# Assessing Ethics Knowledge: Development of a Test of Ethics Knowledge in Neonatology

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**Objective** To develop and validate the Test of Ethics Knowledge in Neonatology (TEK-Neo) with good internal consistency reliability, item performance, and construct validity that reliably assesses interprofessional staff and trainee knowledge of neonatal ethics.

**Study design** We adapted a published test of ethics knowledge for use in neonatology. The novel instrument had 46 true/false questions distributed among 7 domains of neonatal ethics: ethical principles, professionalism, genetic testing, beginning of life/viability, end of life, informed permission/decision making, and research ethics. Content and correct answers were derived from published statements and guidelines. We administered the voluntary, anonymous test via e-mailed link to 103 participants, including medical students, neonatology fellows, neonatologists, neonatology nurses, and pediatric ethicists. After item reduction, we examined psychometric properties of the resulting 36-item test and assessed overall sample performance.

**Results** The overall response rate was 27% (103 of 380). The test demonstrated good internal reliability (Cronbach $\alpha = 0.66$), with a mean score of $28.5 \pm 3.4$ out of the maximum 36. Participants with formal ethics training performed better than those without ($30.3 \pm 2.9$ vs $28.1 \pm 3.5$; $P = .01$). Performance improved significantly with higher levels of medical/ethical training among the 5 groups: medical students, $25.9 \pm 3.7$; neonatal nurses/practitioners, $27.7 \pm 2.7$; neonatologists, $28.8 \pm 3.7$; neonatology fellows, $29.8 \pm 2.9$; and clinical ethicists, $33.0 \pm 1.9$ ($P < .0001$).

**Conclusions** The TEK-Neo reliably assesses knowledge of neonatal ethics among interprofessional staff and trainees in neonatology. This novel tool discriminates between learners with different levels of expertise and can be used interprofessionally to assess individual and group performance, track milestone progression, and address curricular gaps in neonatal ethics. *(J Pediatr 2018;■■:■■-■■).*

N eonatologists must effectively navigate ethical dilemmas that commonly arise in the neonatal intensive care unit (NICU).[1-17] Training in ethics and professionalism is now a required curriculum component according to the Accreditation Council for Graduate Medical Education (ACGME) for neonatal-perinatal fellows.[1] However, ACGME Program requirements are vague, stating that "bioethics must be addressed in the formal curriculum," including "attention to physician-patient, physician-family, physician-physician/allied health professional, and physician-society relationships."[1] Such training should also include "adherence to ethical principles," professionalism, "instruction in scientific, ethical and legal implications of confidentiality and of informed consent," research conduct, and resource allocation.[1]

Our recent national needs assessment of neonatal-perinatal PDs, fellows, and recent graduates found that many neonatologists report inadequacies in their fellowship training in ethics and professionalism.[16] We showed that >97% of respondents agreed that training in these domains was "important/very important" for fellows.[16] Nearly 96% of PDs reported inclusion of ethics and professionalism teaching during training (one-third indicated a formal curriculum), although only 70% of fellows/graduates reported such teaching ($P < .001$), with reported learning methods varying widely.[16] In general, program directors were more confident in their trainees' abilities to effectively confront various ethical challenges than reported by trainees/graduates themselves ("extremely confident" vs "confident").[16] For example, trainees/recent graduates reported being significantly less confident than perceived by PDs when making decisions about life-sustaining therapies for infants with potentially severe neurocognitive disabilities ("extremely confident/confident," 51% vs 80%; $P = .004$).[16] These data raise questions for the neonatology community about whether the outcomes of current

| ACGME | Accreditation Council for Graduate Medical Education |
| ASBH | American Society for Bioethics and Humanities |
| NICU | Neonatal intensive care unit |
| PD | Program director |
| TEK-Neo | Test of Ethics Knowledge in Neonatology |

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efforts to teach ethics and professionalism to fellows are optimal and provide a rationale for more deliberate efforts to assess ethics and professionalism knowledge among these trainees.

Assessment of ethics knowledge, an important component of professionalism, is also required by the ACGME and training programs.[1] Optimal assessment requires measurement of a learner's knowledge, as well as attitudes, skills, and behavior.[18] Trainee assessment of ethics and professionalism continues to be challenging, due in part to the inherent nebulous nature of the domain and a lack of validated assessment tools. One instrument, the Test of Residents' Ethics Knowledge for Pediatrics (TREK-P), examined pediatric residents' knowledge of ethical dilemmas in pediatric practice, ranging broadly from newborn medicine to adolescent medicine.[18] However, there remains a lack of validated assessment tools in ethics and professionalism expressly for interprofessional trainees and staff in neonatology, to properly evaluate this knowledge relevant to the NICU.[16,17] Educational curricula and dedicated assessment tools in neonatology would potentially be of enormous benefit and value for neonatal-perinatal and pediatric training programs.

The present study aimed to fill this gap in knowledge through rigorous development of a novel tool, the Test of Ethics Knowledge in Neonatology (TEK-Neo), adapted from TREK-P,[18] to evaluate domains of neonatal ethics knowledge. Knowledge of ethical principles and concepts is only one of the components needed to adequately address ethical challenges in clinical practice. As the American Society for Bioethics and Humanities (ASBH) outlines, core competencies in healthcare ethics also include skills (eg, interpersonal, communication, ethical assessment and analysis) as well as attributes, attitudes, and behaviors (eg honesty, patience, compassion, humility).[19] It is essential to measure not only what a learner knows, but also how such knowledge is applied in practice, and how this ultimately affects physicians' relationships.[1] Ideally, a comprehensive assessment would measure performance in all of these areas. However, assessment of ethics knowledge is a valuable starting point. Thus, we aimed to develop and validate the TEK-Neo that reliably assesses interprofessional staff and trainee knowledge of neonatal ethics. We hypothesized that the TEK-Neo tool would have good internal consistency reliability, item performance, and construct validity and would be able to reliably discriminate among interprofessional learners at various levels of training in neonatology.

## Methods

This study was reviewed and approved by the Committee on Clinical Investigation at Boston Children's Hospital (IRB-P00013058), and was granted exemption from full Institutional Review Board review under federal regulation 45 CFR 46.101(b), including a waiver of written consent.

We started with an existing, previously published tool in pediatric ethics, the TREK-P,[18] which was then adapted to better reflect and assess knowledge in neonatal ethics. Questions from the 23-item TREK-P were retained (n = 9), omitted (n = 9), or revised (n = 5) to ensure relevance to neonatology. Finally,

additional test items were developed de novo (n = 32) for the TEK-Neo to fill remaining content gaps in neonatal ethics as indicated by the ACGME and American Board of Pediatrics requirements.[1,15] The de novo questions were written by an author, a neonatologist with expertise in medical ethics, and reviewed and revised by another author, a pediatric subspecialist and codeveloper of the TREK-P with expertise in medical ethics and graduate medical education. Correct answers were derived from published statements from the American Academy of Pediatrics and the American College of Obstetricians and Gynecologists.[20-38] We conducted pilot testing with neonatologists and pediatric ethicists (who were excluded from the study) to assess for item clarity and content validity. Following cognitive interviews with pilot participants, we revised the instrument. The preliminary TEK-Neo instrument consisted of 46 true/false questions, distributed across 7 ethical domains, including ethical principles, professionalism, genetic testing, beginning of life/viability, end of life, informed permission/decision making, and research ethics. Participants were also asked about demographics and formal ethics training.

The study population included 5 groups with differing levels of medical and ethical training varying from novice to expert (first-year medical students, neonatal-perinatal fellows, neonatal nurses/practitioners, neonatologists, and pediatric clinical ethicists) from 2 centers (Boston Children's Hospital/Harvard Medical School and Tufts Medical Center). Participation was anonymous, voluntary, and uncompensated.

A letter was sent via e-mail in April 2015 to convenience samples of the 5 participant groups using current internal list servers and e-mail lists at Boston Children's Hospital, Tufts Medical Center, and Harvard Medical School, with appropriate permission. The letter, e-mailed 3 times at 1-week intervals, described the research study and invited participants to complete the online survey containing the TEK-Neo instrument via a provided link.

### Statistical Analyses

We used psychometric and statistical methods similar to those used to validate the TREK-P.[18] The sample size was chosen to provide 80% power with 5% type 1 error rate to detect a 3-point score difference between professional groups, assuming a within-group SD of 2 points. The test initially included 46 items in 7 domains. To optimize internal consistency within each domain, we calculated point-biserial correlation and the Cronbach alpha coefficient measuring the internal consistency of each item with the other items in the domain. To ensure that performance on each test item would optimally correlate with overall test performance, we identified and removed the 10 most inconsistent items, those showing the lowest point-biserial correlation, leaving a 36-item test.[18] We calculated the Cronbach alpha for the reduced test as a measure of overall consistency. To establish construct validity, we compared test scores between less trained and more trained respondents using the Student $t$ test. As further tests of validity, we determined the correlation of a respondent's test scores with age (a surrogate for experience) and compared scores among the 5 professional groups by 1-way ANOVA, with Tukey-Kramer