Forschungsprojekte nationaler Tragweite
Vorlage für das Einreichen eines Projekts

Ausschreibung No 4

Die Beschreibung des Projekts darf nicht länger als 5 Seiten sein

Titel des Projekts	Prescribing errors in children: What is the impact of a computerized physician order entry with a sophisticated clinical decision support system?	**Datum** 18. April 2014
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Identifiziertes Problem und Bedeutung des Problems in der Schweiz	In the current health care system medication errors are an important source of morbidity and mortality. Pediatric patients are one of the most sensible groups regarding medication errors. The American Academy of Pediatrics recommends (among other interventions) the implementation of a computerized physician order entry (CPOE) with clinical decision support system (CDSS) to reduce medication errors in children. In Switzerland, the safety of drug therapy in pediatric care is an ongoing problem. In most hospitals, CPOE with pediatric CDSS is not yet established. However, in 2008 the pharmaceutical service of the University Children's Hospital Zurich began to develop a highly structured database which is published on the website www.kinderdosierungen.ch since 2012. Today it contains up-to-date drug information about around 330 different active substances. Furthermore, the website offers the possibility to automatically calculate required dosages for any child according to age, weight and / or body surface area of the patient. This database and the corresponding calculator could be used as a CDSS in a CPOE.	

Literatur **Analyse von Literaturdaten**	In the current health care system, especially in neonatal and pediatric intensive care, medication errors are an important source of morbidity [1, 2, 3, 4, 5, 6, 7] and efforts for improvement are paramount. Children are a challenging group of patients because of the increased need of dose calculations and special preparations of medicines and the fact that a lot of medications are in the off label use. It is known that dose calculation errors are the most common error source in neonatal and pediatric patients [8]. Kaushal et al reported that the rate of potential adverse drug events (ADEs) resulting from medication errors was threefold higher for children than for adults [3]. A review estimates that 5 to 27% of medication orders for children contain an error somewhere along prescribing, dispensing and administering. The review also estimates that there are 100 to 400 prescribing errors per 1000 patients. This review of the literature on medication errors in children highlights without question the prioritization of implementation of medication error reduction strategies. [9] The American Academy of Pediatrics recommends interventions which have the capacity to prevent medication errors in the pediatric inpatient setting: computerized physician order entry (CPOE) with clinical decision support systems, ward-based clinical pharmacists, educational programs for all hospital and medical staff in calculating, prescribing, preparing and administering medications, reporting of adverse medication events (critical incident monitoring system) and drug-use evaluation program. [10] The evaluation of CPOE in adults and children yielded conflicting results. In adult intensive care the introduction of CPOE was associated with a reduction in the proportion of medication errors. However, it introduced new types of error that may be more serious [11]. In a general adult hospital, CPOE decreased potential ADEs more than errors that actually resulted in an ADE [12]. The results of a systematic review [13], analyzing 27 studies, indicate that CPOE seems to be a useful intervention for reducing the risk of medication errors and ADEs. 25 studies reported on the risk of medication errors. 23 of these showed a significant relative risk reduction, with a risk ratio between 0.01 and 0.87. Nine studies reported on the risk of ADE. Six of these studies showed significant relative risk reduction with a risk ratio between 0.02 and 0.65. Unfortunately, less evidence is available for such systems outside the U.S. There are limited data evaluating the impact of CPOE on medication errors in the pediatric population. Fortescue et al showed that CPOE with clinical decision support reduced medication errors but not ADEs in pediatric inpatients [14]. King et al observed a significant decrease in the rate of medication errors but not adverse drug events in pediatric inpatients after implementation of CPOE [15]. In two studies performed in pediatric intensive care unit (PICU) it has been shown that the mortality did not increase after implementation of CPOE and that the introduction of CPOE was associated with a significant reduction in medication administration variances [16, 17]. In a study performed in PICU and pediatric ward beds, it could be shown that the rate of incomplete/wrong order errors declined after CPOE implementation but the rate of dosing errors did not decrease [18]. These findings are substantially different from those in adults for whom the introduction of CPOE was followed by a significant reduction in medication errors [12]. In another study, only errors that occur during the medication ordering process were analyzed [19]. This study focused on ADEs, medication prescription errors or rule violations and could show that all three categories were reduced after CPOE implementation.

	References 1. Bordun LA, Butt W. Drug errors in intensive care. J Paediatr Child Health 1992; 28:309-311 2. Folli HL, Poole RL, Benitz WE, et al. Medication error prevention by clinical pharmacists in two children's hospitals. Pediatrics 1987; 79:718-722 3. Kaushal R, Bates DW, Landrigan C, et al. Medication errors and adverse drug events in pediatric inpatients. JAMA 2001; 285:2114-2120 4. Raju TN, Kecskes S, Thornton JP, et al. Medication errors in neonatal and paediatric intensive care units. Lancet 1989; 2:374-376 5. Ross LM, Wallace J, Paton JY. Medication errors in a paediatric teaching hospital in the UK: five years operational experience. Arch Dis Child 2000; 83:492-497 6. Vincer MJ, Murray JM, Yuill A, et al. Drug errors and incidents in a neonatal intensive care unit. AJDC 1989; 143:737-740 7. Wilson DG, McArtney RG, Newcombe RG, et al. Medication errors in paediatric practice: insights from a continuous quality improvement approach. Eur J Pediatr 1998; 157:769-774 8. Conroy S, Sweis D, Planner C, et al. Interventions to reduce dosing errors in children: a systematic review of the literature. Drug Saf 2007; 30:1111-25 9. Miller MR, Robinson KA, Lubomski LH, et al. Medication errors in paediatric care: a systematic review of epidemiology and an evaluation of evidence supporting reduction strategy recommendations. Qual. Saf. Health Care 2007; 16:116-126 10. American Academy of Pediatrics. Prevention of medication errors in the pediatric inpatient setting. Pediatrics 2003; 112:431-436 11. Shulman R, Singer M, Goldstone J, et al. Medication errors: a prospective cohort study of hand-written and computerised physician order entry in the intensive care unit. Critical Care 2005; 9:R516-R521 12. Bates DW, Leape LL, Cullen DJ, et al. Effect of computerized physician order entry and a team intervention on prevention of serious medication errors. JAMA 1998; 280:1311-1316 13. Ammenwerth E, Schnell-Inderest P, Machan C, et al. The effect of electronic prescribing on medication errors and adverse drug events: systematic review. J Am Med Inform Assoc. 2008; 15:585-600 14. Fortescue EB, Kaushal R, Landrigan CP, et al. Prioritizing strategies for prevention medication errors and adverse drug events in pediatric inpatients. Pediatrics 2003; 111:722-729 15. King WJ, Oaice N, Rangrej J, et al. The effect of computerized physician order entry on medication errors and adverse drug events in pediatric inpatient. Pediatrics 2003; 112:506-509 16. Keene A, Ashton L, Shure D, et al. Mortality before and after initiation of a computerized physician order entry system in a critically ill pediatric population. Pediatr Crit Care Med 2007; 8:268-271 17. Taylor JA, Loan LA, Kamara J, et al. Medication administration variances before and after implementation of computerized physician order entry in a neonatal intensive care unit. Pediatrics 2008, 121:123-128 18. Walsh KE, Landrigan CP, Adams WG et al. Effect of computer order entry on prevention of serious medication errors in hospitalized children. Pediatrics 2008; 121:e421-e427 19. Potts AL, Barr FE, Gregory DF, et al. Computerized physician order entry and medication errors in a paediatric critical care unit. Pediatrics 2004; 113:59-63
Zielsetzungen des Projekts **Hypothese** **Begründung** **Erwartete Ergebnisse** **Auswirkung für die Praxis**	The purpose of our study is to evaluate the impact of the implementation of a pediatric CPOE with a sophisticated CDSS on medical and surgical wards. The number and the type of prescribing errors before (pre-CPOE) and after (post-CPOE) the implementation of CPOE with CDSS will be compared. Before 2013 drug ordering was done in hand-writing forms (pre-CPOE). Then, between 2013 and the implementation of the COPE a semi-structured order form was used. In first quarter of 2015, the implementation of a novel pediatric-adapted CPOE software (Phoenix G3 Application for children, developed by Compu Group Medical in close collaboration with the AllKids-children's hospitals: Basel, St. Gallen and Zurich) is planned. This CPOE interoperates with the calculator and the drug dosage database, both provided by the Children's hospital Zurich. Therefore dosages specified by indication and based on patient's age and weight or surface area are proposed. In addition, all information from the database about drug safety issues will be available directly in the CPOE software at the time of prescription. The implementation of any CPOE with CDSS should increase the medication safety. However, there are limited data evaluating the impact of CPOE on medication errors in the pediatric population and the results do not prove a predictable benefit.

Beschreibung der Methode **Protokoll, Methode, Analyse der Ergebnisse, Statistik**	Design Retrospective observational study Setting Medical and surgical wards of a university children's hospital, totally 119 beds, annual patient admission numbers: 2'700 patients on the medical and 3'600 patients on the surgical wards Data collection Data are retrospectively collected in the first period (before CPOE with CDSS implementation) from 100 randomly selected patient charts (50 medical and 50 surgical charts, April 2012 to June 2012). Post CPOE data collection will also be done in 100 randomly selected patients (50 medical and 50 surgical charts) about three month after implementation of CPOE, presumably in April 2015 and June 2015. (The reason for the pre-CPOE data collection in 2012 is the introduction of a semi-structured order form in the meantime.) Patient data are collected in all analyses on demographic parameters (age, sex, nationality, mother tongue, weight, height, body surface and creatinine clearance. Creatinine clearance is estimated according to the simplified formula of Schwartz. Length of stay on the medical or surgical ward and diagnosis will also be recorded. All medications are included in this analysis except the following: parenteral nutrition (PN), lipids and solutions for dialyse. After a specific training, a junior pharmacist checks all orders on errors such as wrong dose, inappropriate dosage adjustment for renal function, wrong interval, wrong units, wrong dosage form, allergy, drug-drug interactions and missing information. Review process A senior pharmacist independently reviews all original medication orders for 10% of randomly selected patients in both the pre-CPOE and the post-CPOE groups to determine the level of agreement with the master student. Agreement between reviewers will be calculated (reliability, kappa). Statistics Summary measures are given as medians, means or percentage as appropriate. The denominator is the total number of the drugs ordered or the number of patients. Differences between the two groups are analysed by unpaired t-test, Mann-Whitney test, chi squared test or Fisher's exact test, as appropriate.
Ort (e) der Studie **Institute, die am Forschungsprojekt teilnehmen**	Children's hospital Zurich, Pharmaceutical service, in collaboration with the medical and surgical wards
Outcomes **Erwartete Hauptergebnisse**	Number and type of prescribing errors before and after implementation of a pediatric-adapted CPOE with CDSS
Nationale Tragweite **Aspekte hervorheben, die einen nationalen Impact rechtfertigen (z.B. Bedeutung der Ergebnisse, multizentrisch, interdisziplinär)**	The CPOE software was developed by Compu Group Medical in close collaboration with the three AllKids-children's hospitals: Basel, St. Gallen and Zurich). The CDSS (calculator) and the pediatric dosage database was developed by the Children's hospital Zurich and is used over whole Switzerland since November 2012. Within one year 37 health care institutions and more than 9'000 single users were registered. The pediatric CPOE with CDSS will be introduced first in the Children's hospital Zurich. However, every Swiss pediatric health care institution will be able to use our CDSS application by a web interface or by an in-house installation, without any further development regarding automatic dosage calculation. Therefore, we think,

	the question of the impact of a CPOE with CDSS should be answered before implementation in other institutions.
Planung **Vorgesehener Zeitplan Etappen (milestones)**	CPOE: May 2014 — first test of the CPOE/CDSS June - Sept 2014 — further developments of the CPOE Oct 2014 — second test of the CPOE/CDSS Nov – Dec2014 — pilot phase from Feb 2015 on — implementation Study: March – May 2015 — retrospective review of the pre-CPOE charts (April 2012 to June 2012) June 2015 — Analysis of the pre-CPOE data July – Sept 2015 — retrospective review of the post-CPOE charts (April 2015 to June 2015) Oct – Dec 2015 — Analysis of the post-CPOE data and comparison of both groups
Finanzierung **Notwendiger Betrag Verwendung Andere Finanzierungsquellen**	This study will be done by a junior pharmacist (diploma thesis FPH in hospital pharmacy): salary for 10 months (70%, based on 13 months/year): CHF 54'597.50 additional 17% for employers' contribution: CHF 9'281.60 total: **CHF 63'879** other financial source: none conflict of interest: none