Knowledge had prepared for us. Then we will do in evaluation.

<Presents the Perfect Storm slide>

* Ozone occurs naturally in the stratosphere, making the earth habitable.
* ground level ozone occurs in the troposphere and affects the air people breathe, drives global warming and produces health impacts.
* there are no natural sources of ozone in the troposphere, it is produced from interactions between emissions from human activities and meteorological conditions.
* Specifically, ozone is created when hydrocarbons interact with nitrogen oxides and sunlight.
* Nitrogen oxides occur when fuel is burned EG car emissions and commercial, industrial and residential emissions.
* Sources of methane and non-methane volatile organic compounds (Non MVOCS) include vegetation, waste processing, fuel production and combustion.
* Maintain important because it stays in the troposphere for longer than other pollutants - up to 12 years - compared to less than one day to months for NMVOC's.
* While non methane V OCS are more reactive, accounting for a greater proportion of ozone production, methane is more abundant due to its longer atmospheric lifetime.
* Methane is also a major driver of climate change, with 80xs the warming power of CO2 background levels reflect cumulative build up.
* Methane and climate change are linked via a positive feedback loop

<Presents the Perfect Storm slide>

* <Shows image slides for Perfect storm>
* <Evaluation> take a couple of minutes to consider the people in your life who might benefit from the ME-NET application. Do you think the perfect storm module would be easy to understand for those people? Please respond to the brief survey items using the QR code.

Int1: That's really good feedback, thank you. And not too dissimilar to the feedback that we got in our NE Lincolnshire stakeholder group on Monday. Well, there’s comments about technicality, needing to be simpler, no surprises there. Researchers would benefit but the public might struggle. Descriptions need to come first – that’s a really interesting point, so giving some definitions and some descriptions first and then talking to people about the relationships between things. I sat down and thought that I had really simplified things but it's easy for me to say. Just as a general question to open things up then, do people think the simplified version of this that is far more infographic, and far more visual, unless text based would be more effective? Any specific suggestions that you have? R?

Res11: Maybe this is contentious, for me the presentation should be in reverse, and bring out the narrative, I think. The story is a really important part of it. And that's why my contentious part of it is that I don't think descriptions come first, I think the situation comes first, I think you would lose people with the descriptions. Methane is this and this… and now this is what happens. I think it should actually work backwards and take it through. Whatever is the first thing that you do, that’s the thing that gets the buy-in. If it's done in slides, then you have two slides to get people to buy in and be interested. That is crucial, or else once you move on from that, then you are not going to get anywhere. There's something to do with narrative structure, really thinking about a first slide to really grab their attention, and if you've got it, then you can hold onto it, I think. The other thing I mentioned is the using of terminology, I think the last thing says a positive feedback loop, which I read as - Great, that's good, I'm glad we've got some positive feedback loop! I don't think it is positive in that sense, it is a bad thing. I was confused by the end of myself. Catch them in the beginning, have a story that's easy to follow, and I think it would make sense. I probably do it with a little cartoon or something.

Int1: Absolutely, thank you. J?

Res8: Pretty much what R has just said, I think that the first slide completely turned me off because you're already using language that is not familiar to me. It is not familiar to me, and I am here because I am interested, you're going to lose a lot of people who you are interested in. It's almost a case of – Do you want to tell the story to a child and get the child to explain it? You almost need to be that simple. I was keen about getting the descriptions in early, but having listened to R, I agree with that actually - You need the why first. They need to understand what all these words mean. – So what, otherwise.

Int1: In our NE Lincolnshire meeting on Monday, someone just said – Who cares, I don't care! I thought that's a really good point - Who does care? I care because I'm an academic but who else cares? K?

Res13: I would agree, I was slightly concerned about positive feedback loop, until you said it actually, I think people would think that it was good that it was positive. I think the information that you have there is the right information, I'm not concerned about things being technical because I think if you have it presented in the right way, people take from it what they can take from it, and they just ignore the technical words that are on there. I wouldn't present anything to anyone on slides. I think the majority of what you have presented there would be infographic. You would have a picture that would have the different levels of atmosphere. You could start with a blank piece of paper, and if you want to talk about the upper atmosphere, and then right at the right-hand side, stratosphere for people that want to know it's called that. And then the next bit that might appear might be the lower bit, and you can have troposphere appear on that bit. Then you might have the sun come out, and you could show all of that in one easy graphic that appeared bit by bit. And then people can watch it as a little video or you could just have the PDF right there, the final infographic that is right there that has all the information on. People as simple as that, people take the right story, if they have a really low level of understanding or they take on the complex stuff if they have a much higher level of technical understanding, so I think it would be really easy to do that. A lot of the sentences that you've got, even a bit of structure change to the sentences, it would make it much more accessible. Definitely pictures more than words, I think are incredibly useful.

Int1: I really like those ideas, thank you. S?

Res7: Just building on what people have said. If You look at Vimeo actually, quite often a short clip that is animated captures people's imagination a little bit more. The majority of people associate ozone as a protective, not as a harm. It's about saying that you heard about ozone, have you heard about this? And then a graphic would illustrate the potential impact that would have on either mental health or respiratory illness. The most powerful videos I've seen are the child safeguarding ones: literally within 30 seconds they have a message across that is really engaging but quite powerful at the same time, and then perhaps the link if you want to know more, then they can go into technicalities. But for the majority, that first bit of the visual. The first 30 seconds really describes everything else.

Int1: I'd be thinking about that single image bit, rather than separating out the ozone story with the health story, having them together, rather than having them separate, having it all together as a single image. AM?

Res3: Just to build on what you said there, there are some really good infographics out there in the acid rain cycle, in the atmosphere and how that links to cause and effect. So it might be worth having a look that some of those, there's quite a lot of them around. I agree, a little video that builds is often more helpful than just one particular picture.

Int1: I'm just looking at the chat around the background colours and text, and M saying – The hole in the ozone layer being a panic. Yes, I remember in high school looking for it – I can't see it, apparently it's over Australia, where is it? Thank you for all that feedback. I will look in more detail at the written responses of course. We will have a break now but when we get back, I will do something similar and look at that evidence base with me rapidly synthesising what I could on the effects of ozone on health. We don't have any visual material for that, so what we're looking for is your input on what bits everything that I show and present, what are the important bits, what would matter to people.

Res14: Basically, keep it simple is the thing that I would advocate because it's so easy to put it in our language, academic language, which just turns people off. So we need to keep it simple if we were ordinary people to understand and be interested of course as well.

Int1: Very good points. So as I mentioned the next little bit is just going through some of the evidence base. On a separate note, we probably have to do a few systematic literature reviews properly on this topic with people from health and environmental backgrounds because there isn't a lot out there. Throw a handful of good reviews, but the evidence base, particularly around health and mental health, is a little bit all over the place. When it comes to ozone and respiratory health, it is pretty straightforward, a lot of research has been conducted in this area.

<Presents ozone and respiratory health slides>

* WHO estimates greater than 7 million deaths per year from air pollution.
* Deaths attributable to ozone specifically during warm periods across Europe between 2015-2017 was > 100,000(Achebak et al, 2024).
* As soon as associated with approximately 0.7 million deaths per year, on average 6.3 million years of lost life related to cardiovascular and respiratory illness (Aneburg et al 2010).
* Long and short term exposure decreases lung function, particularly for children) Holm and Balmes, 2022).
* Peak daily ozone and ozone in warm months is associated with cardiopulmonary and respiratory mortality.

<Present Mental Health slide>

* Zhao et al (2018) reviewed 31 studies –> Links between ozone and cognitive function, possible links to suicide, depression to ED admission for panic attacks, notably:
* two cohort studies showing association with depression, including increased risk of reporting symptoms per 10ppb ozone exposure, association with them being concentration and suicide mortality in Belgium for all seasons except winter;
* one case control studies showing difference in ozone for days with +2 suicides (x=86.4 ug/m3) and those without (x=79.8 ug/m3)

Mental health research is less clear

<Presents Direct vs Indirect Pathways slide>

* Increasing evidence for direct impacts of pollutants on central nervous system, cerebral white matter, cortical grey matter and basal ganglia (Bernardini et al, 2020b)
* Alterations to brain regions and process is linked to psychopathology EG changes to neurotransmitters (Zundel et al, 2022).
* maybe some direct pathways to? EG possible links between respiratory systems and mental health flare ups/escalations. Biophysical effector blue inhaler salbutamol overuse EG increased heart rate, tremors, stomach acid precipitating anxiety?

Int1: K?

Res13: If this is about information that we share with the public, we need to be clear that it's evidenced and not share things that aren't evidenced. Or just say that there is currently no evidence that suggests. Because there will be some things that ozone directly impacts, of course there will, we might not be clear on what they are yet, there will be some things that ozone directly impacts. There will be some things that are indirectly impacts like pollen sensitivity, or all sorts of other things that will have health impacts on individuals, but there will be some things that appear to be a link in lack of evidence or poor evidence, but they aren't: the weather can have an impact on ozone, it can have an impact on mental health, the fact that both things happen to go in a particular direction a certain time, doesn't mean that ozone and mental health are linked at all they're just both impacted by the weather. So we just need to be really careful about sharing any information with the public that isn't evidenced?

Int1: That's a fantastic point. I’ve spoken to a few people recently who have raised this potential indirect pathway, so it links between represent presbytery symptoms and mental health flare ups and escalations. I deep dives and did a rapid review of the effects of so beautiful, which will have happened at some point more formally. It's a really good question, is this something we even mentioned to people. Or is it something that we simply embed a self-reporting mechanism that is about how I feel today, so that we can explore this link, rather than directly embedding a mental health component to this education. Or do we just say something like - Having bad air pollution can also affect how you feel. And leave it at that. Is it necessary or not? J?

Res8: For me, my experience with anybody that has any kind of physical illness or situation that they're having to deal with, will have poor mental health alongside it. There are very few people who are suffering physically that aren't feeling it some way mentally. The question is when you're doing these studies and the evidence is showing the effect, is it specifically looking at people who are already suffering in some way, or is it a blanket across anybody?

Int1: We're going to be designing this application for mobile phones and for a website. And we are going to be sharing QR code and encouraging people to actually use it. It's a prototype, and people will know it's prototype; so they will know that it is being trialled, and people will hopefully respond anonymously if we set up a profile that is an anonymous profile. And then we will try it for a period of time and see how it goes and encourage everyone like yourselves to share their QR code and see where it goes. But the thing is, it's not about necessarily targeting patients, it could be that there are support groups like community support groups out there who might benefit from something like this. It may be that there are people who are interested in environmental condition who end up using something like this. Very much the hope is that we can disseminate and prototype beyond people who are already managing health conditions because it would be super interesting to see differences between.

Res8: Sometimes there can be a tendency to - cling on to a reason why I'm feeling bad. I'm feeling bad because of this. If somebody is struggling, it's much easier to have a reason for it. You can have a tendency for people to jump onto that situation because it makes them feel better: they can't do anything about it, it's the air pollution that's making them like this. I think it's really important to have such a widespread amount of data that you're looking at, because it can almost create its own thing.

Int1: A really interesting point.

Res8: But at the end of the day, if there's some things poisoning you then it's poisoning you, and that will come out physically and mentally in the end. It's going around in my head, and I'm already conflicted on it.

Int1: Thank you. S?

Res7: My preference would be not to say that this could have an effect on your mental health. There are lots of validated scales that we could embed if possible. A short one we quite often use for measuring anxiety and depression and mental health symptoms. So you could report - How do you feel today? Do you feel any worse, better? If the answer is - I don't feel as great as I normally do. That automatically opens up a short scale. At least you have a measurable, and you can see impact. One of the is a PHQ score of nine out of 20, when the is 100 ug/m3, and it's 2 when it's 40, do you think start to get much better data validation going forward. K’s point about cause and effect, you might get an evidence based gathering.

Int1: S, Let's chat outside of this because we are looking at some ways to rapidly evaluate things like that. K?

Res1: I will answer both of those points. I think the best way to do this, I think J is right, just have an open profile where people put their information in, and they can go on whenever they want and report symptoms. They're going to report symptoms for lots of the reasons that you have no knowledge of. So I would make it really explicit that this is part of a research trial, get people to include their information in their profile, that means they can answer less questions. Do they already have a diagnosis of asthma? Do they have an inhaler? That sort of thing so you know to ask those questions. Then I would say to them that they will be us to respond at various times when the app sends them an alert and asks them to do so. You could make some promises that that would only ever be between 8:00 in the morning at 9:00 at night, so it's not going to get an alert in the night and that sort of thing. You could link to a really easy range 1 – 10 questions, or 1-5 questions or whatever around the main things that you wanted to ask. So the alert goes out, you do it in a polarised fashion. You would tell them it's random, but actually they would send an alert out when you have really low levels, and an alert out when you have really high levels, so you could just polarise two datasets. You would collect things around - When did you last use your inhaler? Are you suffering respiratory issues at the moment 1-5? How do you feel in your mental health right now 1-5? Are you suffering headache? Things that you know you want to ask, you can't make it too long, it has to be really quick to do it. But if you've already had some information in their profile, you could make it really succinct, and just push it out when you have really low or high levels so you have two controlled data sets, and that way you'll get sufficient population to account for any of the confounders, and you won't have the issue of skewing a data set by people wanting to go on and report things when they have other reasons to do so that might not be associated with ozone.

Int1: You just given me a million things to think about, thank you! All really good things to think about.

<Shows some points to consider slide>

* WHO estimates that dangerous ozone concentrations are greater than 100 ug/m3.
* Thresholds might be low for mental health.
* What are the actual links, drivers and pathways?
* Much more research needed.

<Shows Ozone and your health slide>

* Think about the most important thing you have learned about ozone and health. Which bits are the most important to include an educational module ‘Ozone and your health’. Which bits should be represented visually? <Shares mages designed by Lincolnshire’s University Academy Holbeach in Kings grammar Grantham students> Picture – How bad air things get out.

Int1: Have a think and when you're ready put your hand up.

Res14: I think that traffic has to come into this somewhere, if mothers are taking their kids for walks, pushing their pushchairs along busy roads but busy times, when traffic is stationary. I think people ought to know that there is a danger to that. Perhaps they should pick somewhere where it's not such a polluted area.

Int1: So something about the local sources of pollution might help people make sensible decisions about their health?

Res14: I think the majority of people are going to be more interested in things that affect them directly then the overall picture.

Int1: Really good point. J?

Res8: It's difficult because there are some really scary statistics that you have on there, and there's a fine line between absolutely terrifying people that they won't go out and leave their front door again, to making them stop and think. I'm a big believer in giving people information to make themselves healthier, so they are stronger to be able to cope with it, as opposed to telling them not to go out, don't go out in the warm weather, don't go here because it's busier. It is how do we make them healthier to be able to cope with to start with. Is there any angle on that? Otherwise, you will be locking the doors and not coming out again!

Int1: I think that goes back to some of what S. said – preventative inhaler, that sort of thing really. K?

Res13: The fact that everyone isn't jumping into the same pool of statistics probably tells us something. I think there is a lack of robust evidence, which would make me nervous. I think if there is a clinical review of the existing evidence, then the clinical judgement, would be what is most important. And if the judgement is that there's likely to be a link, but there isn't yet evidence, what I would personally nearly do is go to the next robust level where we do have a lot of robust evidence around pollutants in general. So all of that stuff that we had in the first part of the session about ozone and how it appears, and the fact that it might impact your health, I think is really useful, and the infographic would be really good for that, you could then say - pollutants including airborne pollen, can have an impact on… and then you cover really short section on the things that can impact that is really well evidenced. Ozone is a source of pollutants, but we're not saying that it specifically does that, it's pollutants in general. We can provide sources of help as well - What might you do about those symptoms. If you are in need, call 111. That sort of thing as well. Then you could have a preventative section, under section that says to remember to balance this with the positive impacts for being outdoors and exercising and all those sorts of things. So they've just got something balanced and people can make up their own minds. We don't want to be fearmongering one way or the other, and we should only be sharing stuff that we do have robust evidence for.

Res14: You can highlight the fact that Lincolnshire doing things around the Sincil Bank area, for instance. They're doing a lot of work on that, making it one way, improving the conditions there.

Int1: So some positive messages as well, I think that's a great idea. C?

Res4: There were three things that I just wanted to say, this kind of epidemiological evidence on that slide is a bit too much, and kind of disables people. It is disempowering, I guess, if anybody sees the statistics then they might think that there is nothing they can do about it. The other thing is around providing alerts when pollution is high, it's useful perhaps to tell people where and when it's actually low at the same time, so they can adapt perhaps how do I get to someplace, decide to go somewhere at a different time of the day when the pollutants are less around there. I don't know if that can easily be put into the opposite stands. I think the pictures are really good. I think the information might need to be checked from a science point of view, so as to not educate people with the wrong facts. For instance, if you're talking about ozone and car emissions, I think P is probably the best expert in that area, but my understanding is that it's nitric oxides that come out of the cars, and then it's the sunlight that will create the ozone from the nitric oxides. So it is the sunlight that creates the ozone, and if there's no sunlight then you won't have the ozone. It is trying to balance between providing the right information that is scientifically robust, and having something that people can act on.

Int1: Absolutely. All of those suggestions are really useful. It sounds to me like we've had a bit of a consensus that probably you absolutely have to stick to information that is robust, and the probably that it's not necessary to even include knowledge base around the mental health links. What is more important just to facilitate some mental health reporting that might actually add to the evidence base in a useful way. Keeping it simple and having a narrative that's useful rather than having an evidence base around all the negative effects for ozone and respiratory health, which could be really debilitating. That is already helpful. There will be a follow-up survey where we can capture some of this a bit more.

<Displays Follow up Survey Screen>

- Find out more: your ideas about the links we should embed in the app.

- Opportunity to recommend additional stakeholders for the board.

- Days of the week/times of the day for future meetings.

- Further opportunity for feedback and input.

<Meeting Transcription>

- All recorded meeting will be transcribed.

- Transcriptions will be uploaded to Teams.

- Opportunity to feedback.

<Displays Future Meetings slide>

- Similar format, feedback and Co develop content for the application following the themes below

- Timeline for future meetings

<Future Themes>

- Visual self-assessment tools for MH and respiratory symptoms

- Graphing self-reported data, alert me

- Mapping observational data, explore and learn

- Prototyping functionality of alerts of the system/app

Int1: Any final comments come with questions or concerns?

Res14: What are we planning to do with the findings that have come up? How will that improve things for everybody? Also, will we need some help from people like councillors.

Int1: The purpose of these sessions is that we are developing this app, so all of the feedback given by people like yourself in these sessions will go into actually physically developing an app that people can download. Yes, it will be available on a standard computer as well. We're going to try all the app to see if it will I actually have benefits for supporting people with their health. Should councillors be involved? Absolutely. But how do we go about doing that, is another question. – ‘10% up the UK population do not use smartphones’. Yes, it will definitely be on a standard computer as well. I guess that's it everyone, thanks so much for coming, and we look forward to chatting again in the future. I will send around the follow up surveys capture the most convenient times of day and days a week for everyone to make sure everyone can attend next time. Thank you so much for your time today.

Interview Ends