mHealth for Maternal Mental Health: Everyday Wisdom in Ethical Design

Marguerite Barry*, Kevin Doherty*, Jose Marcano Bellisario§, Josip Car§,
Cecily Morrison§†, Gavin Doherty*
*Computer Science & Statistics, Trinity College Dublin
§School of Public Health Imperial College London; †Microsoft Research Cambridge
{marguerite.barry; dohertkc; gavin.doherty}@scss.tcd.ie; {jose.marcano-belisario10;
josip.car}@imperial.ac.uk; cecilym@microsoft.com

ABSTRACT

Health and wellbeing applications increasingly raise ethical issues for design. User-centred and participatory design approaches, while grounded in everyday wisdom, cannot be expected to address ethical reflection consistently, as multiple value systems come into play. We explore the potential of *phronesis*, a concept from Aristotelian virtue ethics, for mHealth design. Phronesis describes wisdom and judgment garnered from practical experience of specific situations in context. Applied *phronesis* contributes everyday wisdom to challenging issues for vulnerable target users. Drawing on research into mHealth technologies for psychological wellbeing, we explore how *phronesis* can inform ethical design. Using a case study on an app for self-reporting symptoms of depression during pregnancy, we present a framework for incorporating a phronetic approach into design, involving: (a) a wide feedback net to capture phronetic input early in design; (b) observing the order of feedback, which directly affects value priorities in design; (c) ethical pluralism recognising different coexisting value systems; (d) acknowledging subjectivity in the disclosure and recognition of individual researcher and participant values. We offer insights into how a phronetic approach can contribute everyday wisdom to designing mHealth technologies to help designers foster the values that promote human flourishing.

Author Keywords

Ethical design; mHealth; maternal mental health; phronesis; psychological wellbeing; virtue ethics; human flourishing;

ACM Classification Keywords

H.5.m. Information interfaces and presentation (e.g. HCI): Miscellaneous.

INTRODUCTION

Mental health is a primary determinant of wellbeing and a major concern for society [83]. HCI research has recently started to focus on how technology can support psychological wellbeing [e.g. 1, 21, 78]. The growth in use and sophistication of mobile health (mHealth) apps for mental health presents particular opportunities and challenges for design [22, 83]. Applications for mHealth for psychological wellbeing have complex design requirements, involving sensitive information and client/therapy conditions [22] and there are practical difficulties in understanding users' experience of such technologies early in the design process [ibid]. Indeed we still know relatively little about how such mHealth technologies are actually experienced and engaged with by clients outside the clinical context [81].

Meanwhile, applications and systems that support wellbeing are central to the turn to 'positive computing' in HCI [15]. Researchers are paying greater attention to the human and societal impact of technological design [e.g. 34, 67, 86] while encouraging a more holistic view of user experience that looks beyond the purposefulness of technologies towards how they might also promote wellbeing [e.g. 45, 75]. Humanistic approaches can contribute insights into how HCI can foster 'the good life' [4], a primary concern of Aristotelian virtue ethics (VE), which promotes the values that achieve human flourishing [25]. VE is drawing increasing interest from researchers in philosophy of technology and ethical computing [25, 73, 76, 77] and offers particular insights for HCI design [27].

Design is not value neutral and requires certain questions to be addressed early on to ensure a value-sensitive process [34]. However, an ethical design process needs to be not just value-sensitive but sensitive to *whose* values are in play [47, 73], an issue of particular relevance in relation to psychological wellbeing.

Being 'user-centric' is a core tenet of HCI [65] and a well-informed design process uses various methodologies to produce knowledge about the needs of those for whom it is designed [56]. We generate user knowledge from standards and principles of interaction and through cognitive and behavioural concepts [41], as well as in specifying project requirements and conducting user experience (UX) research

[40], which has for some time included social science methodologies such as ethnographic fieldwork [23, 65]. This user knowledge arises from the scientific and technical 'know how' described as *episteme* and *techne* in Aristotelian ethics [3, 38]. Aristotle also describes a third form of knowledge – *phronesis* – understood as the wisdom or practical judgment acquired through contextual experience [ibid]. Phronesis describes the prudence in knowing which action is appropriate to the task [3, 36, 38, 55, 66]. Crucially, Aristotelian VE requires the combination of *phronesis*, *episteme* and *techne* to promote the values that foster *eudemonia* or human flourishing [24, 38, 73]. Therefore, it offers an additional source of information to technical and scientific knowledge that could improve user insight towards more ethically sustainable design, particularly for mHealth.

In this paper, we reflect on the design process for an app to support psychological wellbeing in pregnancy. We discuss feedback from design sessions held with participants with *phronetic* knowledge from everyday experiences with pregnant women who encounter issues with psychological wellbeing. We analyse how their input can benefit the early stages of design, contributing to a deeper understanding of potential client characteristics and challenges, to illustrate how this kind of information can differ from technical and epistemic knowledge of this target group.

We identify four aspects that can help shape a *phronetic* approach to design: 1) using a wide net to capture contextual experience and reflection, which means including multiple participants with distinct perspectives on the same phenomena in different contexts and who offer different input that may not necessarily arise in user-centred processes; 2) observing the order of feedback in design which affects the values governing design with an impact on design ethics and outcomes; 3) adopting an ethically pluralist approach [73, 24], which entails acknowledging the different value systems (of researchers, institutions and participants) circulating within and around design; 4) formally including subjective input and experience on the part of researchers and designers, drawing on Brey's concept of 'disclosive computing ethics' [13].

The case study explores how phronesis arises in design sessions and illustrates how such input can inform the values governing design. We discuss how these projects benefit from interdisciplinary research with an emphasis on diversity in critical feedback – both personal and professional – that can be applied in specific technological contexts, while tackling complex human problems. This paper offers a perspective on applying phronesis or 'wisdom that works' [26] to HCI design. It puts forward an approach to ethical reflection for sustainable design education that promotes the values that foster the good life.

BACKGROUND
Mobile devices can help identify people who are struggling with depression, by delivering validated psychological health screening surveys, with the benefit of 'anytime, anywhere' usage. In addition, smartphones and tablets can support the implementation of data collection techniques, such as the on-going and remote monitoring of mood and other symptoms [58]. Self-report data, which is a valuable component in psychological therapy and treatment offline, is a central feature of mHealth application design [22].

A number of smart phone applications have been released in recent years to support psychological wellbeing among the general public, such as offering mindfulness techniques (e.g. Headspace, Smiling Mind), improving sleep and rest skills (e.g. DeepSleep), using CBT therapy (e.g. MoodGym), offering tools, planning and reporting facilities towards healthier lifestyles (e.g. Balanced, Life Charge) or specific tools to address anxiety, PTSD and depression (e.g. CPT Coach, What's My M3). Some apps focus on physical and mental health during particular life events such as bereavement (Grief: Support for Young People), illness (CaringBridge) or pregnancy (Baby Bump, Mind The Bump). Others focus on women's health in particular, for example menstruation tracking apps (e.g. Clue), which offer a combination of mood and symptom tracking, analysis and feedback for monitoring both physical and psychological aspects of the monthly cycle.

Meanwhile, mHealth apps are being developed for use in clinical environments, for research into using technologies for particular groups with specific psychological conditions, for example: apps that allow young people and teenagers to record and monitor symptoms of depression and anxiety which therapists can review [58]; apps that track mood and feelings to enhance wellbeing in young people with chronic health problems in transition from paediatric to adult medicine [78] and applications using automatic smartphone sensing to generate passive data for monitoring mood rhythms of individuals with bipolar disorder [1]. These technologies are designed for clients whose needs go beyond standard UX requirements for the general user.

Design challenges for mHealth
User studies and participatory design sessions are well established in HCI and digital media design, in order to identify and cater for user needs [61]. Sharing responsibility and ideas during the process of design is considered to lead to more positive outcomes [72]. User-centred design sessions are particularly important in a mental health context, given the sensitive nature of these applications and studies recommend designers collaborate with mental health professionals as well as clients early in the design process for mHealth apps [22], with a particular focus on how to encourage and maintain engagement [21]. Both individual and general 'client factors' contribute most to successful mHealth interventions [22]. But design for wellbeing should also consider the client's 'indirect' needs, such as what or when they might need the technology to communicate to others (e.g. therapist, family etc.) [59].

A major obstacle in carrying out design sessions for these technologies is the difficulty in accessing potential 'users' for requirements analysis during the early stages of development [22]. These clients are a vulnerable group where the kind of access and feedback required, especially for experimental applications, is frequently severely constrained [57]. It has also been argued that using clients currently experiencing significant psychological distress to evaluate design is ethically problematic [22]. Suggested alternatives have included the use of 'peer users' (close in age, education, social background and interests to the target users), former psychological service users, or therapists as 'proxy' to represent and communicate client interests [21]. However, mHealth applications are increasingly designed to target groups not yet reached by traditional methods of communication and treatment or where no clinical relationship exists [e.g. 62, 63].

Design for mHealth needs to balance a client's direct and indirect needs with clinical requirements for reporting and treatment, while maintaining client engagement. Where self-report and feedback are required, the design needs to support client-therapist relationships without placing excessive burdens or expectations on either [22], while also capitalising on enhanced opportunities for interactivity offered by mobile technologies. Our understanding of the role of interactivity in digital applications is improving, moving from an instrumental view as a characteristic of technology towards a more nuanced understanding of its layered potential in communication [6]. Designers can use interactivity strategically with regard to empowerment to produce different participants outcomes [7].

ETHICS & VALUES IN DESIGN
There is a rich history of research investigating how technologies support human values [34, 48]. The knowledge that informs design, whether about content, context or user requirements, deeply influences the values that become embedded within technologies. Values can influence design objectively via legal frameworks, disciplinary standards and principles, or can be imposed subjectively (even unconsciously) through the value systems of individuals and cultural frameworks collectively held within design teams [13, 70, 73]. One issue for design is distinguishing between intrinsic values (e.g. happiness, health, self-expression etc.) deemed valuable in their own right and the extrinsic values (e.g. privacy, security, trust), which support them [73]. Studies have observed a phenomenon of "paralysis-of-moral-judgment" in IT projects [24 cf. 70, 73] where design teams suffer from 'disorientation as to what values to embed in technology' and hierarchies of values emerge that seem to be subjectively held [69].

Computing ethics has tended to focus on extrinsic values in the design of large-scale systems, whereas more recent research has argued for ethical IT on a 'human scale' [39], for example in examining how social media can support the

value of 'friendship' [77]. The challenge for HCI is how to better educate designers, developers and ultimately users in the consideration of such values in design [27, 47, 52, 70].

Practical techniques developed for ethical approaches to design include reflective design [67], tools for value conscious game design [9], 'values at play' frameworks [29, 30], participatory design [11], values 'levers' to open discussion in design [69], values advocates [61] and value-sensitive 'Action Reflection' and co-design models [86]. These approaches often focus on how to define guiding values at the outset, however values can also arise as local phenomena 'discovered' through design [52]. Some techniques suit certain design settings better than others, and tend to produce different levels of ethics expertise rather than establishing ethical consideration as the responsibility of all designers [70], in a continuing process of reflection on what it means to be value sensitive in design [52]. HCI requires additional perspectives that draw more attention to the local values of individual design cases and new approaches to ethical design that acknowledge the problem of highly heterogeneous user groups that are difficult to distinguish or access [47].

Spiekermann [73] observes that values are 'empty shells' until they are acted upon by those in a position to use them in design. Thus, the effort involved is not just in establishing which values or whose values, but *how* they are expressed, promoted or even neglected, in other words, to what ends. Aristotelian VE attends to the values that foster wellbeing or human flourishing [25, 73]. VE has been rising in prominence in IT and computing ethics [24, 25, 76, 77] not least because of its appeal for understanding human and digital relations [76, 77]. In particular, VE seeks ethical pluralism [25], which supports cooperation, a level of uncertainty and understanding of the sources of paralysis in decision-making.

Virtue ethics for design
> "..technē without phronēsis is blind, while phronēsis
> without technē is empty" [10]

In VE, phronesis is the core intellectual virtue through which other scientific, artistic and technical virtues are expressed [77]. Phronesis comes from an intimate familiarity with practice in contextualized settings [66]. It represents knowledge that is context-dependent and particular, rather than what is abstract and universal [2, 55]. Phronesis involves practical judgment about the right 'choice' to make among various possibilities and therefore inherently involves ethical reflection [24]. It is ultimately concerned with the appropriate action in relation to "the things that are good for human beings" [3].

The concept of phronesis has recently drawn interest from fields such as social science and public policy [31], politics and international relations [14, 55], feminist epistemology [26], philosophy of technology [25, 76, 77], healthcare ethics [2] ethics in information technology [73] and digital

media ethics [26]. It has been applied for example, to digital games analysis where players exercise phronetic judgment about what action to take in specific gameplay contexts where the goal is not just to play/win but to do so with respect to opponents and 'fairly' [26:p.xxxv].

Flyvberg et al's [31] applied phronesis places emphasis on issues of power in decision-making where research is required to 'see no neutral ground' and focus on context and perspective [ibid]. Phronetic social science seeks to move beyond positivist vs. interpretivist positions and is concerned primarily with what 'matters' [66, see also 36]. Applied phronesis is engaged to empower change [32]. This is similar to action or participatory research, but phronesis differs in that it does not privilege collaboration with the people being studied but prioritises producing the knowledge that improves their position [66] that may come from others. Applied phronesis is context-sensitive and especially suited to case studies [32, 66].

Applied phronesis seeks information based on experience in context for the benefit of the people being studied and for whom systems are designed [66]. It demands analysing what appear to be the same phenomena or requirements in different contexts and reflecting on the choices and dilemmas arising. It also requires that we examine the value frameworks of all who contribute to the design process. It calls for scrutiny of judgments and assumptions made in design and playing through the outcomes of different options, to ensure the values of fostering wellbeing are upheld. Thus, building phronesis into HCI design processes contributes to deeper ethical reflection, which leads to a more sustainable design ethics [70]

Applied phronesis in mHealth
The key elements to consider in designing mHealth technologies for clients include: diagnosis, treatment, treatment providers, life history and personal profile [22]. These require the kind of detailed epistemological and technical knowledge generated through UCD and UX research. However, life history and personal profiles involve social, cultural, gender, economic and individual traits specific to individuals and contexts, which can impact significantly on engagement and outcomes. These specifics may arise more readily from phronetic knowledge.

The WHO recommends that designers of mHealth interventions for maternal-child health should be particularly attuned to socio-cultural, -economic and demographic factors that can influence female health behaviors [84]. Therefore, designing mHealth technologies for psychological wellbeing in pregnancy requires paying attention to value systems as well as the needs of clients, therapists and others in the healthcare context.

A phronetic approach to design seeks input from sources that provide personal or contextual knowledge or are familiar with daily routines of potential clients for mHealth applications. Including phronetic input in the early stages of design helps to ground technologies in such everyday wisdom and shape appropriate interactions and communications. Phronesis also provides an ethical framework promoting values that foster wellbeing.

CASE STUDY
Psychological wellbeing during pregnancy is a serious public health issue due to its impact on women's lives, birth outcomes, and on children's emotional, behavioural, cognitive and social development. Perinatal depression (PND) is one of the most common psychiatric disorders during pregnancy, affecting up to 15% of women during pregnancy or within one year of giving birth [8, 85]. However, its frequency is probably higher as it often goes undiagnosed [49].

HCI researchers have recently been looking at how technology can benefit pregnancy and motherhood, using social media to identify women at risk of PND [18], designing mHealth apps for the pregnancy 'ecology' [63], context-sensitive approaches to design for post partum technologies [20] or using social media style platforms for reporting and recording child development [46, 74].

The particular case we examine is BrightSelf, a prototype mobile smartphone application, designed to allow pregnant women 'check in' and report on their psychological wellbeing. It is part of a research project that aims to explore the feasibility of self-report apps for early detection of PND, how its design might address issues around engagement with technology and how such a system might work within the relevant healthcare delivery structures. The app captures data in two separate and distinct ways: (1) retrospective reporting, where clients can 'Check back' on wellbeing over the previous week. This uses the Edinburgh Postnatal Depression Scale (EPDS), a standard clinically approved 10-question format designed to identify and measure symptoms [17]; (2) clients can also 'Check in' at any time and quickly self-report on how they are feeling 'in the moment'. This follows an Ecological Momentary Assessment (EMA) method [68] and is based on 5 questions, which track Mood, Sleep, Worry, Enjoyment and Energy. In addition, the user completes contextual information ("*Where I am…*") and activity information (*"What I'm doing…"*). On completing both kinds of reports, the user can see overall results for that report or look back at results over time.

Design sessions
In order to address the balance of needs and values in design for the BrightSelf app, we used a qualitative approach involving group and individual design sessions. We sought to elicit feedback on early prototype designs for content, functionality, interaction and potential for engagement. However, we also aimed to facilitate informal conversation among participants where phronetic insights might emerge, particularly in relation to unconscious assumptions made in design. We focus here on reflection on the perspectives offered by different types of clinical staff,

particularly midwives, early in the process, which had an impact on design decisions. The project also included design sessions with individual pregnant women, however these do not form part of this analysis (although we discuss issues related to the overall process later).

We conducted five design sessions in Spring 2016 with different groups of participant types including medical (obstetric and midwifery) researchers/clinicians, mental health researchers/clinicians, psychologists, social scientists with expertise in pre- and postnatal care, and practice and research midwives. In total, 21 participants took part in the five design sessions, both male and female and ranging in age from c.25 – 55, each with various levels of experience with pregnant women through practice and research. Each design session was recorded and transcribed and the data was then subjected to a thematic analysis.

Thematic approach
In reflecting on the discourse data, we draw on Eubanks' [26] precepts for an applied feminist phronesis, which requires research to: 1) ground analysis in "the subjectivities and everyday/everynight experience" of the people being studied; 2) recognize that different individuals and groups inhabit different social locations in relationship to the phenomena being studied, shaped by their relationship to power along the lines of race, class, cultural specifics and so on; 3) uncover how social location shapes different 'situated knowledges'; (4) put specific situated 'knowledges' in conversation with each other in the context of collaborative, action-oriented practice in order to develop better accounts of the world; 5) produce knowledge that is useful for praxis and social movement through design [ibid:p.244].

We reflect on these 5 precepts in the analysis of discourses arising from design sessions in order to provide guidance on a phronetic approach to design. We focus on contributions around issues of 'subjectivity', 'everyday/night experiences' of pregnant women and reflections on assumptions held around their socio-economic and cultural positions. Next, we include multiple participant types to put various 'situated knowledges' together. Thirdly, we address the diversity of individuals and groups not just as target users but involved in feedback and design. Finally, we formally highlight the personal input and experience of researchers and participants in design, towards producing further phronetic knowledge to promote wellbeing.

Arising from this analysis, we then discuss four elements of an applied phronetic approach: casting *a wider net* for input; reflecting on the *order of feedback* in which 'situated knowledges' that inform design is received, both within design sessions and also in the early project design stages; adopting the *ethical pluralism* of VE, which recognises different value systems (of researchers, institutions and participants) circulating within and around design; and *acknowledging subjectivity* in a reflective design process.

In the following analysis we present examples of discourse from the design sessions to illustrate phronetic input and how it can guide ethical reflection within design. We follow this with a discussion based on the four elements of our applied phronesis and their impact on design decisions.

ANALYSIS
The key to applied phronesis is gaining different perspectives on similar phenomena in different contexts [31]. During pregnancy, women are often already engaged with a variety of health professionals for whom psychological wellbeing is just a part of the overall care path. Each has a different perspective on the requirements of an mHealth app for perinatal psychological wellbeing. GPs, midwives, obstetricians, psychologists and social workers each have a particular responsibility in relation to pregnancy and a different experience of engagement and communication with pregnant women. We draw on Peyton et al's [63] concept of the 'pregnancy ecology' where the daily 'lived' experience of pregnancy and psychological wellbeing is unique to each pregnant woman. While design cannot cater for each unique case in detail, it can be sensitive to these orientations.

As potential clients, pregnant women clearly offer crucial 'user' feedback at the core of a user-centred design process, while psychologists and specialist researchers in PND provide essential clinical knowledge for design. However, by casting *a wider net,* our phronetic approach includes feedback from others with experience of the everyday conditions for pregnant women. These conditions impinge not only on psychological wellbeing but also the potential for and quality of self-reporting in different contexts as well as the kind of interactivity and tone more likely to sustain engagement. The following examples illustrate the valuable phronetic judgment offered by practicing midwives and how it provokes reflection on design.

"What's not said"
> "I'm going to be really honest with you, I really have a problem with the [points to app] interface rather than face to face when you're talking about… um… sensitive… um… subjects like mental health, because… it's all about body language and what's <u>not</u> said?"
> (MW1)

This midwife has valid concerns that mHealth apps are a poor replacement for the multisensory signals picked up in an interview about emotional wellbeing, which often lead to a referral. This provokes questions for design around whether technology can be used to consider more deeply the kind of deliberate withholding of communication, often subconsciously or unconsciously done, especially but not only in mental health consultations.

In HCI we design technologies to interactively mediate communication and focus on designing for multi-modal actions and interactions. We do not usually focus on "what's *not* said". Yet there is much that is left out in

communication and in relation to psychological wellbeing, this is manifested in the many subtle ways people cope with presenting their 'front stage' face and disguise what is happening backstage [37]. For some more than others, this coping mechanism is a continuous daily effort and challenge, and yet is precisely the kind of information that clinicians and psychologists need in order to understand, to explore with individuals, to intervene if necessary and to help improve their psychological wellbeing. A discussion between two midwives continues:

> "I'd like to see it compared though…with…human contact... in exactly the same way, that would be really good…" (MW1)

> "Well that's very subjective isn't it whereas this is more… objective" (MW2)

This exchange reveals a key aspect of the face-to-face form of conversation around mental wellbeing that occurs where a 'subjective' judgment is formed on the part of the clinician. That an app might offer more 'objective' forms of information (in their words) opens up a discussion among other midwives around how the app could empower those experiencing mental health problems. By allowing people access to and control over their own self-knowledge, an mHealth app can possibly offer alternative assessments, outcomes for judgment or clinically actionable information. However, an individual may also form her own subjective judgment of her wellbeing based on her interaction with the app. Trust in our own subjectivity and judgment is of course directly relevant to our psychological wellbeing.

Despite the concerns expressed, this input suggests that the app can provide a channel for a pregnant woman to talk to herself in private and may be able to form part of the backstage 'cast' that helps to mediate what is or is not said. Other participants later acknowledge that this aspect may particularly appeal to younger women, who have difficulty engaging with mental health services through existing communication channels.

The efficacy of the EPDS
Several midwives described the EPDS as somewhat 'ineffective' as core app content because of their experience that 'people try to trick it' by gaming their answers. One midwife offered her own experience of answering the EPDS where she found herself changing her answers while completing the questionnaire and wondering to herself: *"Are they trying to catch me out here?"*

Other participants were critical about the language of the EPDS, not just for the purposes of the app, but in general diagnosis. For example, according to one midwife, Question 5 on the EPDS uses "patronizing" language, when it asks, *"Have you been worried for no good reason?"* She stated that several pregnant women have justifiably replied:

> "I have a bloody good reason for being anxious, thank you very much".

This EPDS question is seen to undermine a woman's personal assessment of acceptable reasons for anxiety, possibly reinforcing anxiety over wellbeing. Its tone suggests that others (possibly clinicians) may question a woman's basis for worry. This reinforces the sense that pregnant women are not best placed to assess their own wellbeing, which is a source of disempowerment in relation to the 'situated knowledge' being negotiated, an aspect that requires a phronetic approach to informed design.

Actionable inputs
Design Session 1 involved a mixed group of participants and was initially dominated by clinical concerns in relation to the potential burden the app may create for medical professionals.

> "You've got a hammer you see… and every problem is a nail"

This maternal health researcher observes that clinicians have a preference for technologies that allow them to use 'their area of expertise' or can collect information they can 'act on'. A further exchange explored concerns around training in the use of such mHealth technologies, and knowing how to recognise 'flags' that need actions:

> "Is it red and green flags or…? Is it that they have to look out for a marker and make a decision based on the spot?"

Clinicians have expectations that communication with patients will provide information for them to 'do something' rather than to better understand something, with connected concerns about responsibility chains and emergency response in extreme case scenarios. This feedback contrasts with that of public health researchers later in the session who observe the reality of clinician/client relationships in some contexts:

> "In [city] you're much less likely to see the same clinician during pregnancy than you are outside of [city] where you might see the same midwife for the entire gestation and then often afterwards as well…"

In relation to assessment for PND using traditional methods, what tends to happen in this context is:

> "…they give the questionnaire out in the waiting room and let them answer it and do they look at the notes? Absolutely not…"

So despite clinical requirements and expectations for information to act upon, the everyday lived experience of pregnant women is that opportunities to offer information may be constrained.

"Their husbands have the phones"
Design Sessions 2-5 involved 14 different midwives and tended to focus much more on the daily lives of pregnant women in relation to health care. The discussions raised pragmatic issues around transport, affordability and even

access to mHealth applications that had not been addressed in the project research to date. For example, they expressed valid concerns about demographics when recruiting 'peer user' participants for design research, where assumptions might be made around ownership of smart phones, personal access to apps and purchasing power as well as privacy and autonomy over communications.

> "You're going to get many of the same kind of women…motivated articulate intelligent interested in their own well being… and the ones that we really want to target…probably don't have… access to… and you think…of our Asian population…their mobile phones…actually their husbands have the phones"

It must be emphasized that the participating midwives themselves represented a variety of ethnic groups, including those under discussion, and so their comments could be seen to reflect both professional and personal community knowledge. This illustrates the value of eliciting feedback from those operating closely with a target community who can identify assumptions and vulnerabilities in design where access to peer users is not possible. It reflects the *ethical pluralism* approach, which recognises that different value systems coexist and that localised phronetic knowledge can benefit design.

"A tool for good"
A further concern for midwives is getting clients to admit to their 'true' feelings on emotional wellbeing, in whatever form they communicate.

> "If it's a tool to elicit their true feelings, then that's only going to be good isn't it?"

A point made repeatedly throughout the design sessions was how mental health struggles are still highly stigmatized in the general community, but even more so among pregnant women, who have real fears that admitting to experiencing psychological difficulties might result in their child being taken from them. They noted that an app could provide crucial access particularly to younger women whose smartphones are an essential communication tool and to the many for whom admitting struggles with emotional wellbeing is still taboo.

Configuring 'Users'
During analysis, we became aware of differences in the way the target 'user' group for the app were described by different participants. As HCI researchers we tend to refer to 'users', whereas the midwives referred to 'women' or 'clients' e.g.:

> "It's about empowering women to take responsibility for their mood and contacting us"

> "It's a risk assessment on whether that woman or client needs additional support"

However, clinical researchers from the first design session used a mix of terms including 'user', 'women', 'patient' and 'mums' e.g.:

> "It depends on some groups as well, because the younger mums would love it…but then a lot of the other mums of different cultural groups would be like 'no, don't like that'…"

The term 'user' is increasingly regarded as problematic in HCI [80] while the term 'patient' prioritises medical perspectives and 'mum' or 'mother' is questionable due to uncertainty over pregnancy outcomes. One outcome of an ethically pluralist approach is reconsidering how we refer to the human in relation to designing mHealth applications.

On reflection, the analysis suggests that for mHealth technologies at least, and following the phronetic input of midwives, the term 'client' better captures the relationship and strategies of communication. It reflects the nature of the relationship and between a woman and therapist (whether this is human or technological) or service offering to support wellbeing. In addition, the term client implies the receipt of some benefits of a service-oriented relationship, which the term 'user' does not. The term 'client' reminds us of the vulnerabilities that these communications seek to address, and notably takes into account the original Latin meaning (*cliens*) describing someone seeking the protection of something/someone with power [OED]. This acknowledges the non-neutral positioning of technologies in their interaction with vulnerable people and the exchanges of empowerment entailed in using mHealth technologies for supporting psychological wellbeing.

DISCUSSION
The design sessions reveal insights into how an app could address the psychological wellbeing of people whose needs are frequently not met in traditional healthcare paths. But it also shows how even the most well informed designs following user-centred and/or participatory processes may not sufficiently uncover unconscious assumptions and may miss some ethical design considerations.

For example, the midwives expressed concerns about three vulnerable groups in particular: a) young pregnant women who do not communicate or engage with the health system at all and have poor personal emotional support systems but who 'do everything on their phones'; b) women from ethnic minorities who have cultural and economic barriers to accessing smartphones or autonomy over purchasing apps for wellbeing or any other purpose; c) women suffering from domestic abuse who may have similar barriers to access and autonomy but are strongly motivated to remain private and even less likely to report PND. These groups are least likely to engage in research feedback on such an app, rendering them inaccessible for user research and yet are more likely to benefit from the app than most. Phronetic

input allows at least some representation of such groups for ethical consideration.

The Wider Net

Midwives use everyday wisdom to help them judge what may or may not work in practice with pregnant women. Their phronetic input through the design sessions prompted us to critically revisit the language and tone of clinically approved assessment methods used in the app, such as the EPDS, to ask if there are better ways to ask the important questions. While extensive research would be required before the EPDS could be replaced with another assessment method (e.g. PHQ-9 questionnaire [50] or other), their feedback draws attention to where values become embedded in *how* we communicate as much as in what we communicate.

This provoked an internal discussion within the design team around the language used throughout the app. Depending on whether we use the first or second person 'voice' in onscreen information, we can shape how a person configures with whom (or what) they are communicating. The second person 'you' implies communication with another entity (as with the EPDS report) but the 'I' voice internalizes her relationship with the app and with herself. This discussion informed the decision to change the 'voice' of the EMA report to the first person, to distinguish it from the EPDS and to orientate the client towards a more intimate and personal form of self-reporting that values and is more likely to produce self-knowledge.

Such wellbeing apps cannot assess 'truth' in communication, but neither, arguably, can a clinician in a face-to-face encounter. An app might however facilitate communication where none was previously forthcoming, simply operating as a tool to mediate *what is not* or *what cannot be said* directly to another human being.

Order of Feedback

Involving as many people as possible in critiquing prototypes is of course essential for design [60]. However, participatory design recommends a methodical approach to assessing and assimilating feedback [80]. It is not enough just to add more participants "and stir" [61]. Each contributes in different ways [53] and, crucially, is always inevitably directed and 'interpreted' by designers and researchers in formal processes like 'design sessions' [80].

An applied phronesis approach pays attention both to *how* participants contribute and to *when*, as this can influence the interpretation of observations and the direction of future feedback. By putting situated 'knowledges' in conversation with each other we draw attention to the 'order of discourse', a concept from discourse analysis, which describes how the social structuring of relationships can impact on how we make meaning [28]. It also emphasizes issues of power and (dis) empowerment in how knowledge is produced in discourse [42]. So when specifying

requirements for this particular mHealth app, the order in which different expertise contributes is as follows:

1. Project researchers from the fields of HCI and public health – research problem and questions, general mHealth design parameters, best practice, case examples;

2. Medical (midwifery) researchers/clinicians – clinical requirements, assessment methods, protocols, research ethics framework;

3. Mental health researchers/clinicians –relevant material specific to target group;

4. Midwives – practical experience, daily issues, potential for acceptance and engagement, case studies of clients from care;

5. Pregnant women – peer user feedback of use/practicality

The research context of mHealth application design generally follows this order of feedback, with input from medical researchers and clinicians at the outset in order to ensure clinical requirements are met. A framework is then arranged whereby further 'expertise' is included in the process. This is shaped by strict research ethics guidelines under which, and *only* then, can clients or 'peer users' be recruited for participation in design and evaluation work. While a requirement of academic and institutional structures, this process also involves building human relationships and trust so that clinical responsibility can be taken for eventually including clients in research and design.

Healthcare responsibilities are critical and the volumes in a public health system are so great that epistemic and technical knowledge takes precedence for medical researchers and clinicians. We see from the design sessions that the values they wish a technology to promote include actionable information, timely warning signals, protection of patient information and consistent communication expectations. However, inevitably their position in the order of feedback can have the effect of embedding such values in prototype design from an early stage. Often by the time potential clients or 'peer users' are invited to participate, much of the content and design is already preset by clinical requirements whose values necessarily dominate.

Research ethics is concerned with the safety and efficacy of research particularly where it involves humans. But a project that has achieved ethical approval still requires ethical reflection in design. Designers must make explicit distinctions between research ethics (supporting extrinsic objective values) and the ethical framework for design, which can support intrinsic values but also reflects subjective value systems.

Ethical Pluralism

Ethical pluralism recognises shared universal values but acknowledges cultural differences and notes that each participant brings with them a particular system with its

own set of values and value hierarchy [26, 73]. Before and during design sessions, we noted participant and design team profiles pertinent to the interpretation, communication and understanding of app design and content, and the values embedded within. These are relevant to technology design generally and yet may not always be acknowledged as such. Each individual attribute represents different circles of cultural influence from the institutional to the personal, of which we must remain aware, for example:

(1) Disciplinary differences – HCI, computer science, medical practice and research, psychology and communications studies, each contributes different interests, foci, methodologies and theoretical frameworks and differing approaches to ethical considerations. This has implications for whose values become embedded in design earliest, and how, as observed through the order of feedback.

(2) Geography – research is located in different geographic locations with diverse structures around delivery of both maternal and mental health services. Different value systems can arise out of professional and personal experience of these services. There are implications for how mHealth technology might sit within the provision of physical and psychological perinatal services and be received by potential clients. Design must address practical contextual issues that arise when mHealth technologies go beyond the local.

(3) Gender – considering the target user group for mental health in pregnancy, gender is highly relevant to design in this instance and all researchers bring gendered perspectives and assumptions to the design process. Researchers (and authors) and midwives participating in the design sessions include females with experience of pregnancy and childbirth. But other sessions included clinicians, psychologists, social scientists and perinatal health researchers both female and male. The latter provided at least one insight into design values that had not arisen previously, around the app's appeal and opportunities to support engagement available:

> "If I was a partner of someone who was struggling with pregnancy, I'd be very keen to support them and encourage them to use something like this…"

Inasmuch as it is vital to focus on the needs and values of pregnant women with this mHealth application, researchers must be attuned to the possibilities of input from men in supporting ethical reflection in its design.

(4) Ethnic background – the design sessions involved participants from many different cultural backgrounds, which enrich the project enormously, as represented specifically in feedback on concerns about particular cultural groups. While acknowledging cultural differences, ethical pluralism also seeks ways to find common values that can be applied in local and contextual ways [25].

(5) Experience – researchers and participants all carry professional and life experiences relevant to different aspects of the design whether through involvement with health care, use of mHealth technologies, experience with pregnancy and attitudes to or challenges with psychological wellbeing. Each produces personal perspectives on existing or desirable value systems that might apply.

Acknowledging Subjectivity

Individual value systems have implications for value considerations in design and should be acknowledged for the purposes of disclosure. The personal profile of each researcher and design participant guides the values they hold in relation to many relevant issues in design. In addition, we note that the target client group is also highly heterogeneous – all pregnant women are not the same. This follows the acknowledgement in HCI research that user studies are too often constructed as abstract ideal or 'intensional' users [5] rather than actual users whose responses to digital technologies and interactivity are individualised and inherently strategic [7].

Here we draw on Brey's [13] concept of 'disclosive computing ethics' and how the design of systems can affect user autonomy. Design can facilitate monitoring or "may constrain their users and may help install dependencies" (on systems, operators or others with power over technologies) [ibid, p.14]. This concern is not just for autonomy of individuals but also for groups, or even the sovereignty of countries [ibid]. Pregnant women are a particularly vulnerable group whose autonomy is collectivised through public health services and placed in balance with that of and responsibility for the foetus. Verbeek notes that technologies around pregnancy, like ultrasound, already facilitate monitoring creating new kinds of knowledge of the foetus not previously possible [79]. However, technologies also create dependency, taking the place of what was once intimately communicated bodily knowledge between mother and baby, even isolating the foetus from the mother [64, 79]. Further, ultrasound not only constitutes the foetus as a person but as a medical patient [79] and in some jurisdictions, one with legal rights [16].

In acknowledging subjectivity, applied phronesis sees 'no neutral ground' in the design process [31]. It acknowledges the 'lived experience' [54] of pregnancy and grounds analysis in "the subjectivities and everyday/everynight experience" [26]. Using phronetic wisdom for ethical reflection in design in this mHealth application respects the individuality and autonomy of pregnant women, thus supporting their wellbeing during pregnancy.

The subjectivity analysis provoked a change to the app name following detailed discussion both within and outside design sessions. The prototype app began as 'BabyBright', with an emphasis on a positive and light touch and an associated attractive graphical theme around sunlight. However, one researcher (and author, female with experience of pregnancy) expressed concern about the

inclusion of the word 'baby' in the title – admitting to instinctive and strong personal rather than research-based concerns around the implications for values embedded in design. This was echoed in feedback from midwives and informally from other research colleagues (also female with experience of pregnancy). The concerns were that maternal mental health is closely connected to the sense of autonomy (or loss of) experienced by pregnant women. Of the health services available around childbirth, most tend to be expressed as for the benefit of the baby rather than the woman as a separate entity. A decision was made that the app name should not reinforce a loss of autonomy but instead be an intimate resource focused on the pregnant woman herself. The name could be motivational or abstract, it might even describe what the app does but could not be prescriptive or imply an intervention of any kind and so a process of renaming began. The result is 'BrightSelf', which aims to describe, with a light touch, an app as a personal tool for reporting on and developing deeper self-knowledge during pregnancy.

Some Limitations
This is one situation where phronesis adds vital knowledge to the design process. Not all design contexts have a 'wider net' of participants available to contribute such everyday wisdom. Equally, adding further diverse situated knowledges adds complexity and competing value systems, which may not always be tempered by ethical reflection, and will still produce challenges for design. Further, a phronetic approach does not necessarily guarantee the 'right' or a 'better' design decision. However, it does produce a considered rationale where the likelihood of 'wise' decisions increases in each new project. More work is needed on the potential of applied phronesis in the absence of extra contextual client knowledge, how to balance design for autonomy and empowerment with seeing 'no neutral ground' and what other elements might aid applied phronesis in mHealth or other application domains.

While this work can only partially contribute to addressing ethical design for vulnerable groups, it does provoke discussion around how such technologies are designed and might be made more accessible for challenged communities in the context of healthcare delivery.

CONCLUSION
We have introduced an approach to applying phronesis in mHealth technologies for a more informed design process based on everyday wisdom. This is not a new technique for designers, but offers a perspective on how to shape ethical reflection in design. The approach described offers some additional reflective activities that designers can use when carrying out a user-centred design process - building on the methodologies and approaches from social sciences now commonplace in HCI through stages of planning, analysis, and reflection (personally, collectively and institutionally) in light of the constraints placed on us by designing within the healthcare context. The elements of applied phronesis that we describe are:

1. Cast a wider net for feedback in research: this goes beyond contextual design practice to include multiple participants with distinct perspectives on the same phenomena in different contexts. Our analysis shows that involving a large number of midwives as well as clinical researchers and medical practitioners produces value 'conversations' that result in changes to the 'voice' and tone of the app design.

2. Pay attention to the order of feedback: this relates to which values may become embedded first in design. While clinical requirements take precedence in mHealth, our analysis reflect on the challenges for vulnerable groups of accessing and using technologies, and how design can support intrinsic values like empowerment in simple ways.

3. Adopt an ethically pluralist approach that expects and acknowledges difference among designers and participants. The study reveals small but important differences in how designers and participants conceptualise those who use mHealth technologies, suggesting the term 'client' best reflects the communication relationship.

4. Acknowledge and disclose practitioners/researchers subjective value systems: this ensures that we continue to 'see no neutral ground', an outlook that provokes a name change to ensure the app supports psychological wellbeing without carrying further implications for outcomes.

Phronesis contributes to HCI in a number of ways. It encourages designers to seek phronetic input from participants that add important insights for designing technologies for sensitive contexts and outcomes, especially where target clients are vulnerable and inaccessible. This phronetic input has a dual role in also calling to attention the values with which technologies are being designed and in shaping applications towards wellbeing. This in turn encourages a more informed, ethically reflective and sustainable design process.

Being informed by *phronesis* does not mean a designer 'knows' how to act in a certain situation, but uses her own experience, knowledge and judgement to understand it, to perceive what is at stake, to weigh the demands of competing value systems and to make decisions about the 'right' thing to do towards promoting the good life.

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