PODCAST SCRIPT – THOSE LITTLE INHALERS ARE CAUSING BIG DAMAGE

On today's episode, I'm going to discuss an article published in the British Columbia Medical Journal, in May 2023. The authors of this article are Kevin Liang, a Family Physician and clinical instructor at UBC; Jiayun Angela Yao, a regional epidemiologist for the BC Centre for Disease Control; Philip Hui, a Respirologist and clinical assistant professor in the UBC's division of Respiratory Medicine; and Darryl Quantz, a public health consultant for the Fraser Health authority. The article has open access, which means you can access it freely through the link in the show notes.

This article caught my eye because it talked about the climate impact of inhalers, and I thought, wait a minute, I thought this problem was kinda dealt with already, and that the 'bad stuff' in inhalers, the propellants or the gas used to make the spray, had been replaced with something not harmful. But in this study, the authors present the findings of their retrospective longitudinal analysis of inhaler prescriptions in the Fraser Health region, in BC, between 2016 and 2021 and its resulting carbon footprint. Retrospective meaning – they are using data collected in the past, and longitudinal, meaning they have multiple years of data.

And an interesting thing about this article too is -- they estimated the climate impact of the use of such medications, yes, but they didn't just throw their hands in the air and say oh well, nothing we can do… they also presented alternative scenarios to reduce this impact.

Okay, so let's go back a bit, and provide some general background.

Inhaled medications are used mostly to treat obstructive lung diseases, such as Asthma and COPD, due to their capacity of delivering drugs straight to the lungs. There are 3 main types of inhalers: pressurized metered-dose inhalers, dry powder inhalers and soft mist inhalers. From these types, the first one is known to carry a significant carbon footprint. That happens mainly because they use gases called hydrofluoroalkanes to propel and deliver the medication to the lungs. These gases are very potent greenhouse gases, having a global warming potential more than 1000 times greater than carbon dioxide. That stat is based on an article published in the European Respiratory Journal, I'll put the link to that in the show notes.

On the other hand, dry power and soft mist inhalers do not use these gases, and, therefore, have a much reduced climate impact.

Despite the negative environmental effect of metered-dose inhalers, these medications are widely prescribed. Numbers from the United Kingdom, presented in the article, show that pressurized metered-dose inhalers account for 70% of all inhalers prescribed. Why is that? I'm not sure of all the reasons, but I do think that the cost of medications delivered by metered-dose inhalers is much less, in many cases, than medications delivered in the other formats. And they have been around for a lot longer, so their may be some prescribing trends that have hung on.

But is the environmental effect from these inhalers actually significant? The short answer is yes. A report from 2021 published in Lancet, estimates that the health-care activities constitute 4.6% of the global

carbon footprint. And more specifically to inhalers, the carbon footprint related to inhalers use account for up to 4% of the country's total health care footprint. Think of that! 4%! From those little inhalers.

But in order to make local changes, sometimes you need local data. It's hard to change the way things are when you're using data that comes from another country, far away. So these authors decided to look at the impact of these drugs in an area of our province of British Columbia (in Canada) called the Fraser Health region, and to do that they used data from the PharmaNet system. So for context again, this study was done in the country of Canada, in the province of British Columbia, in a region of British Columbia called the Fraser Health region. PharmaNet is a BC database that is the envy of many researchers across Canada and the world. It tracks all drugs prescribed to pretty much the whole population of British Columbia. Researchers can apply to get access to this massive database and answer all sorts of questions. So they used it to estimate the number and type of inhalers dispensed between 2016 and 2021 in the Fraser Health region. This region has almost 2 million residents. Then, they calculated the carbon footprint for each type of inhaler, using a stepwise approach: First, they obtained the manufacturer's carbon footprint information. If not available, a British database was used, matched to the Canadian drugs' characteristics. For the remaining inhalers, the carbon footprint was calculated based on the propellant's global warming potential.

So they were able to identify how many inhalers, and then the carbon footprint for those inhalers, over the 5 year time period. And what did they find?

Their analysis showed that during the analysed time, more than 3.56 million inhalers were prescribed in the Fraser Health region, an average of almost 600,000 inhalers every year. From these, approximately two-thirds were pressurized metered-dose inhalers. So that is in line with the data I previously mentioned, that most inhalers prescribed are metered-dose inhalers.

And what did those inhalers do? They released the equivalent of 8.5 thousand tons of CO_2 every year. To put this amount in context, Fraser Health as a health care organization reported annual average measured emissions of 38.9 thousand tons of CO_2 equivalents. This number takes into account all health authority's 174 buildings and 13 acute care hospitals. This means that the carbon footprint of inhaler corresponds, in average, to approximately 22% of the Fraser Health facilities footprint.

But, you might argue, this is a big population, it makes sense there would be a lot of necessary use of pressurized metered-dose inhalers, right? Or was it all necessary? The authors also analyzed inhalers' prescription patterns, aiming to determine the rate of over prescription of these drugs. For that, they defined the rate of "overuse" as the number of individuals of 12 to 40 years old who were dispensed three or more short-acting beta 2-agonist inhalers in a calendar year, divided by the number of individuals of the same age who were dispensed at least one inhaler. According to the analysed data, the overuse rate ranged from 11.5% to 14.2% during the 6-year period, with an average of 12.9%. Okay, this might not be overuse, per se, but over-reliance on short-acting beta2-agonists is a problem in general, so it is possible that some of these people may be better served if they were switched to a longer-acting medication using a different delivery system.

Finally, the article suggested three scenarios in order to reduce greenhouse gas emissions from inhaler use, which is helpful because it can be difficult to know how to tackle this important problem.

- Scenario number 1 considered that all pressurized metered-dose inhalers would be replaced with versions containing lower volumes of propellant gas, while delivering a similar amount of medication. This scenario was considered based on the fact that different pressurized metered-dose inhaler preparations use different amounts of propellant gas. For example, Zenhale is an inhaler that uses a type of propellant gas with a much higher global warming potential. If these changes were put into practice, the authors estimated a 44% reduction in the carbon footprint every year.
- In scenario number 2, the authors proposed that all patients older than 12 years of age in need of inhalers would be prescribed with dry powder inhalers instead of pressurized metered-dose inhalers. This would result in a 78% reduction in the carbon-footprint, more than 6.5 thousand tons of CO_2 equivalents per year.
- In the last scenario, the article took into consideration the current guideline for asthma management. The current GINA guidelines recommend that patients older than 12 years old, with mild or very mild disease, should be prescribed budesonide-formoterol solely instead of short-acting beta-2 agonists as a rescue inhaler. This means they should be prescribed a dry powder inhaler instead of a pressurized metered-dose inhaler. For the calculations, the authors applied this change to patients between 12 and 40 years old, in order to prevent the inclusion of older patients with COPD. This scenario would result in a 14% reduction in the carbon-footprint every year.

Altogether, this analysis presented some interesting data regarding the carbon footprint of inhalers, especially the pressurized metered-dose type, and also gave us some ideas on how to tackle this problem. In the discussion section the authors mention that the carbon footprint is not the only concern of pressurized metered-dose inhalers. They are also more prone to be used sub optimally by patients – we know that it requires more coordination, and if not used with a spacer, often less medication is delivered to the lungs, resulting in more need to use the inhaler. As they do not have a dose counter, it is hard to determine when these inhalers are empty, which results in either inappropriate disposal or continued use of empty inhalers. On the other hand, dry powder inhalers and soft mist inhalers have a better dose control and most are available in once-a-day dosing which improves medication adherence.

From all inhaled drugs, salbutamol, the most commonly dispensed as a pressurized metered-dose inhaler, is the single largest source of carbon emissions in the Fraser Health region, accounting for 67% of the carbon footprint. Besides its environmental impact, salbutamol use was also shown to be associated with poor asthma control, increased risk of exacerbations, hospitalizations and death. This means that a trend towards substituting this drug would not only have environmental but also clinical benefits. Alternatively, even when pressurized metered dose inhalers are deemed to be necessary, the use of brands with lower volumes of propellant gas can be considered, and this was shown in scenario 1 to have a significant impact.

In terms of costs and PharmaCare availability related to these changes, the authors did a great job and presented a table containing the commonly prescribed pressured metered-dose inhalers and the available alternatives, with their respective prices and mentioning if they are covered by PharmaCare, or

if a special authority request is necessary. This is very specific to BC policy, but you can consult this material in the link available in the episode description.

Now, as I previously mentioned, many patients might not have the financial ability to purchase the more expensive inhalers. But for those that can, if you can suggest to your patients that they ask for medication therapy that does not include pressurized metered-dose inhalers, and make this content part of your education session on medications, you'll likely be giving them very valuable information that needs to be considered. I bet most of them wouldn't even know that their medication is having such a negative impact on the environment. There are important patient decision-making tools in healthcare, and I expect that few of them have as part of the decision – what is the impact of this therapy on the environment? But people do care about the environment, and may be "inspired" (sorry for the pun) to make a different decision when provided this information. So think about including this in your education – and encourage them to bring it to their doctor. If things are going to change, likely it will come from the patient asking for alternatives.

I hope you enjoyed this episode, I personally was surprised to learn about the enormous impact of that small little inhaler. Take care everyone!