The IPAC-RS inhaler common use errors matrix

Nia Stevens[1], Julian Dixon[1], Sonja Lederhilger[2], Fredrik Mannerstråle[3], Juan Cheng[4], Charles Buckner[3], Stephan Horst[5], Krystal Limouzin[6], Lesley Hoe[7] & Svetlana Lyapustina[8] on behalf of the IPAC-RS Devices Group
1. Team Consulting, 2. Novartis, 3. Astra Zeneca, 4. Merck, 5. Boehringer Ingelheim, 6. Aptar Pharma, 7. 3M & 8. Faegre Drinker

1 Background and purpose

All inhalation devices present the opportunity for use error. Understanding the potential for use errors with different inhalers, and the possible consequences on the delivered lung dose, allows a common industry baseline for use-related risk assessment, human factors programs and regulatory engagement.

The IPAC-RS Devices Group has compiled a list of known use errors common to each inhaler class and assessed these for their impact on the delivered lung dose. This "Inhaler Common Use Error Matrix" provides a shared industry input to use-related risk assessments (URRA) and human factors programmes for inhaled products.

2 Scope

In scope of this matrix are use errors (sequences of events) and the lung dose change (hazardous situation) that they create. The potential patient harm resulting from use-error related mis-dosing is not in scope since this relationship is highly product specific. Similarly, the probability of any use-error occurring is out of scope, user study data, where available, can support this. The cumulative impact of repeating those use errors and patient risks other than mis-dosing are also out of scope. These aspects should all be reviewed separately by project teams.

Scope of Common Use Errors Matrix and Relationship Between Hazard, Sequence of Events Hazardous Situation and Harm - Adapted from ISO 14971:2019

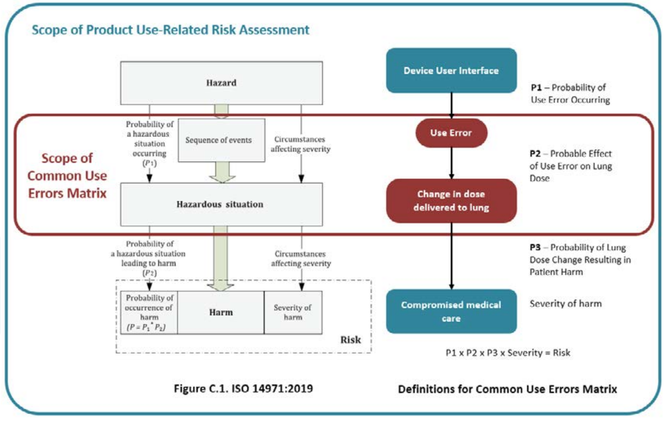

Figure C.1. ISO 14971:2019 — Definitions for Common Use Errors Matrix

3 Matrix overview and scoring rationale

Use errors covering all dosing steps, preparatory and post-dosing tasks, and inhaler storage and care are listed. Each error is grouped according to which inhaler classes it is applicable to: pMDI, BAMDI, SMI, DPI (manual loaded) and DPI (pre-loaded).
Each use error is scored for its impact on the dose delivered to the lung. Score categories differentiate between hazardous situations in which the patient is certain to receive no dose, where dose is has a reasonable probability of being substantially affected and where there is minimal impact on dose delivery to lung.

	Task Step / Sub-Step	Associated Use Error	pMDI	BAMDI	SMI	DPI (Manual-Load)	DPI (Pre-Loaded)	Lung Delivery Effect	Comment	Score for Effect on Lung Delivery
2.1	**Preparation for Dose Administration**									
2.1.1	**Preparation for Dose Administration (All Inhalers)**									
a.	Remove inhaler cap/cover	Cap / cover not removed	X	X	X	X	X	No dose		10
b.	Check for dirt/debris in mouthpiece	No check for dirt/debris in mouthpiece.	X	X	X	X	X	No impact	Inhalation of foreign object and infection hazards.	Not Scored, should be scored by project team.
c.	Check for blockages in mouthpiece	No check for blockages in mouthpiece.	X	X	X	X	X	Potential for severely reduced dose		7
d.	Retain cap after removal	Cap discarded before inhaler is empty.	X	X	X	X	X	No impact	Inhalation of foreign object and infection hazards.	Not Scored, should be scored by project team.
2.1.2	**Preparation for Dose Administration (pMDI)**									
a.	Leave canister in acutator	Canister removed from actuator prior to use	X					No dose		10
b.	Prime inhaler after specified re-priming period (e.g. 5 days)	Inhaler not primed after specified re-priming period (e.g. 5 days)	X					Potential for no dose/reduced dose for first 1-3 actuations		4
c.	Shake inhaler correctly prior to dosing (for specified duration)	Inhaler not correctly shaken (for specified duration) prior to dosing	X					Potential for increased or reduced dose.	Suspensions only. Magnitude of dose effect and impactful time period both product dependent.	7

Selected sample of matrix pictured. Click here to download your copy of the full use error matrix.

Category	Score	Description	Examples
Maximal effect	10	Patient certain to receive no dose	Not opening inhaler Not inserting unit dose Removing canister
High effect	7	Risk of severely reduced dose	Inhaler not shaken (pMDI) Incorrect inhalation flowrate Inhale into device (DPI)
Moderate effect	4	Risk of reduced dose	Inhaler not primed (pMDI) No deep exhalation prior to inhalation
Minor effect	1	Low risk to dosing	Inhale into device (pMDI)

Abbreviations
pMDI – Pressurised Metered-Dose Inhaler; BAMDI – Breath Actuated Metered-Dose Inhaler; Soft Mist Inhaler – SMI; ML-DPI – Manually-Loaded Dry Powder Inhaler; PL-DPI – Pre-Loaded Dry Powder Inhaler.

4 Use of matrix as input to use-related risk assessment

This common use error matrix is intended to provide a starting point for teams seeking to conduct a product risk assessment and ensure some consistency of approach between across the industry and regulators.
Project teams should adapt this matrix to their product by reviewing each use error and associated risk score carefully.
The inhaler use error dosing score rates the effect on the delivery to the lung of an individual dose ranging from 10 (maximal effect – patient certain to receive no dose) to 1 (minor effect – low risk to dosing). The product risk assessment will consider the harm caused by reduced dose delivery of the specific drug product under development
Where an error does not impact dosing but does pose another risk, e.g. microbial infection if not cleaned regularly, then this risk is listed but not scored. It is nonetheless important that the project team evaluate these risks appropriately for their product.

References *ISO 14971:2019 Medical devices – Application of risk management to medical devices*

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