

Children's Hospital of Philadelphia Extemporaneous Formulations

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Overall, the *Children's Hospital of Philadelphia Extemporaneous Formulations* is a great pharmacy compounding reference book, especially for oral products. The book contains formulations (some with more than one recipe) for a total of 78 elixirs, solutions, suspensions, and syrups, 6 ophthalmic solutions, and 2 topical agents.

The book begins with an introductory section highlighting legal considerations, most of which are highly relevant to the Canadian pharmacist. (All compounding pharmacists should also review Health Canada's policy on "Manufacturing and Compounding Drug Products in Canada", available at http://www.hc-sc.gc.ca/hpfb-dgpsa/inspectorate/pol_fram_man_comp_drug_prod_can_entire_e.html). This section also comments on compounding and preparation methods, giving some practical advice along with the do's and don'ts of compounding. The introduction is followed by 2 appendixes, both of which are "must reads". Appendix A is the American Society of Health-System Pharmacists (ASHP) Technical Assistance Bulletin on Compounding Non-sterile Products in Pharmacies, and Appendix B is the ASHP Technical Assistance Bulletin on Pharmacy-Prepared Ophthalmic Products.

The last section of the book contains the formulations themselves, divided into 3 subsections: the first for elixirs, solutions, suspensions, and syrups; the second for ointments and ophthalmic solutions; and the third for commercially available products. The last of these subsections contains recipes for items that are commercially available in the United States (but not Canada) and are to be used only when the commercial product is unavailable. The book contains only formulations that have been published or for which documented stability data are on file (in this regard, a few of the cited references are very old).

The formulations, all of which are listed in the table of contents, are laid out well and presented in large print. Each recipe has an ingredients section, preparation details, storage conditions, special instructions, alternatives (if applicable), expiry information, and references. Most are good formulations, and I certainly cannot comment on every recipe; however, I feel that a few notes are warranted to make this book fully useful for Canadian pharmacists.

First, to my knowledge, 4 ingredients mentioned in the formulations — specifically Roxane diluent (Roxane Laboratories, Columbus, Ohio), syrpalta, cherry syrup, and aromatic elixir — are not commercially available in Canada. Furthermore, cherry syrups from different manufacturers lack

uniformity in composition.¹ This may be true for commercially available orange and strawberry syrups as well.

For some drugs (flecainide, chloroquine, granisetron, spironolactone, and ursodiol), I would recommend alternative recipes using Ora-Plus (a suspending agent) and Ora-Sweet (a sweetening agent). Compounding pharmacists are strongly advised not to substitute unlisted vehicles for those given in the formulations.

Ora-Plus and Ora-Sweet have superior suspending properties to some of the vehicles given in the formulations presented in this book. There is minimal (or no) settling or caking in the products that we make using these vehicles at our institution.

Specific Comments on Recipes

- Aminophylline: Chong and others² provide a much better formulation than the one listed here.
- Bethanecol: Use only the recipe listing the combination Ora-Plus–Ora-Sweet vehicle.
- Captopril: The formulation given in the book has no preservatives and is stable for only 28 days at room temperature. The listed expiry period is 56 days with refrigeration. However, when the drug is removed from the fridge to be administered, it is exposed to room temperature. Therefore, I would shorten the expiry period. Furthermore, captopril is degraded by oxidation, so it should be stored in glass or polyvinylchloride (PVC) bottles.
- Ethacrynic acid: Note the alcohol and sorbitol content (for pediatric patients). The 220-day expiry period should be shortened.
- Labetalol: In trials in our pharmacy with both of the tablet brands available in Canada, suspensions in Ora-Plus and Ora-Sweet vehicles were unsatisfactory. Depending on the brand, irreversible clumping occurred either immediately or after a few days.
- Lamotrigine 1 mg/mL: For some patients, using this concentration of this drug would necessitate giving large volumes. Chewable/dispersible tablets are available in 2-mg and 5-mg strengths, which may be more suitable.
- Lansoprazole: The study cited³ examined the stability of this drug in plastic oral syringes and found that it was stable at room temperature for only 8 h, after which it turned into an insoluble paste. Because lansoprazole is removed from the fridge daily, the expiry period should be much shorter than what is given in the book.
- Mexiletine, pentoxifylline, and potassium perchlorate: The formulations for all of these drugs use sterile, unpreserved water. Therefore, I would use very short expiry periods, not the long ones listed in the book. The alternative recipe for mexiletine is better than the primary one. Another preserved recipe for potassium perchlorate can be found in the stability reference⁴ cited in the book. However, the process is more complicated.



- Midazolam and verapamil suspensions in Ora-Plus and Ora-Sweet: At the recommended 50 mg/mL strength, these suspensions are very bitter.
- Midazolam: As noted above, the recommended syrup vehicle is not available in Canada. The Hospital for Sick Children has a formulation in chocolate-cherry vehicle (see <http://www.sickkids.on.ca/pharmacy/manu.asp>).
- Omeprazole solution in sodium bicarbonate: Reports in the literature have shown that omeprazole in sodium bicarbonate has poorer bioavailability than the intact capsule.⁵⁻⁷
- Propranolol: The authors do not mention that for maximum stability of propranolol, the pH must be adjusted to between 2.8 and 4.0 (because the drug degrades readily at alkaline pH). The syrup used in the cited stability study⁸ contained an “undisclosed quantity of citric acid”. We have found that the pH must be adjusted with citric acid when this drug is prepared in simple syrup, as the pH is only 6.24 when the drug is freshly compounded. Furthermore, the suggested expiry date of 238 days should be shortened considerably.
- Tacrolimus: This lipophilic molecule has high solubility in lipids and can therefore adsorb onto plastic surfaces such as PVC.^{9,10} The stability study¹¹ cited in the book was done in glass and plastic (type not specified) prescription bottles. Therefore, it is advisable to store this suspension in glass (preferred) or non-PVC plastic bottles.
- Trimethoprim: In the cited stability study¹² the drug was prepared in a simple syrup–methylcellulose combination (50:50 v/v) and was stable for 42 days at room temperature. However, the authors of the book under review suggest that it be made in simple syrup. I recommend a shorter expiry date than 90 days with refrigeration, as the product must be removed from the fridge daily.
- Ursodiol: Use the recipe with Ora-Sweet-SF instead of the one with strawberry syrup.

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Competence Assessment Tools for Health-System Pharmacies (2nd edition)

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Over the past several decades, hospital pharmacy practice has become increasingly regulated. Hospital pharmacy departments must routinely undergo accreditation to ensure that they are providing safe and effective patient care services and, in some cases, to ensure staffing and infrastructure are sufficient to provide adequate education for pharmacy students and other trainees. Pharmacists, managers, and directors are well aware of the stress and turmoil that often precedes accreditation reports and site visits. Such events frequently require completion of self-assessment questionnaires, submission of documents (such as policy and procedure manuals), and measurement of the efficacy of existing or new services. While few would argue with the goals of accreditation or its necessity, many pharmacists preparing for accreditation may express concern about their skills and abilities to fully deal with reviewers' needs or anticipate their concerns.

Competence Assessment Tools for Health-System Pharmacies (2nd edition) by Lee B. Murdaugh provides pharmacists in institutional settings with an opportunity to evaluate their processes, staff, and initiatives systematically and comprehensively. Originally developed to help pharmacy directors and staff meet the accreditation standards of the Joint Commission on Accreditation of Healthcare Organizations (Joint Commission), this manual includes a series of templates, resources, job descriptions, and other tools that may assist facilities and practitioners preparing for accreditation.

