Using Standardised Concentrations of Liquid Medicines in Children

Take home summary

NPPG and the Royal College of Paediatrics and Child Health (RCPCH) strongly recommend that when children require liquid medications, they should receive the RCPCH and NPPG recommended concentration, where one exists. There are currently 15 such recommended concentrations detailed in Table 1, 14 of which are published in relevant drug monographs of the BNF for Children. The recommendation for each medicine is made either in terms of drug salt or drug base, in line with the relevant BNF monograph.

By standardising the prescribed concentration of these medicines, we will reduce the risk of errors being made in the doses given to children and prevent hospitalisation from accidental under and overdoses. When selecting an appropriate product for children, the excipient content should also be considered; further details can be found in the position statement *Choosing an oral liquid medicine for children*.

Table 1: Standard concentrations which should be prescribed

Drug	Concentration
Azathioprine (as base)	10mg/mL
Calcium Carbonate (for use as a phosphate binder)	100mg/mL
Chloral Hydrate	100mg/mL
Clopidogrel (as base)	5mg/mL*
Ethambutol hydrochloride	80mg/mL
Hydrocortisone (as base)	1mg/mL
Isoniazid (as base)	10mg/mL
Lisinopril (as base)	1mg/mL
Morphine sulphate *(**note:** this product must always be prescribed and dispensed in secondary care)*	100micrograms/mL**
Phenobarbital (as base- alcohol free)	10mg/mL
Pyrazinamide (as base)	100mg/mL
Sertraline	10mg/mL
Sodium chloride	5mmol/mL
Spironolactone (as base)	10mg/mL
Tacrolimus (as base)	1mg/mL

*Clopidogrel concentration agreed, but as no monograph for this drug exists in the BNFC it is not included there.
** Only to be used where the required dose is too small to allow safe use of a licensed 2mg/mL oral solution.

Further Information

Every year there is harm to patients caused by accidental under and overdosing of medicines in children solely due to the fact that the concentration of their liquid medication changed and the person administering the medicine did not realise they needed to change the volume given.

A study by Rawlence *et al* was undertaken to establish through evidence and Delphi review of experts the most suitable concentration of each of the top 20 prescribed liquid special medications in children[1]. When selecting initial concentration for review the following criteria were used:

1. Ideal : Dose for 1kg patient should not be less than 0.2mL, and for a 50kg patient should not be more than 10mL
2. Satisfactory: Dose for 1kg patients should not be below 0.1mL, and for a 50kg patient should not be above 20mL

Consensus on a standard concentration was found for 17 of the top 20 liquid special medications and these have been endorsed by the Medicines Committee at the RCPCH and published through the BNF for Children which NPPG and RCPCH publish with the Royal Pharmaceutical Society. The first version of this position statement included all 17 medicines, though some were removed from later versions as licensed products have become available. Lisinopril and calcium carbonate have been added following a later (currently unpublished) consensus-finding exercise amongst NPPG members.

This position statement has been written to highlight that these standardised concentrations exist and to encourage all prescribers to prescribe these concentrations. We also encourage the use of these concentrations to be supported through their inclusion in local guidance. This will help prevent errors in children whilst enabling further work to look at excipient suitability and cost control.

The recommended concentrations can be found in the prescribing and dispensing section of the BNFC monographs for each of the drugs, whether accessed in paper or electronic form.

Safe use of Oral Morphine in Neonatal and Paediatric Patients:

In July 2023, a patient safety alert was issued by NHSE (North East and Yorkshire), highlighting a case where a 4-week old baby experienced significant harm; confusion between an unlicensed 100microgram/mL morphine oral solution and the licensed 2mg/mL product were cited as contributory factors. One of the required actions within the alert was the tightening up of supply routes for the 100microgram/mL product, ensuring that prescribing and dispensing is restricted to secondary care[2]. The licensed 2mg/mL product can be safely used to administer morphine to most neonates and children, but for doses under 200micrograms, the 100microgram/mL solution is recommended due to difficulties in accurately measuring volumes less than 0.1mL with an oral syringe.

References

1. Rawlence E *et al*. Is the provision of paediatric oral liquid medicines safe? *Arch Dis Child Educ Pract Ed*. 2018;103(6):310-313.
2. NHS England, North East and Yorkshire. Serious Incident Case Study: Infant Morphine Overdose Investigation Summary & Learning. July 2023. Accessed via https://www.cdreporting.co.uk/nhs/portal/resources/get?id=100 .

Disclaimer

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Key changes from Version 10 (published December 2024):

- Addition of statement that morphine 100microgram/mL oral liquids must be prescribed and dispensed in secondary care.

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