

Switches Between pMDI and DPI Asthma Preventers in England: Discontinuation, Persistence and Switch-back

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Summary

National policy initiatives in the UK, such as the NHS Net Zero strategy, have encouraged switching from pressurized metered dose inhalers (pMDIs) to more environmentally sustainable dry powder inhalers (DPIs). However, real-world evidence on the impact of such nonclinical switching remains limited. This retrospective cohort study used Clinical Practice Research Datalink (CPRD) data to evaluate the characteristics and outcomes, specifically discontinuation, persistence, and switch-back, of 13,482 asthma patients who switched between pMDIs and DPIs without changing drug class or dose from 2015 to 2024 in English primary care. A higher number of patients switched from pMDI to DPI compared with those who switched from DPI to pMDI, reflecting national policy direction. However, persistence was lower in this group, particularly among older adults and women. In contrast, patients switching to pMDIs showed consistently higher persistence. Approximately 25-30% of all switchers reverted to their original inhaler. Monthly switching trends revealed strong alignment with NHS policy events, even prior to their formal implementation, indicating that policy signals can influence clinical behavior. These findings highlight the importance of patient-centred approaches to inhaler switching, especially for groups at higher risk of discontinuation. Further research is needed to assess safety and effectiveness outcomes of switching, including exacerbation control and treatment success.

Key Message

National policies promoting low-carbon inhalers have driven increased switching from pMDIs to DPIs in UK primary care. However, this shift is associated with lower persistence, particularly among older adults and women. Switching decisions should be patient-centred and avoid blanket policies to ensure long-term asthma control.

Introduction

The National Health Service (NHS) aims to become the world's first net zero health system, but pMDIs (one of its most prescribed asthma treatments) emit 9-36 kg carbon dioxide equivalent (CO₂e) per inhaler. Current pMDIs account for approximately 3% of the NHS's total carbon footprint due to their hydrofluoroalkane (HFA) propellants, which are potent greenhouse gases. In contrast, DPIs, which do not require propellants, emit less than 6 kg CO₂e per inhaler [1,2].

The environmental impact of inhalers has gained increasing attention from policymakers and professional bodies. Between 2019 and 2020, four national guidance documents were published advocating for greater use of lower-carbon alternatives, recommending a shift from pMDIs to DPIs when clinically appropriate and acceptable to patients. More recently, the NHS Investment and Impact Fund (IIF) introduced financial incentives to support this transition and encourage DPI prescribing in primary care [3].

Despite this strong policy direction, real-world evidence supporting the safety and effectiveness of switching between pMDIs and DPIs remains limited. A small number of studies including one post-hoc trial have suggested potential benefits in asthma control after switching from pMDIs to DPIs [4]. However, this finding was confounded by changes in drug regimens before and after switch, as well as structured inhaler training, conditions that are rarely replicated in routine clinical practice.

This study uses large-scale, high-quality real-world data from UK primary care to evaluate persistence of inhaler switching between pMDIs and DPIs. It aims to generate evidence to inform clinical guidelines and policy decisions on the conditions under which inhaler switching regimen should be undertaken, ensuring that such changes are implemented appropriately, and without compromising patient safety.

Methods

We conducted a retrospective cohort study using data from CPRD, which contains the anonymized electronic primary care records of 20 million patients from England. The study period ranged from 2015 to 2024.

The inhaler switching cohort included patients aged 18 years or older at the index date with at least two asthma diagnoses recorded on different dates prior to cohort entry. Patients were excluded if they had a prior diagnosis of chronic respiratory disease, or if they received two or more courses of oral prednisolone within a 28-day window during the baseline period. Eligible patients had continuous prescriptions for inhaled corticosteroids (ICS) or ICS combined with a long-acting β_2 -agonist (ICS-LABA) during a 12-month baseline period, with no changes in dose band, drug or inhaler device. ICS dose bands were categorized as low, medium or high according to British Thoracic Society and Scottish Intercollegiate Guidelines Network (BTS/SIGN) 2019 guidelines based on daily dose [5]. To ensure treatment stability, ICS or ICS-LABA inhalers, as well as any additional inhalers such as long-acting β_2 -agonists, long-acting muscarinic antagonists, or oral asthma treatments were required to be prescribed at least twice within the baseline period, with the earliest issue date occurring at least 330 days before the index date.

The baseline period was followed by a switch in inhaler type (from pMDI to DPI or vice versa) within the same dose band at the index date. Inhalers were assumed to have equivalent clinical effectiveness within the same dose band, regardless of the specific drug used.

Three key outcomes were assessed: discontinuation, persistence, and switch back. Discontinuation was defined as a subsequent change in the dose band, drug, or inhaler device of the preventer inhaler following the initial switch. Persistence referred to continued use of the newly initiated inhaler without any further changes. For example, DPI→pMDI denotes a switch from DPI to pMDI, with persistence measured as continued use of the new pMDI. Switch back was defined as a patient returning to the same inhaler used during the baseline period.

Results and Discussion

	ICS low dose		ICS medium & high dose		ICS-LABA low dose		ICS-LABA medium dose		ICS-LABA high dose	
	N	%	N	%	N	%	N	%	N	%
N (PMDI to DPI)	1503		172		5003		1471		1751	
Gender										
- Male	609	40.5	68	39.5	1912	38.2	539	36.6	600	34.3
- Female	894	59.5	104	60.5	3091	61.8	932	63.4	1151	65.7
Age categories (years)										
- 18-40	372	24.8	38	22.1	1315	26.3	413	28.1	453	25.9
- 41-60	553	36.8	71	41.3	1928	38.5	558	37.9	710	40.5
- 61-80	500	33.3	55	32.0	1495	29.9	408	27.7	491	28
- >80	78	5.2	8	4.7	265	5.3	92	6.3	97	5.5
BMI (kg/m²)										
- <25	454	33.0	38	24.4	1326	27.6	407	28.4	372	21.9
- 25-29.9	457	33.3	65	41.7	1637	34.1	442	30.9	542	32.0
- 30-34.9	263	19.1	31	19.9	987	20.6	296	20.7	395	23.3
- ≥35	75	14.6	22	14.1	849	17.7	286	20.0	386	22.8
Smoking Status										
- Non-smoker	694	46.2	83	48.3	1959	39.2	544	37	702	40.1
- Current smoker	409	27.2	39	22.7	1598	31.9	473	32.2	625	35.7
- Ex-smoker	225	15.0	24	14.0	799	16	239	16.2	236	13.5
- Missing data	175	11.6	26	15.1	647	12.9	215	14.6	188	10.7
	ICS low dose		ICS medium & high dose		ICS-LABA low dose		ICS-LABA medium dose		ICS-LABA high dose	
	N	%	N	%	N	%	N	%	N	%
N (DPI to PMDI)	176		76		1774		687		869	
Gender										
- Male	69	39.2	31	40.8	597	33.7	216	31.4	272	31.3
- Female	107	60.8	45	59.2	1177	66.3	471	68.6	597	68.7
Age categories (years)										
- 18-40	49	27.8	22	28.9	521	29.4	177	25.8	196	22.6
- 41-60	56	31.8	27	35.5	632	35.6	246	35.8	349	40.2
- 61-80	60	34.1	18	23.7	474	26.7	208	30.3	245	28.2
- >80	11	6.2	9	11.8	147	8.3	56	8.2	79	9.1
BMI (kg/m²)										
- <25	56	33.5	23	31.9	472	27.5	190	28.1	189	22.6
- 25-29.9	62	37.1	20	27.8	541	31.5	219	32.4	238	28.5
- 30-34.9	29	17.4	20	27.8	370	21.5	159	23.6	211	25.2
- ≥35	20	12.0	9	12.5	334	19.5	107	15.9	198	23.7
Smoking Status										
- Non-smoker	89	50.6	41	53.9	727	41	288	41.9	366	42.1
- Current smoker	35	19.9	21	27.6	541	30.5	195	28.4	256	29.5
- Ex-smoker	32	18.2	9	11.8	271	15.3	115	16.7	143	16.5
- Missing data	20	11.4	5	6.6	235	13.2	89	13	104	12

Table 1: Population characteristics for the switching cohort (dose band definitions are based on BTS/SIGN 2019 guidelines)

A total of 9900 patients switched from pMDI to DPI and 3582 from DPI to pMDI. Across almost all groups, the most frequent sex, age and BMI were female, 41-60 years and 25-29.9 kg/m², respectively. Current smokers accounted for 20-30% across subgroups, while 11-15% had missing smoking data.

A greater number of patients switched from pMDI to DPI, consistent with NHS policy encouraging environmentally sustainable prescribing. The demographic skew toward older, female, and overweight individuals aligns with known asthma patterns in primary care [5]. The relatively high smoking rates may indicate patients with more severe disease or poor symptom control [6].

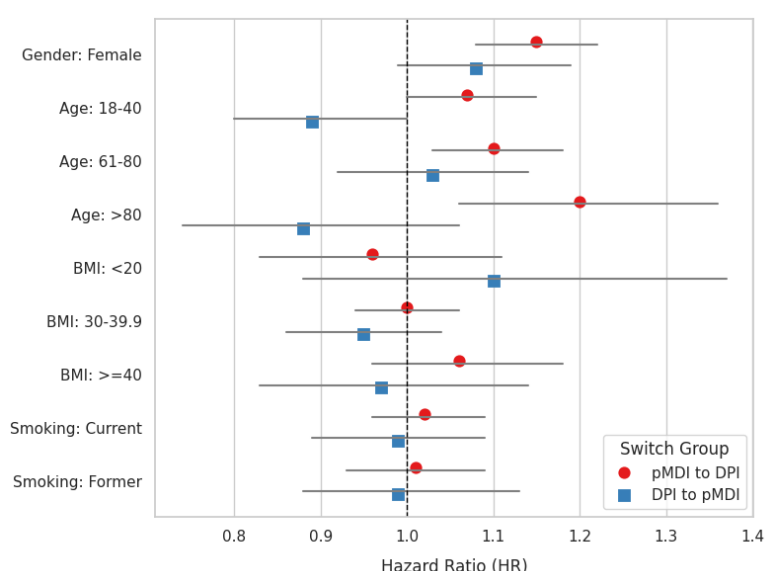


Figure 1: Adjusted hazard ratios (HRs) for discontinuation of the new inhaler in the switching cohort

Females who switched from pMDI to DPI had a significantly higher risk of discontinuation (HR = 1.22; 95% Confidence Interval [CI]: 1.15–1.30), suggesting lower persistence. Patients aged 61–80 (HR = 1.10; 95% CI: 1.03–1.18) and >80 (HR = 1.20; 95% CI: 1.06–1.36) also showed reduced persistence in the pMDI to DPI group. Additionally, younger adults (18–40) switching from DPI to pMDI demonstrated better persistence (HR = 0.89; 95% CI: 0.80–1.00). No clear differences were observed across BMI or smoking categories.

The lower persistence in older adults and women switching to DPI may reflect challenges with DPIs, which require sufficient inspiratory effort and may be harder to master for these groups. These results reinforce the need for tailored inhaler selection based on patient preferences, rather than blanket switching strategies.

	Median Persistence Days with IQR (pMDI → DPI)	Median Persistence Days with IQR (DPI → pMDI)	% Switch Back (pMDI → DPI)	% Switch Back (DPI → pMDI)	% 12 Months Persistence (pMDI → DPI)	% 12 Months Persistence (DPI → pMDI)
ICS Low dose	272.0 (57.8-433.5)	257.0 (62.0-979.0)	27.5%	36.9%	35.4%	46.6%
ICS Medium & High dose	267.5 (97.0-439.5)	185.5 (41.8-769.8)	25.0%	23.7%	34.9%	39.5%
ICS-LABA Low dose	252.0 (62.0-502.0)	326.0 (58.0-1030.8)	35.2%	33.2%	37.0%	48.0%
ICS-LABA Medium dose	279.0 (55.0-700.0)	275.0 (51.0-867.2)	30.1%	36.3%	43.3%	44.8%
ICS-LABA High dose	226.0 (47.0-533.0)	279.0 (48.0-860.0)	37.2%	32.5%	37.1%	45.0%

Table 2: Persistence outcomes of the switching cohort

Median persistence times varied across dose bands and switch directions. Generally, patients who switched from DPI to pMDI exhibited higher upper interquartile values, indicating that a subset of patients in this group tended to persist longer. At 12 months, persistence was highest among DPI to pMDI patients for all doses and drugs. Around 30% of patients switched back to their original inhaler, observed in both switch directions.

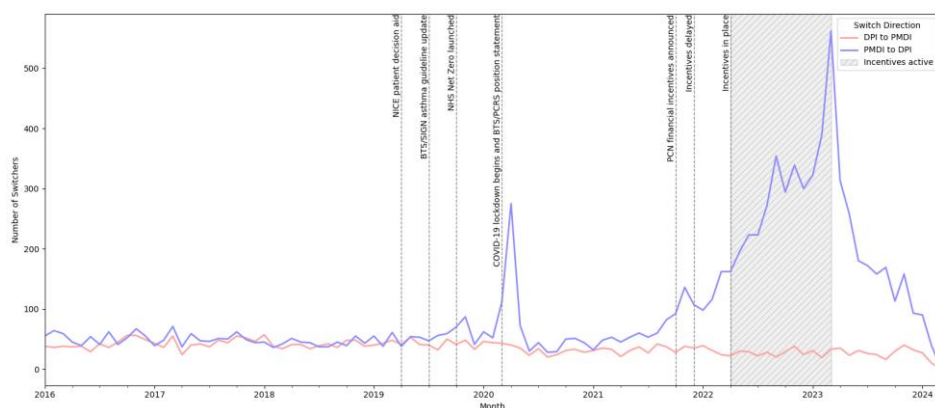


Figure 2: Monthly inhaler switches trends with NHS policy events from 2015 to 2024

Prior to major policy interventions, the number of patients switching from pMDI to DPI was broadly similar to those switching in the opposite direction, suggesting a baseline level of switching driven by clinical need. Following the announcement of NHS Net Zero and subsequent NHS guidance from 2019, switching from pMDI to DPI began to rise modestly. A sharp increase was observed from October 2021, coinciding with the announcement of financial incentives to reduce pMDI prescribing. Notably, this rise occurred before the actual implementation of the incentives in April 2022, indicating that policy announcements alone may have influenced clinician behaviour. It is also worth noting that the switching rates declined immediately after the incentive period ended and have now returned to baseline. These patterns highlight the influence of national policy on prescribing behaviour [3] and confirm the face validity of the algorithms used to identify switches.

Conclusions

This study highlights the impact of national policy on inhaler switching patterns in UK primary care. While switching from pMDI to DPI supports environmental goals, it is associated with lower treatment persistence. In contrast, switching to pMDI showed better persistence, and many patients reverted to their original device. These findings suggest that switching decisions should be based on individual patient needs rather than blanket policies. Policy-driven changes must be balanced with clinical judgment and patient acceptability. The introduction of pMDI with low global warming potential propellants over the next few years will support the achievement of a net zero health service while still meeting patient need. Further analysis will assess the clinical outcomes of switching, including asthma control and treatment success.

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