Reducing hospital pharmacies' carbon emissions by distributing fewer metered dose inhalers

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What was done?

All Metered Dose Inhalers (MDI) of our formulary were screened for the following criteria:

Which Active Pharmaceutical Ingredient/s (API) is/are contained? → Are comparable Dry Powder Inhalers (DPI) available? → Can a MDI be replaced by a DPI considering wards and patients´ needs?

Distribution numbers one year before and after formulary adaptation were analysed. Furthermore, subsequent savings of greenhouse gas emissions have been calculated.

Why was it done?

Nowadays, norflurane is often used as MDIs' propellant. It has a Global Warming Potential (GWP) 1,430 times higher than CO_2[1]. Therefore, MDIs cause larger emissions than DPIs. By lowering the numbers of MDIs´ in-house prescriptions, savings of emissions can be achieved.

How was it done? *

For each MDI, availability of comparable DPIs with the same API/s and dosage was assessed for the German market

At the same time – current distribution numbers of MDIs and DPIs were analysed

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Wards with highest orders of MDIs were identified to see who may be affected by a device change

Physicians in charge were contacted to replace MDIs where possible

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Subsequently the formulary was adapted

Saved emissions were calculated on the basis of current literature

Background data for emission calculation:

$$\underset{[g\ CO_2e]}{Emissions\ per\ device} = 120\ \frac{puff}{device} * x\ \frac{g\ CO_2e}{puff} * y$$

x: *individual Emissions per Device (Table 1)*
y: *number devices distributed during defined time period*

Figure 1: calculation of the carbon emissions per device [g CO_2e]

Device	Emissions [g CO_2e/puff] [2]
Foster® 100/6 µg	94.42
Foster® NEXThaler® 100/6 µg	7.63

Table 1: individual carbon emissions [g CO_2e/puff] *caused by the different inhalation devices*

What has been achieved?

One MDI was replaced in the formulary by an equivalent DPI. Results of distribution numbers and carbon emissions are shown in Table 1. By means of this the hospital pharmacy reduced emissions by **2.921,9 kg CO_2e** compared to preadaptation.

	Distribution numbers		Carbon emissions (kg CO_2e)	
	before adaptation	after adaptation	before adaptation	after adaptation
Foster® 100/6µg	274	4	3,104.5	45.3
Foster® NEXThaler® 100/6µg	-	150	-	137.3

Table 2: Numbers of distributed MDIs and DPIs one year before and after formulary-adaptation and the resulting carbon emissions caused by the named MDIs/DPIs

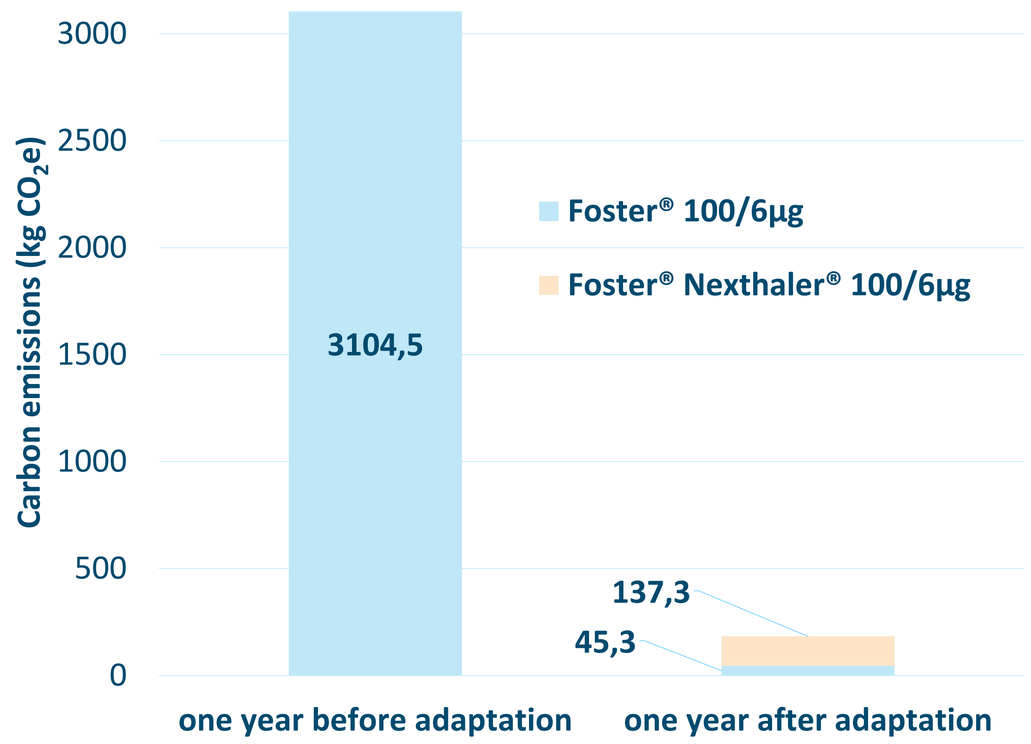

Figure 2: Carbon emissions caused by the named MDIs/DPIs during one year before and after formulary-adaptation

What next?

MDIs containing new propellants with lower GWP are already being worked on by the pharmaceutical industry and thus, more climate friendly opposed to conventional MDIs. Replacing current MDIs with the novel, climate friendly alternatives once available on the market, is a useful approach to further lower hospital pharmacies' carbon emissions.

[1] 2.10.2 Direct Global Warming Potentials - AR4 WGI Chapter 2: Changes in Atmospheric Constituents and in Radiative Forcing (ipcc.ch), accessed 20.12.2023, 08:30
[2] Panigone, S.; Sandri, F.; Ferri, R.; Volpato, A.; Nudo, E.; Nicolini, G. Environmental impact of inhalers for respiratory diseases: decreasing the carbon footprint while preserving patient-tailored treatment, *BMJ Open Respir Res*. **2020, 7**.

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