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**Evaluating pharmacotherapy education:
urgent need for hard outcomes**

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Recently, a call was made for more high quality articles on clinical pharmacology and therapeutics (CPT) education.¹ Not only is there a lack of research in this field, but also the quality of the available literature is disturbing. Most of the evaluation methods currently used in undergraduate CPT education rely too heavily on “soft” endpoints, such as satisfaction with the education received, and on intermediate endpoints, such as increase in knowledge and skills instead of improvement of patient care. Moreover, measures of knowledge and skills are often not valid, because self-assessment does not reflect actual knowledge and skills. Both issues are discussed in this letter.

First, the lack of “hard endpoints” is a problem. In educational research, it is common to classify endpoints on the basis of the four levels of evaluation described in Kirkpatrick’s model of impact of education (modified by Freeth) (Table 1).^{2,3} Unfortunately, studies of CPT education with hard endpoints (levels 3 & 4) are rare. For example, in four systematic reviews of undergraduate CPT education,⁴⁻⁷ only 2 of the 63 included articles (3%) used level 3 or 4 endpoints to evaluate their educational interventions (Table 1). In fact, most of the included articles (47; 75%) used level 2 endpoints, so called intermediate endpoints. Improvement in intermediate endpoints (Kirkpatrick level 2) does not necessarily translate into improvement in patient care (Kirkpatrick level 4). Thus it is difficult to interpret the results of level 2 studies in terms of their value for CPT education.

Secondly, the validity of the (soft) endpoints used in educational research is sometimes dubious. A recent study showed that self-reported confidence in prescribing skills is poorly correlated with assessed competence.⁸ A logical consequence of this finding is that self-reported confidence should not be used as the primary measure of students’ prescribing skills at the undergraduate level. This prompted us to question whether the same is true for pharmacology and pharmacotherapy knowledge. Is self-evaluated knowledge also poorly correlated with objectively assessed knowledge? To evaluate this hypothesis, we reanalysed data obtained from bachelor and master students in an earlier study by Keijsers *et al.*⁹ In this study, students’ knowledge of basic pharmacology and clinical pharmacology was assessed using a written multiple choice assessment, and students rated their confidence in applying pharmacology and pharmacotherapy knowledge in clinical practice. Correlations between self-reported confidence and assessed basic or applied knowledge were absent or weak, with Pearson’s correlations ranging from $r = 0.07$ to $r = 0.25$ ($P < 0.05$). This mismatch between confidence scores and knowledge scores has also been reported for residents.¹⁰

A commonly used approach to bridge the gap between knowledge/skills assessments and clinical practice is simulation-based education (Kirkpatrick level 3). While simulation has been shown to improve important learning outcomes, its contribution to clinical outcomes remains unclear.⁶ Moreover, simulation does not adequately reflect the more demanding conditions of everyday practice, such as time pressure, a high workload, and a hierarchical culture, and for this reason we think that a better approach to evidence-based CPT education is to involve students in prescribing for real patients, such as in student-run clinics,^{11,12} student participation in medication safety programmes, or on clinical rotations (Kirkpatrick levels 3 & 4).^{13,14} Although the implementation of these “real context” training programmes requires organizational effort, they are feasible and of educational value.¹² More importantly, these programmes provide new opportunities for “hard” outcome studies, and there is an urgent need for such studies in CPT educational research, because evidence-based educational programmes can only be designed if there is enough supporting high-quality research available.

Table 1. Included articles (n= 63) classified by Kirkpatrick’s modified model of evaluation.

Modified level of evaluation of Kirkpatrick	Amount of articles
level 1: learners views on the learning experience	8 (13%)
level 2a: modification of attitudes or perception	2 (3%)
level 2b: modification of knowledge and skills	45 (71%)
level 3: behavioural change	1 (2%)
level 4a: change in organizational practice	0
level 4b: benefits to patients	1 (2%)

* unknown= 6 (9%)

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REFERENCES

1. Keijsers CJ, Ross S. A pharmacological approach to education. *Br J Clin Pharmacol*. 2015;80(3):329–330.
2. Steinert Y, Mann K, Centeno A, et al. A systematic review of faculty development initiatives designed to improve teaching effectiveness in medical education: BEME Guide No. 8. *Med Teach*. 2006;28(6):497–526.
3. Freeth D, Hammick M, Koppel I, Reeves S, Barr H. A critical review of evaluations of interprofessional education. London: Learning & Teaching Support Network for Health Sciences and Practice; 2002.
4. Keijsers CJ, van Hensbergen L, Jacobs L, et al. Geriatric pharmacology and pharmacotherapy education for health professionals and students: a systematic review. *Br J Clin Pharmacol*. 2012;74(5):762–773.
5. Ross S, Loke YK. Do educational interventions improve prescribing by medical students and junior doctors? A systematic review. *Br J Clin Pharmacol*. 2009;67(6):662–670.
6. Aura SM, Sormunen MS, Jordan SE, Tossavainen KA, Turunen HE. Learning outcomes associated with patient simulation method in pharmacotherapy education: an integrative review. *Simul Healthc*. 2015;10(3):170–177.
7. Kamarudin G, Penm J, Chaar B, Moles R. Educational interventions to improve prescribing competency: a systematic review. *BMJ Open*. 2013;3(8):e003291.
8. Brinkman DJ, Tichelaar J, Agtmael MA, de Vries TP, Richir MC. Self-reported confidence in prescribing skills correlates poorly with assessed competence in fourth-year medical students. *J Clin Pharmacol*. 2015;55(7):825–830.
9. Keijsers CJ, Segers WS, de Wildt DJ, Brouwers JR, Keijsers L, Jansen PA. Implementation of the WHO-6-step in the medical curriculum to improve pharmacology knowledge and pharmacotherapy skills. *Br J Clin Pharmacol*. 2015;79(6):897–906.
10. Ramaswamy R, Maio V, Diamond JJ, et al. Potentially inappropriate prescribing in elderly: assessing doctor knowledge, confidence and barriers. *J Eval Clin Pract*. 2011;17(6):1153–1159.
11. Schutte T, Tichelaar J, Dekker RS, van Agtmael MA, de Vries TP, Richir MC. Learning in student-run clinics: a systematic review. *Med Educ*. 2015;49(3):249–263.
12. Dekker RS, Schutte T, Tichelaar J, et al. A novel approach to teaching pharmacotherapeutics-feasibility of the learner-centered student-run clinic. *Eur J Clin Pharmacol*. 2015;71(11):1381–1387.
13. van Unen RJ, Tichelaar J, Schneider AJ, et al. The feasibility of incorporating structured therapeutic consultations with real patients into the clinical clerkship internal medicine. *Naunyn Schmiedebergs Arch Pharmacol*. 2012;385(11):1111–1116.
14. Brinkman DJ, Tichelaar J, van Agtmael MA, Schotsman R, de Vries TP, Richir MC. The prescribing performance and confidence of final-year medical students. *Clin Pharmacol Ther*. 2014;96(5):531–533.