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Nudging in Neonatology: Practical Wisdom and Accountability for Reasonableness

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Commentary

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Objectives. The way choice is presented has an impact on decision-making. This is the case also in the context of neonatal intensive care units (NICUs), particularly in the challenging cases that concern the limit of viability. The objective of this article is to examine the role of nudging in the shared decision-making in neonatology and elaborate on the respective moral challenges.
Results. Nudging is not morally neutral. There are two key sources of ethical issues at the heart of nudging. The first one concerns the lack of transparency, while the second concerns the background value judgments that are imminent whenever nudging is used for achieving a particular end. To solve the underlying conflict, a virtue ethics approach combined with the accountability for reasonableness framework is suggested to guide the use of the tool of nudging.
Conclusions. NICU professionals ought to use the tool of nudging transparently in line with their act of profession and their practically wise judgment.

The way choice is presented has an impact on decision-making. This is the case also in the clinical context of neonatal intensive care units (NICUs). Particularly, in the challenging cases that concern the limit of viability, which is the point in fetal development at which the infant has a reasonable chance of extra-uterine survival (1). There, between the beginning of week 22 and the end of week 25 of gestational age, shared decision-making with parents takes place (2). According to a systematic review from decision-making in high-income countries, weeks 23 and 24, in particular, are the zone of parental discretion where the parents ultimately make the decision between comfort (palliative) care and active care based upon the portrayal of choices by NICU professionals (2). This situation is of extreme gravity because it requires the surrogate decision-makers, the parents or NICU professionals, to operate at the border of beginning of life as well as end of life. The main aim is thus to minimize undertreatment as well as overtreatment by attempting to save each infant that has reasonable chances for meaningful survival and let go the one that does not, in order to prevent unnecessary harm (3).

This study is set against the backdrop of our research of the Austrian context where a limited number of intensive care beds, limited number of NICU professionals, and scarce financial resources make the decision-making in NICUs a matter of resource prioritization (4;5).

In this study, I want to examine the use of the tool of nudging using the NICU as the paradigm case. In doing so, I am going explain what nudging is, suggest that we should understand it as a tool, and elaborate on the moral challenges that come along in the context of NICUs. Furthermore, I am going argue that the democratic framework of *accountability for reasonableness* together with the virtue of practical wisdom (*phronesis*) can guide the right use of nudging in the NICU profession.

Nudging definition and theory

In the following section, I try to establish that, in any situation of decision-making, whenever one chooses between alternative options, choice architecture is present. Choice architecture refers to the particular way the options are laid out in front of the decision-makers without anybody intentionally guiding the choices. The way the options are presented triggers a spectrum of cognitive biases, where some are avoidable while others less so. Intentional alteration of choices based on the knowledge of these biases is what it means to nudge. Hence, when decision-makers intentionally decide to work with choice architecture, they become responsible for nudging.

Nudges operate on two premises. The first premise is that people are not *econs,* rational economic optimizers, but that they exhibit *bounded rationality* (6). They do not always rationally weigh all the options at hand in the limited time available to them, but they follow their cognitive biases and decide by following the principles such as rule of thumb, common sense, or educated guess (6;7). Irrational as it may be, such decision-making is predictable. The

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Table 1. Avoidable and Unavoidable Cognitive Biases in NICUs (11;12)

Unavoidable cognitive biases	*The possible influence of the bias on the communication between NICU professionals and parents*
Anchoring/order effect: the tendency to rely on the first piece of information received (the anchor) that is used to make subsequent judgments.	When doctors communicate benefits before risks, it may create a positive anchor on parents' perception (or the other way around).
Authority bias: the tendency to attribute more importance to the opinion of a person with authority and follow the opinion.	When NICU professionals recommend parents to go for active or comfort care, parents may have the tendency to follow the opinion of the NICU authority figures.
Availability effect: the tendency to base the likelyhood of an event on how easily the event comes to mind.	When doctors tell the parents that their child may pass away three times, but it survives nonetheless, parents overestimate the chances for survival in case of another event.
Confirmation bias: the tendency to notice that information, which confirms our pre-existing point of view.	When doctors may judge the likelihood of survival of the EP infant based on their subjective assessment of its appearance.
Default effect: the tendency to go with the option that is designated as the default.	When doctors present to parents that their institution generally does not provide active treatment to children born in 23rd week of gestation, that makes parents choose comfort care.
Effective forecasting: the tendency to predict future states inaccurately.	When parents may find it difficult to imagine living with a disabled child, but manage it better than they anticipated nonetheless.
Framing effect: the tendency of different descriptions of the same problem to lead to different responses.	When phrasing the prognosis by means of survival and non-disability rates (positive frame) makes parents more likely to choose resuscitation than when framed as mortality and disability rates (negative frame).
Illusory corrolation: the tendency to establish a causal relationship when the connection may be coincidental or non-existent.	When parents assume that a random event caused the EP birth.
Omission bias: the tendency to prefer inaction (omission) against action (commission).	When prefering comfort care over interventional active care of EP infants as if dealth following an intervention was worse than natural death.
Representativeness bias: the tendency to make judgments about probability of an event around the category prototype.	When in the context of individual conversations, doctors may judge wrongly what level of language to use when talking to the parents if, for instance, they judge them by appearance.
Sunk-cost bias: the tendency to pursue the course of action that includes already irretrievable expenditure of time, effort, or money.	When parents who have conceived after repeated IVF interventions may prefer active care even in situations when comfort care would be more appropriate.
Avoidable cognitive biases	*The possible influence of the bias on the communication between NICU professionals and parents*
Bandwagon effect: the tendency to be influenced by what others are doing or saying.	When doctors provide the information to parents on how other parents decided in their situation.
Focusing effect: the tendency to place too much emphasis on one aspect of the situation thus falsifying the prediction of a future outcome.	When communicating about the infant's likely abilities for an extended period of time and not about the likely disabilities (and the other way around).
Hinsight bias: the tendency to believe after an event that the event could have been predicted.	When parents assume that the event of emergency EP birth could have been predicted.
Institutional bias: the tendency of institutions to present their practices as the official correct ones.	When institutional statistics influence counselling that further influences the decision-making of parents and thus the future outcomes.
Loss aversion: the tendency of people to prefere avoiding losses to acquiring gains.	When framing the information by means of losses and gains may have an impact on parents, i.e., losing a child vs getting a child.
Overconfidence bias: the tendency to overestimate how much we know and how reliably we know it.	When doctors overestimate the correctness of their judgment and hence the right course of action.

cognitive biases (see Table 1) are shared among many and they make people deviate from the *optimal* decision they would have made on the basis of their rationality alone (8).

The second premise is that institutions unavoidably influence the choice presented to people and thus push people one way or the other without having to be intentional about it (6). Being intentional about the way choice is architected is what it means to nudge. In daily life, default settings on a mobile phone are a nudge, so is a GPS, or the size of glasses and plates (9). The decision-makers thus have two options. They can either not use the tool of nudging, but leave the unintentional choice architecture in place to guide the decision-making, essentially, closing their eyes and hoping for the best (10). Or they can use to tool of nudging, which, however, requires them to take a stand on the background issues on the value level and thus be paternalistic. There is no neutral solution, either closing the eyes and hoping for the best or some level of paternalism.

Cognitive biases

In the context of NICUs, there is a list of cognitive biases that are at play when the decision between active and comfort care is taking place. When NICU professionals (neonatal doctors, nurses, psychologists, or other professionals, depending on the hospital) (4) communicate with parents as part of the shared decision-making procedure, some of the biases on the side of parents as well as NICU professionals are unavoidable. Avoidability is defined here to be the freedom to communicate a specific message to the parent without tapping into a cognitive bias. While it is possible to communicate the data without referring to how other parents decided in that position (*bandwagon effect*), the use of the *framing effect* is unavoidable. There is no neutral

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framing NICU professionals may use as they simply must use words such as survival or mortality (or words conveying similar meaning) and their positive or negative connotation may have an impact on the parents' choice (see Table 1 for a list of examples of cognitive biases potentially present in NICUs). The more unavoidable the bias is, the less neutrality in the process of communication is possible.

It needs to be noted that communication trainings for NICU professionals can help avoid the misusing of the more avoidable cognitive biases or, alternatively, can help in nudging parents toward the use of rational thinking in the decision-making processes. Indeed, improving parental decision-making competences should be the first step; however, that does not avoid the issue of biases in the shared decision-making procedure.

The tool of nudging and values

Nudging as a Tool Requiring an End

No longer is it the case then that the arsenal of decision-makers consists only of restrictions and incentives, sticks and carrots, but, in this way, nudging can be approached as another tool that the decision-makers have at hand. The Nuffield ladder of intervention for public health understands nudging strategies to precede the use of incentives and choice restriction, or elimination (13). When taken in the way as a tool, however, nudging requires an end toward which it can be used. Nudging is at the disposal of the agent, the person in the position of authority, who can use it for whatever ends deemed appropriate. Against this backdrop, nudging is criticized for being implemented without being scrutinized the same way other government restrictions are. Nudging often bypasses the principle of informed consent and, due to the lacking transparency, allows for paternalistic manipulation (6).

Also, nudging is by no means a morally neutral tool that the decision-maker is automatically an expert on. When decision-makers choose to intentionally alter the choice architecture at their disposal, they automatically need to take a stand on what the good for the given individual or population is. Using of the tool of nudging brings about a conflict on the level of values as taking a stand is inevitably value laden. For instance, when NICU professionals communicate to parents that active care is the default option already at week 24 of gestation, they take a value stand that saving a child at this point of prematurity is already worth it.

The two points above highlight the need for making a distinction between two key sources of ethical issues at the heart of nudging. The first issue concerns the lack of transparency in the use of the tool of nudging, especially when compared with explicit government regulations that restrict or eliminate choice. The second issue concerns the background value judgments that are imminent whenever nudging is used for achieving a particular end. Nudging in the latter case merely highlights those conflicts that are rooted deeper in the topics at stake; hence, the value clashes vary with interventions.

Conflicts on the Value Level

The need for this distinction applies also to the context of NICUs. In the extreme cases around the limit of viability, not only are there conflicts between NICU professionals and parents, but there are also conflicts on the value level within particular NICU teams (elaborated on in Stanak) (14). It is especially so because of the advances in technology that allow to keep most infants alive and by the prioritization challenges caused by the limited resources that force NICU professionals to participate in ethics (15). Such conflicts in the background will inevitably lead to different positions with regard to the use of nudging. To come up with ethical guidance for nudging, the issues of lacking transparency and the underlying conflicts on the value level need to be addressed.

Solution to normative issues with nudging

In the following section, I am going to argue that the *accountability for reasonableness* (A4R) framework can be a step toward the solution for the first issue with nudging (the lack of transparency) on the level of institutional and national formulation of guidelines (GLs) on the management of extremely preterm (EP) infants (16).

Procedural Justice as a Solution

At the beginning, it is important to establish the similarities between the private insurance rationing context where Daniels and Sabin apply the A4R (16) and the bedside rationing context at the limit of viability. The following core aspects are the same. NICUs face the problem that intersects the fields of medical ethics as well as political philosophy. They must ration due to shortage in staff counts or NICU beds (4), their legitimacy to decide on behalf of the EP infant is in question as their view of the best interest for the infant may differ from the one of the parents (14), and their fair treatment of similar cases similarly cannot be discerned as the outcome data is hard to access.

Moreover, the A4R framework can, in essence, be understood as a large shared decision-making procedure in which, just like in the NICU context, decisions are made by the decision-makers, evaluated and reviewed by the public or patients, and adjusted if unreasonable. The same process occurs in person with the parents of EP infants with the only difference that between weeks 23 and 24, the deliberation goes a step further as it is the parent who makes the ultimate decision based on the doctor's portrayal of the choices. It is important to note that there is a major difference in the nature of the two rationing context as the U.S. private insurance context is for profit, while the clinical NICU context is not.

Even though the A4R framework was developed for the macro decision-making context, I want to suggest that because of the major similarities, the A4R framework can be also used in the clinical context of NICUs. When applying it to the NICU context, the A4R conditions (see Table 2) are hard to be envisaged in the bedside clinical encounter, but their role can be played in the formation of GLs on the management of EP infants. Currently, there is an agreement in the GLs of high-income countries that within weeks 22 and 25 of gestational age, shared decision-making with parents ought to be in place (2). These GLs on decision-making in NICUs in high-income countries are already to a large extent transparent. The roles of parents and NICU professionals are clearly defined, but the GLs do not include the issue of the *form* of communication with parents. Applying the above-outlined conditions of A4R in setting up of institutional and national GLs makes the use of the tool of nudging transparent, revisable, and able to be reflected upon; thus, it is a step toward addressing the first issue with nudging, the lack of transparency.

I want to argue that, even though the A4R framework is in theory a valuable procedural step toward more accountability, it does not address the *how* of the way rationales are communicated. The

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Table 2. A4R Conditions (16)

(i) Publicity condition	Limit-setting decisions, both direct and indirect, as well as their rationales must be publicly accessible.
(ii) Relevance condition	The rationales for limit-setting decisions must provide a reasonable explanation of how a health provider seeks to meet the health needs of a population under resource constraints. Those rationales are considered reasonable which appeal to "evidence, reasons, and principles that are accepted as relevant by fair-minded people" who are disposed to cooperate.
(iii) Appeals and revision condition	A set of "mechanisms for challenge and dispute resolution regarding limit-setting decisions."
(iv) Regulative (enforcement) condition	"There is either voluntary or public regulation of the process to ensure that conditions 1–3 are met"

decision-makers in both macro and micro worlds can thus influence the process through their value-laden communication that can constitute paternalism and that undermines the main goal of A4R, namely, the provision of legitimacy and fairness (16). The A4R, hence, only pushes paternalism one step farther as even a good deliberative shared decision-making procedure remains paternalistic. For that reason, relying on the professional virtue of practical wisdom should guide the use of nudging in the bedside NICU context.

Virtue Ethics as a Solution

Looking for the solution to the second issue with nudging, namely the value conflicts in the background that also penetrate into the decision-making procedures, I want to suggest an agent-centered solution in line with the virtue ethics tradition. As argued by MacIntyre (17), the modern moral conflicts are interminable as they lack a teleological, goal oriented, essence. The goal (*telos*) can be found in the professions and the solution to the moral conflicts in the virtue ethics tradition. The reason being that it is the virtues of the individual that help one discern what course of action to take and how to decide between competing moral principles in practice. Hence, I want to argue that virtues as character traits are necessary for the professional in pursuing the *act of profession* (the good of the patient). I want to suggest that we should look for the solution on how to use the tool of nudging in the moral structures of professionalism by placing trust in the NICU professionals (18).

What makes professions distinct from mere occupations is the commitment to the profession's particular moral template (18). A lawyer commits to protect the good of the client and pursues the value of justice, the teacher commits to protect the good of the student and pursues the value of knowledge, and the medical professional commits to protect the best interest of the patient and pursues the value of health. It is the *act of profession* where respective professionals commit to serve the good of their professions.

Furthermore, I want to link being a professional to a theory of moral virtues and suggest that the act of profession entails specific character traits in the person pursuing the respective profession. When giving the Hippocratic oath, medical professionals commit to using their special knowledge for the sake of patient's good (18). On the way toward the good, certain character traits, virtues, enable one to attain it best. Virtue is understood here as a character trait that disposes the physician habitually to act well and wisely in medicine (18). In the case of clinical medicine, those virtues that dispose the physician to act well that have been debated in the literature range from benevolence, to intellectual honesty, courage, compassion, or humility (18). The application of these virtues (elaborated on in Stanak) (14) puts the act of profession into clinical reality.

Phronesis: Practical Wisdom

Because the topic in question concerns the right use of the tool of nudging, I want to focus on the intellectual virtue of *phronesis*, practical wisdom, that has a key role in discerning what the right course of action is. In the context of professional ethics of NICUs, practical wisdom refers to the capacity to act in line with the good of the profession. Practical wisdom is the virtue that allows the NICU professional to correctly evaluate the value related issues at stake against the backdrop of the particular clinical facts and to make the morally right decision. Just as the clinical setting refers to *clinical judgment* that helps the clinician evaluate the factual data, practical wisdom is its analogue in the moral sphere (18).

The clinical judgment represents a technical mastery of principles of diagnosis, prognosis, and therapeutics that serve the good of the patient (18). In the profession of medicine, the clinical and the moral are inevitably fused. The clinical judgment requires the medical professional to apply the general medical knowledge to a particular patient, while practical wisdom involves complicated interactions between the general moral principles, clinical data, and the particular moral challenge. Practical wisdom, in the sense, is to be taken not as a moral judgment deduced from principles, as it is not an attempt to produce law-like relationships, but a situated context-specific knowledge (19). Practical wisdom is not logically simple, in a way that it would provide self-evident clarity, and so it is not a kind of comfortable scientific approach applied to morality. It leaves the weight on the individual to, upon reflection, act correctly, according to right reason. Practical wisdom is not a theoretical wisdom, but wisdom based on making one's hands dirty in practice.

Deciding around the limit of viability is precisely the situation of making one's hands dirty. When NICU professionals communicate with parents of an EP infant that is to be born in week 23 of gestation, through dialogues, they attempt to work out from the bottom up what the best course of action is. Their decision in the actual situation of birth will thus be context specific. Aware of the general moral principles, the NICU professionals will have to decide in the particular case if active or comfort care ought to be pursued. They will have to use their practical wisdom together with their clinical judgment and parental consultation to discern the right course of action. The pitfall, however, that comes with leaving the NICU professionals to decide exclusively on their own judgment is that, if this position of authority is misused, also the tool of nudging will be used for the manipulation of the parents. For that reason, merging the A4R framework with the virtue of practical wisdom could be a step toward safeguarding the right use of nudging.

Practical Wisdom and Accountability for Reasonableness

I want to argue that merging the modern democratic framework of A4R with the ancient Greek virtue of practical wisdom can be

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seen as a guide to nudging. Through the application of transparency, the A4R framework may bring a solution on the level of GL formation, while the virtue of practical wisdom puts the emphasis on the agent trained in the qualities required for the correct pursuit of its profession to know how one ought to use the tool of nudging in practice. Hence, Hence, I want to sugest a framework merging *accountability for reasonableness and practical wisdom*.

The tool of nudging in the field of NICUs falls at hands of the NICU professionals. They pursue conversations that require reflection and judgment with parents as part of the shared decision-making procedures on daily basis. It is in these conversations where NICU professionals need to adjust their judgment on how to nudge to the specific situation and specific parents. Their aim ought to be improving parental decision-making capacity, reducing the impact of biases, as well as being in line with their professional commitment to the good of the patient. Intentional nudging is easier to justify outside of this morally ambiguous zone around the limit of viability, but the role of nudging is present also in these gray zone cases nonetheless. Even though this model remains to be paternalistic, compared with the current practice, it is a step forward that calls for the recognition of the impact of communication strategies (nudges) at the level of GL formation, as well as it calls for the professionals to recognize the role of ethics in the decision-making processes. The quest to eliminate paternalism in NICUs, however, is debatable as, depending on the context, there seem to situations in which parents explicitly want a competent professional to decide on their behalf (20).

Even in a shared decision-making procedure, the form of communication (of rationales) around the limit of viability cannot be neutral. Transparency and reflexivity can improve the process, but they do not eliminate paternalism and the related challenges with fairness, or legitimacy. In the everyday practice at NICUs, the decision-making must rely on the character of the NICU professional to discern what principle to follow when. Same as with clinical judgment, practical wisdom is largely invisible in action and, hence, hard to be accounted for. But as clinicians are held liable for the clinical judgment, they should also be held accountable for their moral judgment at least on the grounds of GLs. The role of ethics committees and ethics moderation, however, is crucial in supporting the NICU professionals in such normatively intense situations (elaborated upon in Stanak) (14).

In conclusion, I have argued that rather than ignoring the impact of choice architecture on the outcome and, thus, closing our eyes and hoping for the best, the NICU professionals should use the tool of nudging. Transparency about nudging at the level of GLs combined with professional virtues guiding the bedside rationing is the position suggested here. Nudging in this sense is nothing else, but using of another tool that is at disposal of the NICU professional toward the end of medicine, the good of the patient (18). For that reason, NICU professionals ought to use the tool of nudging transparently in line with their act of profession and their practically wise judgment.

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References

1. **Mercurio MR** (2017) Periviable birth (Limit of viability) 2017 [09/11/2017]. Available from: https://www.uptodate.com/contents/periviable-birth-limit-of-viability?source=search_result&search=limit%20of%20viability&selectedTitle=1~23.
2. **Guillén Ú, Weiss EM, Munson D, *et al.*** (2014) Guidelines for the management of extremely premature deliveries: A systematic review. *Pediatrics* **136**, 343–350.
3. **Leuthner SR** (2014) Borderline viability: Controversies in caring for the extremely premature infant. *Clin Perinatol* **41**, 799–814.
4. **Hawlik K, Stanak M** (2017) *Systematic analysis of outcomes and resource needs for neonatal intensive care units (NICU) to inform health care planning*. Vienna: Ludwig Boltzmann Institute for Health Technology Assessment. Contract No.: 97b.
5. **Stanak M, Hawlik K** (2017) Perinatal care at the threshold of viability. Part II: Decision-making at the threshold of viability and ethical challenges at Neonatal Intensive Care Units (NICUs). Vienna: Ludwig Boltzmann Institute for Health Technology Assessment. http://www.hta.lbg.ac.at/page/ankuendigungen/de (accessed January 4, 2018).
6. **Ploug T, Holm S** (2015) Doctors, patients, and nudging in the clinical context—Four views on nudging and informed consent. *Am J Bioeth* **15**, 28–38.
7. **Halpern D** (2015) *Inside the nudge unit*. London: Penguin.
8. **Kahneman D** (2011) *Thinking, fast and slow*. New York: Farrar, Straus and Giroux.
9. **Sunstein C** (2014) Nudging: A very short guide. *J Consum Policy* **37**, 583–588.
10. **Stewart SA** (2005) *Can behavioural economics save us from ourselves?* Chicago: The University of Chicago Magazine 97(3).
11. **Janvier A, Barrington K, Farlow B** (2014) Communication with parents concerning withholding or withdrawing of life-sustaining interventions in neonatology. *Semin Perinatol* **38**, 38–46.
12. **The Gerentological Society of America** (2016) *Medicine, health care and philosophy: Recognizing hidden traps in health care decision-making*. Washington, DC: The Gerentological Society of America.
13. **Nuffield Council on Bioethics** (2007) *Nuffield intervention ladder*. London: Nuffield Council on Bioethics.
14. **Stanak M** (2018) Professional ethics: The case of neonatology. *Med Health Care Philos*. doi: 10.1007/s11019-018-9863-9.
15. **Gallagher K, Marlow N, Edgley A, Porock D** (2011) The attitudes of neonatal nurses towards extremely preterm infants. *J Adv Nurs* **68**, 1768–1779.
16. **Daniels N, Sabin J** (1997) Limits to health care: Fair procedures, democratic deliberation, and the legitimacy problem for insurers. *Philos Public Aff* **4**, 303–350.
17. **MacIntyre A** (2014) *After virtue*. 4th ed. London: Bloomsbury Academic.
18. **Pellegrino ED** (2009) Professing medicine, virtue based ethics, and the retrieval of professionalism. In: Walker RL, Ivanhoe PJ, editors. *Working virtue*. London: Oxford University Press.
19. **Devettere RJ** (2000) *Practical decision making in health care ethics: Cases and concepts*. Washington DC: Georgetown University Press.
20. **Weiss ME, Barg FK, Cook N, Black E, Joffe S** (2016) Parental decision-making preferences in neonatal intensive care. *J Pediatr* **179**, 36–41.

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