

Quite detailed field work on this issue, so over to you Beth I had.

It's gonna pull this out some water.

Open this pourings of water. We should congratulate Beth because she did her pH. D Viva recently, she's passed with minor correction. So just- round of applause.

Thank you.

Hello everyone. Today I'm going to be speaking to you about the cognitive effects of chronic low level carbon monoxide exposure in older adults. I'm gonna go through a brief background to the research and then add the methods that we used the results and then research directions and moving forward. So what we plan to do to continue the research.

Cool.

They can hear me a bit better.

OK, we don't seem to be.

The doc.

They call them monoxide. Poison is actually one of the most common causes of both accidental and intentional poisoning worldwide. So when we breathe in carbon monoxide, it actually enters the bloodstream, where it binds to hemoglobin, forming carboxyhemoglobin. Now, this actually reduces the oxygen carrying capacity of the blood, so the amount of oxygen that can get to the tissues and organs is released. It is reduced due to the binding of CO<sub>2</sub>, the hemoglobin.

And ultimately, this leads to hypoxia. So the majority of research that has been published has studied severe acute carbon monoxide poisoning. So really high levels where people become unconscious and are rushed to hospital. So initial symptoms include headache, fatigue, nausea and vomiting. And then as the carbon monoxide level increases and the exposure duration also increases, symptoms such as dizziness and confusion.

Are experienced and then this is progressively followed by loss of consciousness and ultimately death.

Now, no psychological impairments can actually follow these these high level Co poisoning episodes as well, and these can include a range of neurological deficits, cognitive impairments and effective changes. So personality changes, high levels of anxiety and depression.

So moving onto low level Co exposures. So the researcher I have been carrying out faster did.

Extremely low levels.

OK.

So evidence on the effects associated with less severe exposures is currently quite limited and the results are quite inconsistent as well. So the effects that follow these Lester very exposures are currently unclear.

So there has been a few experimental studies in the literature and these have looked at acute low level Co exposure. So these are durations up to 24 hours.

O what these studies have typically done is expose participants to around 100 parts per million for short lasting durations, usually between one and four hours. So researchers would fill a chamber with low level Co or have the participants brief the Co through a face mask, and then they would get them to carry out some form of cognitive testing. And then what these studies have revealed are that small increases in carboxyhemoglobin levels up to around 5%. We're actually associated with impaired cognitive function in areas such as divided.

Attention or tracking ability.

However, the other experimental studies and that looked so acute low level Co exposure found number of evidence of some effects. So like I mentioned, the literary is somewhat inconsistent

and as you can see from the photos on the slides that the majority of these studies are extremely dated, carried out in the 70s and 80s.

So moving on to chronic low level Co exposure to these describe durations over 24 hours.

Now there have been numerous case reports within the literature. One in particular was a case series, and they followed 7 individuals who were exposed to low to moderate Co levels within the home from malfunctioning domestic appliances and the exposure durations range between three weeks and three years.

What they actually found was consistent symptoms in all 7 individuals, so headache and nausea were very common affective disorders such as anxiety and depression were also high, but they also found memory impairments and motor slowing in all of these seven individuals as well. Now some of the patients did make a full recovery. However, mild deficits did remain. In some cases, this seems to suggest that these deficits associated with these less severe exposures may be more persistent.

In nature, rather than short lasting.

Further evidence of the effects of chronic exposures is provided from epidemiological studies, and these have reported associations between air pollution and increased risk of stroke, myocardial infarction, and heart failure, and this is typically indicated by higher hospital admission or mortality rates in areas of higher pollution and in association between Co exposure in particular, and increased dementia development.

Development risk has also been reported by the studies so taken together, although limited, the evidence does suggest that neuropsychological deficits may present following less severe exposures, and that there may be more persistent in nature, so they may contribute to significant morbidity.

There were not that certain groups within the population may be at high risk of Co exposure. The research that I've been carrying out has to do an older adult sample as we know is a group. There may be more susceptible to the effects of CI.

So poisoning severity depends not only on environmental factors such as the concentration of Co in the ambient air or the duration of exposure, or the rate of ventilation, but also human factors as well, such as preexisting disease. So individuals with, for example cardiac conditions or respiratory conditions.

I likely to be more susceptible to raised carboxyhemoglobin levels and develop severe toxicity from lower concentrations and this is due to their already reduced ability to adequately regulate and maintain oxygen supply so the level at which more severe symptoms such as loss of consciousness become apparent is dependent on an individual's ability to.

Compensate for any reductions in the oxygen carrying capacity of the blood, so older adults may be more susceptible to the effects of Co not only due to preexisting health conditions, but also reduced physiological reserve. But they also may be at higher risk of Co exposure within the home, as they're likely to spend more time within the home due to possible retirement or restricted mobility. Or they may even be housebound.

To move it on to Co levels within the homes, there has been a few studies that have actually monitored the ambient Co concentrations within UK homes and what these studies have reported are that in a proportion of these homes, the Co levels actually exceeded those recommended to be safe by the World Health Organisation. So some of these studies in particular found that of the 326 homes monitored, 19% actually had Co levels exceed in the 8 hour guideline of nine parts per million.

And the elevated CO levels in these studies were frequently associated with gas appliances. There's maybe a particular concern within the UK is gas appliances are widely used for heating and cooking, and homes are often older as well. So they're potentially more likely to contain it dated appliances.

Tell you can quite clearly shift the. See the shift from these positive effects through to negative effects over time, with the exception as I've, as I've mentioned, in visual working memory, the positive effects remain, but it is likely with you know, a higher exposure duration, we would start to see a negative impact in the visual working memory as well.

So the results do indicate that these exposures to chronic low level CO may be associated with longer term cognitive impairments. Now the vascular alterations that I've mentioned that we observe in ageing and cardiovascular disease and their effects on cerebral blood flow along with age-related brain changes such as atrophy of the hippocampus have all been associated with a greater risk of early cognitive decline and dementia development. So the possibility that chronic exposure to low level CO adds to this burden.

Present significant concern and it may place an already vulnerable group at an even greater risk of early cognitive decline or dementia development.

So the association between CO exposure and dementia development has gained attention over the last decade. SO<sub>2</sub> retrospective studies found that CO poisoned patients were at higher risk of dementia development compared to non poisoned patients, and also case reports document associations between less severe exposures and cognitive impairments. And furthermore, epidemiological studies and find that chronic have found that chronic exposure to air pollution, including low level CO.

I increase the risk of dementia and, importantly, air pollution has actually recently been identified as a dementia development risk factor in later life. So future longer longitudinal studies are needed now in order to examine incident rates and the impacts of chronic low level CO exposure within vulnerable groups such as older adults, in order to examine the risk for mark onto impairment and early cognitive decline.

And this may lead to preventative measures and reduced risk.

So thank you for listening. I tried to get through that as quick as I could. I'd just like to thank the Sea Research Trust. They funded the project previously known as the Gas Safety Trust and also W Midlands Fire service, particularly Adrian Hurt and Billy Mills who is here today representing the fire service. And without them this wouldn't have been possible. So thank you.

Keep.

Please.

Aren't you very much, Beth? Some really, really important research there. I love that overall slide at the end where Beth distinguishes between the short term, the long term effects, because I don't know about you. Those of us in academia, we often get, you know, aunties and parents saying, well, why do you spend all this time doing research? It's common sense. Surely carbon monoxide we know is bad for you. Well, actually, this graph tells you a little bit more nuanced than that, and that's why we need to do research, isn't it?