

Article

“Maternal Devices”, Social Media and the Self-Management of Pregnancy, Mothering and Child Health

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Received: 1 April 2014; in revised form: 3 June 2014 / Accepted: 5 June 2014 /

Published: 13 June 2014

Abstract: In recent years the smartphone has revolutionised lay people’s management of health and illness, particularly in regards to pregnancy and parenting. This article analyses smartphone applications, or apps, and social media platforms as mediating technologies which act as performative devices. These devices encourage particular enactments of subjectivity and technologies of the self which combine the expert patient ideal with ideologies of mothering. Some apps and social media can be disciplinary and invoke biological responsibility in various ways including the monitoring of specific behaviours via “push responsabilisation”. Apps claim to allow for greater convenience, connectivity, flexibility, efficiency, and what will be characterised in this article as the “tidbitisation” of information. This article suggests the ways in which health-conscious pregnant or maternal subjects are likely to view apps and social media sites as a means to improve and monitor their pregnancies, health, and their children’s development and health.

Keywords: applications; digital health; social media; pregnancy; mothering; responsabilisation

1. Introduction

The smartphone revolution over the past five years has had a significant impact on our lives, influencing our daily activities in varied ways. One of the most important influences has been the continuing technological expansion of the management of health and illness, which is now incorporated into many people’s smartphones via a range of applications, integrating anything from calorie counters to exercise trainers. Smartphone applications (“apps”) and social media platforms are important elements in the rapidly changing environment around pregnancy and the transition to first-time motherhood. Despite much theoretical research highlighting significant changes in digital health

technologies, studies analysing these technologies, their possible implications and the experiences of users are few.¹ This article begins to address this gap in the literature by analysing smartphone apps and social media platforms that are coming to play a role in the everyday practices of the maternal subject.

Pregnancy and mothering are no longer seen as simply a reading assignment [6]. In the context of an increasingly digitalised world, the transition to first-time motherhood is now an embodied project which encompasses digital health, responsible biocitizenship, accessing the internet as a source for support and advice and the use of a range of new devices, changing the way pregnancy and mothering are understood and practiced. Together, these developments promise to make maternity a self-calculable exercise in data management. In this article, I consider how apps and social media platforms organise parenting practice and have the potential to produce new experiences of pregnancy and motherhood. In contemporary culture's emphasis on choice, individualism and empowerment smartphone apps and social media are an increasingly important object of analysis, through which we could study changing relationships towards technological devices and new patterns of behaviour, understood in this article as technologies of the self [7–9].

2. Maternal Subjects as Expert Patients

The personal management of health is an avenue through which individuals can embrace their duties and responsibilities as “good citizens” and ethical selves [10–12]. In an age of increasing digitalisation individuals have unprecedented access to a huge range of health information and one of the consequences of this access is that one feels the imperative to present as, or be, an “expert patient” [13–15]. The expert patient is expected to negotiate their healthcare with careful research and self-education. Research on the expert patient is most often focused on patients with chronic disease such as obesity [14,16] or cancer [15]. It has, however, important implications for understanding women's experiences as maternal subjects, particularly their use of technology in the management of maternal and foetal health.

Maternal subjects, as expert patients, are expected to adopt a highly reflexive, intentional and carefully researched orientation to the consumer market catering to pregnancy and parenting [11]. This expectation is combined with ideologies of motherhood, such as intensive mothering. According to Hays, intensive mothering: “requires not only large quantities of money but also professional-level skills and copious amounts of physical, moral, mental, and emotional energy on the part of the individual mother” [17] (p. 4). Immediately we recognise the dictates of expert patient and intensive mothering share many features and thus combine to form a particularly powerful technology of the self [7–9]. The intertwined roles of mother and expert patient therefore serve to emphasise personal responsibility over making the “right” choices for your child. This is a central consideration in this article as I analyse how the development of specific apps impacts on the relationship between the expert patient ideal and contemporary mothering ideology.

¹ Specifically there has been very little research on the use and impacts of smartphone apps and social media as they are used as part of pregnancy and parenting practices. At the time of writing there were very few academic papers on this topic [1–5].

3. “Being-for-Intimate-Others”

A growing body of literature reveals the various ways the foetal and infant body are positioned in popular media and medical and public health discourses in order to encourage maternal responsibility [18–22]. In neoliberal society, women turn to a range of technologies and systems of expertise and guidance in order to manage the risks, pressures and challenges characteristic of the transition to first-time motherhood. In doing so, women undertake specific pregnant and maternal practices to ensure the health and well-being of the foetus and infant. These practices can be defined according to Foucault’s [9] notion of technologies or practices of the self. In Foucault’s account, technologies of the self are not coercively directed but are encouraged by the enhancement and pragmatic actualisation of general moral goals and aspirations which may include desires, pleasures, happiness and good health [23]. Technologies of the self therefore reveal the multiplicity of ways in which dominant discourses may be enacted, resisted, negotiated or differentially embodied in the individual’s ongoing ethical project of the self. This analytic frame enables us to identify variations in how individuals or groups of individuals might constitute themselves as subjects of given moral injunctions.

With the growing standardisation of medical technologies and interventions, pre-pregnant couples, pregnant couples and parents actively consume and demand these in order to optimise outcomes, in the process incorporating risk avoidance as a technology of the self. Maternal subjects may therefore embrace medicalisation as part of their desire for the best possible outcomes in reproductive, foetal and infant health [8,24–26]. As more technologies offer more opportunities to optimise foetal health outcomes, “the choice not to choose” appears selfish as this stands as a denial of “the best care” available [27]; [28] (p. 2). It is at this juncture that the responsabilisation of individuals in the neoliberal context becomes something more for maternal subjects as they are not simply acting for the self but also for the unborn “other”. Thus, I argue that responsabilisation for maternal subjects is both gendered and double-pronged; this is not simply neoliberal responsabilisation as we know it, but responsabilisation of the self-for-others; “being-for-intimate-others”. This gendering of responsabilisation is also implicit in the ideology of intensive mothering which argues that mothers must do everything possible, including self-sacrifice, for the sake of their children [17].

The immersion in numerous media forms aids in the self-education of individuals and also allows them to engage in “biomedical self-shaping” [29] (p. 446) where patients actively make choices regarding their genetic and corporeal responsibility, acting on and disciplining themselves according to expert recommendations.² I attempt to move beyond Rose and Novas’s [29] work on “biomedical self-shaping” to demonstrate the ways in which devices such as smartphone apps and social media could be utilised by pregnant women and new mums as they engage in the project of first-time motherhood. I have already suggested that the convergence of the ideologies of intensive mothering and the expert patient ideal work to create a powerful technology of the self for maternal subjects. I consider whether we can now add the technology of smartphone apps to this nexus, potentially attaching new rules, meanings and dynamics to the ethical project encompassing pregnancy and

² Descriptions of self-identity increasingly include “biologically colored languages” [30] (p. 73) which demonstrate active relationships with medical and scientific authorities and products.

motherhood (and instituting these rules through their incorporation into devices). Are smartphone apps and social media platforms simply disciplinary devices, or do they do something more? Are they also performative and if so, what sort of pregnant or maternal subject are they producing? Do women utilise social media and apps to engage with the ideal of the expert patient, the intensive mother or some other ideology of mothering?

4. The “Device-ification” of Maternal Subjects

The integration of apps and other smartphone technologies into everyday life, routines, and definitions of the self illuminates the ongoing dynamic nature of biological citizenship, representing a new development in self-health practices that adherence to self-help guidebooks alone would not afford in the same sort of way. This article explores some of the possibilities associated with this notion of “device-ification”. Apps and social media platforms are able to be integrated into every-day life via the portability of smartphones, tablets and other mobile devices. The employment of such devices suggest a specific way of producing (self-)knowledge of the pregnant body and offer ways in which women can understand or define their pregnancies and/or mothering practices. They could also work to encourage women to evaluate themselves according to various prenatal norms thus allowing them to measure how good or bad their specific practices are deemed to be.

These new technologies are not simply an extension of more static forms of self-help (such as guidebooks) as devices or technologies of the self, but represent a transformation of these. This material development is important. It allows people to relate to what used to be a book via a new set of instructions or practices through a device in a variety of locations and even whilst multitasking. This changes the relationship of the body to sources of authority or information, and specifically, the “pushiness” (the functionality of push notifications) of some devices creates new relationships to technology and advice. These changes suggest the possibility of new forms of subjectivity or enactments of pregnancy and mothering. Therefore apps and social media are not simply sources of information, but also act as performative devices in that they prompt or provoke women to act on and through their bodies via these devices.³ These devices are designed to help women (and their partners) to engage in their pregnancies and parenting in particular ways.

The assemblage of devices specific to pregnancy and motherhood provide a range of detailed techniques to monitor, manage and assess the body and therefore play a role in the ongoing project of motherhood. Women are encouraged to engage with a variety of maternal devices as a way of generating and/or practicing technologies of the self, and smartphones and smartphone apps are one specific genre of these devices. Other maternal devices include: dietary charts, exercise regimes, calculators for pregnancy weight gain, charts for foetal movements, blood sugar level testing and breastfeeding charts. These “maternal devices” prompt the user in particular ways, making suggestions and connections and encouraging them to invest in, make sense of and act upon particular principles. These devices produce

³ The term “devices” is adopted from Kane Race [30]. In his research on hydration practices, Race reappropriates Michel Callon and colleagues’ [31] use of the concept “market devices” in order to consider how certain online functions, including self-assessment tools, act as calculative devices. These devices are connected to technologies of the self already implicated in biocitizenship.

a reflexive subject concerned with health and lifestyle and are geared towards practices of active health, lifestyle, self-assessment and self-education.

Digital health technologies (including apps) are a form of mediating technology which shape meaning and create new spaces for health and responsabilisation, and at the same time, reshape individual's understandings of norms and standards. Digital health technologies are largely consistent with preceding modes of neoliberal governmentality, but their most significant feature is that they extend these modes of responsabilisation into new spaces and practices and forms of calculation. By critically analysing a number of smartphone apps and social media sites, this article draws on and challenges Foucauldian theory on social relations and practices of the self. An analysis of these technologies poses questions as to how pregnant women and new mothers become particular ethical subjects, because as Brown and Webster [32] (p. 7) argue "technologies are always socio-technologies". By assessing the kind of work these devices could encourage and the multiplicity of ways women could potentially engage with them, one is able to consider a wider range of the different approaches to embodying and negotiating the moral injunctions and forms of advice women encounter in the transition to first-time motherhood.

5. Background and Methods

The interview data used in this article was collected as part of a qualitative study on the changing nature of pregnancy and mothering practices in the context of new media, and how technologies may be enabling new spaces for experiential learning and health responsabilisation. This empirical research formed the basis of my PhD entitled "On a Tightrope? Technologies of Motherhood in Neoliberal Society". This project received ethics approval from both the University of Sydney and the Royal Prince Alfred Hospital (RPAH) in December, 2011 (Protocol No X11-0334 & HREC/11/RPAH/526).⁴

The use of smartphones and apps emerged as a theme of interest late in this research project. The constant mention of various apps by the participants prompted me to examine a number of key pregnancy and parenting apps in terms of the discourses they mobilise and their functionality. This examination is the focus of this article. I was also able to draw on the characterisations from participants in attempting to understand the affordances of apps and the role they may play during both pregnancy and new motherhood. These characterisations are central to my analysis and interpretation of these technologies and devices.⁵ Although the interview data collected on the themes of digital health technologies and social media was not exhaustive, I argue that it is important in providing a new methodological approach to research in this area. As the theme of this special issue is the development of critical approaches to digital health technologies I argue that this qualitative research offers a new approach. Rather than focusing on the devices or technologies themselves, the focus is on how it is that people interact with these devices and create new relationships, practices of gathering information and

⁴ The interviews occurred during January and September, 2012. Ten of the twelve participants were interviewed twice: once during the third trimester of their pregnancy and again when their babies were 3-7 months of age. The majority (20 of 22) of the interviews took place in the participant's home, with the remaining two interviews occurring in a neutral public location chosen by the participant. In both cases, this was a private room on campus at the University of Sydney.

⁵ This development was particularly important in the context of my broader research aims which focused on understanding the different ways women negotiate the transition to first-time motherhood.

accessing information as a result of these interactions. Therefore, rather than offering detailed insight into my specific participants' use of smartphones and apps, this article provides an analysis of several significant convergences in software, technologies and practices of the self. The significance of this analysis is that it provides a platform for further research (including more detailed empirical research) in this area.

In this article I analyse smartphone apps and social media sites using a discourse analysis approach. Two theorists using a Foucauldian model of discourse who have strongly influenced my approach to discourse analysis are Deborah Lupton [33,34] and Jane Sunderland [35]. Both of these theorists have applied critical discourse analysis to extensive fields including public health and parenting literature. Their applied use of Foucauldian theories have provided analytical approaches focusing on interpreting the relationships between social knowledge, discourse, power and existing institutional dominance.

It is important to analyse smartphone apps and use of social media sites as forms of discourse, as “different ways of structuring knowledge and social practice”, or “seeing” the world [36] (p. 3). But more than simply providing new ways of “seeing”, these devices also prompt and concretise specific ways of acting, at the same time, shaping and organising the gendered discourses of parenting and mothering in particular. For an increasing number of people, apps and social media have been integrated into daily life which we can view as an extension, and digitalisation, of the expert patient role, shaping the everyday management of illness and health and social processes associated with them. Apps and social media, through their broad range of language and utility, influence gendered identities and relations, suggesting a particular representation of mothering (and fathering). This article will examine how certain apps reference, implicitly or explicitly, ideologies related to pregnancy and mothering, such as “intensive” mothering and “helicopter” mothering, and the expert patient ideal.

6. Pregnancy: Is There An App for That?

Many apps for pregnancy (and mothering) are temporally tailored, meaning that the app is calibrating the pregnancy in terms of “stages” and “time” and encouraging the user to connect with her pregnancy as an exercise in foetal development. Temporally tailored apps often also include a notification function which sends regular (usually daily or weekly) updates to the user. Many pregnancy-specific websites also send regular temporally tailored updates via email and these emails function in a similar way. This adds a new level of awareness to pregnancy where the updates are “pushed” to the user rather than the user seeking this information out. The updates can include a variety of information but will usually include details on foetal development as well as what the pregnant woman should expect that week. They can also include pieces of advice for the mother such as foods to avoid and exercises to engage in, possibly invoking behavioural change as a result. The *Dr Miriam Stoppard Pregnancy* [37] app includes weekly reminders for the user to watch video content which includes Dr Stoppard giving them “personalised” advice for each week of their pregnancy, and to record notes on their experiences and to update the “Bump Tracker”, a feature which allows women to use their smartphone to create a gallery of images of their growing “bump”. From this perspective, the pregnant woman is made to be constantly aware of her pregnancy and from the first signs of pregnancy, to interactively engage with her body and her foetus as an exercise in both health management and bonding.

Apps are marketed as convenient because they allow access to information anytime, anywhere, but they are also imposing, pushing information to women at regular intervals that they may otherwise avoid or fail to seek out of their own accord. In this sense, apps are not simply temporally tailored but involved in the organisation of women's temporality through the mechanism of the push notification. Therefore these devices create a new form of awareness and responsabilisation: "push responsabilisation".

Many women access temporally tailored emails or apps for the supposed convenience of regular updates. Therefore, not only is content important, but the accessibility and portability of these apps can be viewed by users as essential for today's busy lifestyles. These sentiments were echoed by the women interviewed in my study. When asked about emails or apps they receive or use, their descriptions focused not just on the content, but the portability, accessibility and integration into a busy lifestyle:

Emily, 37 (prenatal interview): "I would kind of flick through, say something, he'd [her husband] be interested, grab it, read it, put it down. But I think they're the kind of, like app things are good, 'cause you can update them little things and try and talk about them...little bits of information at the right time".

As this quote indicates, apps also appeal to individuals in regards to the digestibility of information they contain—rather than searching through an entire chapter or pamphlet or website, apps provide tidbits of information for pregnant women, mothers, and partners. Apps and email updates allow for what I characterise here as a convenient and accessible "tidbitisation"⁶ of information, as the following quotes indicate:

Simone, 32 (prenatal interview): "so every week I receive a follow-up of where the baby is at in the womb and maybe what's going on with the pregnancy...that was really helpful, 'cause just a few hints, like a small newsletter, not too long to read, just enough".

Emily, 37 (prenatal interview): "I mean, it's [the regular app update] very brief, basic. But no, no it's been good. Lots of little tidbits along the way as opposed to you sit down and read a chapter [laughs]. So, which is kind of good."

Diana, 29 (prenatal interview): "I've had...weekly email updates and that sort of thing, um, so little tidbits of information as I go, just about how the baby's going and things that I might want to aware of...they're good because they're just little bits of information...they're not too much, and there's usually not enough to freak you out or be confusing or anything".

Smartphone apps and social media such as Facebook and Twitter offer mums, particularly new mums, also offer a novel form of socialisation or communication whilst staying inside the home, even whilst multitasking, as Jenny states in the following quote:

Jenny, 41 (postnatal interview): "And, actually something else that's probably, possibly revolutionised um breastfeeding and mothering is the I-phone...I can be here for a long time sometimes [feeding the baby], which is why the I-phone can be useful, for emails or looking at the Facebook or the Twitter".

⁶ This word is taken from the interview participants' use of the word tidbits (as used by Emily and Diana, above) and other similar characterisations of information as small and accessible by other participants.

Other mums in my study also spoke of the convenience of their smartphone and many used Facebook and emails on their phones regularly in order to check for events related to their mothers' groups or to ask questions about their baby. So for new mums the smartphone offers an extension of their social life and allows them to continue communicating with friends, even whilst being housebound or involved in domestic tasks specifically related to mothering.

Therefore smartphones and apps are "revolutionising" the experience of pregnant women and new mothers, as they claim to generate convenience, connectivity, flexibility, efficiency and the tidbitisation of information. These apps are often sold as tools of convenience although this "convenience" at times involves greater work and expectations than the alternative (discussed in more detail later). In addition, women may view new technologies like apps as empowering in that they offer women new feelings of control over their bodies and give them a particular knowledge of their pregnancies and the behaviour of their baby/babies or children; although having more knowledge could also equate to engaging in a greater deal of physical labour and "emotional work" during pregnancy and motherhood [38]. Because the female body has traditionally been seen as leaky, uncontrollable, open and permeable, new technologies appear to allow women to attempt to reassert control via diet, exercise or the gathering of information.

7. Apps and Social Media

Facebook is a high-traffic social media platform which can be accessed on smartphones via the Facebook app or the Facebook mobile site. There are many uses for Facebook, including social connection, joining shared interest groups, virtual people watching and social surveillance [4]. Facebook therefore offers a variety of social networking options and potential for the maintenance and formation of social capital for both pregnant women and new mums [39]. The social support networks parents access have therefore expanded to include online communities such as social networking sites. Declaring one's pregnancy online could enable women to connect with other expecting mums, bonding and sharing in experiences, leading some social work researchers to argue the social value of social media. For example, Bartholomew *et al.* argue: "Facebook serves an important function in the acquisition of social capital and social support resources, which are beneficial at the transition to parenthood" [1] (p. 464). Facebook may also serve as a site through which individuals seek to validate their identification as parents. In this sense, Facebook provides a new form of comparison of social and cultural expectations surrounding pregnancy and motherhood. The calculability of "likeability" on social media forums like Facebook has the potential to transform online "performances" of mothering into specific forms of social competition.

Devices and social media such as Facebook also have the potential to transfer the pregnant woman or mother's virtual identity onto her baby. In this sense, the virtual identity of the baby works to simultaneously deflect attention from the mother (as she hides behind the scenes like a puppeteer) and projects the mother's work (of being a good mother) and worth (measured through her baby), rendering these visible. This presents a digital performance of what I call the "puppeteering mother". In wanting to project her baby, instead of herself, she also encapsulates "being-for-intimate-others" where this projected version of self-centeredness or self-worth, of presenting the baby as "my measure" reconfigures neoliberal self-centeredness to include the projected "other". By representing

their baby though digital platforms mothers are able to accrue self-worth that might otherwise be difficult to attain or is normally accrued through other social forums. In particular, the “likeability” feature makes these digital projections so interesting because self-worth is rendered calculable.

Facebook may be one of the social communities in which women and their partners first announce their pregnancy⁷ and where they may share ultrasound images, their experiences during pregnancy such as dietary and fitness dilemmas, as well as their excitement at the impending arrival of their baby. In this way, babies (or foetuses) have an “online birth” prior to their physical birth. This online presence may continue as the child’s birth is announced on Facebook, along with other key milestones. As social media gains more importance in people’s everyday lives they are increasingly likely to announce life events online, in the process altering the dynamics of social relations.

Rose and Novas [29] (p. 440) describe new forms of citizenship in collectives organised around specific medical conditions and/or knowledge as “informational bio-citizenship” and the new electronically networked individuals who are linked to such communities as “digital bio-citizens”. Deborah Lupton goes one step further in describing “the digitally engaged patient” [40] (p. 256) who embodies digital health technologies to engage in self-care and self-monitoring. I argue that social media creates a whole new set of relationships for the “digitally engaged” maternal subject which involve the publicising of foetal and child development via a so-called “friendly” spectacle. This publicising enables others—a public of virtual friends and acquaintances—to become directly implicated in what was previously a very personal sphere of intimacy. This new spectacle is also interactive and allows others to engage with the online foetus by commenting, liking or sharing images or statements. This suggests a new way of quantifying or measuring social status.

Using the ultrasound image in such a way provides a social rather than medical way to view the insides of women’s bodies as well as the foetus/baby. This new social ritual also reinforces foetal individuality and personhood in a very visible and public way. This not only occurs via the ultrasound image, but also via regular profile updates and comments. The foetus has developed its own digital social identity and status before it is even born—some new parents even create Facebook profiles for their new babies—and a digital footprint of pregnancy and mothering is also created.

One software designer has taken advantage of this new trend by creating an app which allows the user to do more than just post an ultrasound image. *Pimp My Ultrasound* allows users to “have fun” with ultrasound images: “you can have several months of entertainment and create everlasting memories” [41]. The app enables you to add text bubbles, headgear including tiaras, bows, baseball cap or football helmets, accessories including a credit card, microphone, guitar or martini glass and picture frames. In this way, the app allows the user to pick and choose certain item in order to give the foetus a gender and/or personality.

The app is purported to provide harmless fun for parents-to-be but could also play a role in early social shaping, particularly gender shaping as many of the accessories are gender stereotyped. “Playing” with the ultrasound image is performative as it encourages a particular type of bonding and attachment with the foetus. It makes the foetus “real”. It sexes the foetus. The foetus is no longer an abstraction, but a baby with an imagined personality. “Babyhood” is created when the image is

⁷ The list of profile options on Facebook now even include “Expected: Child” and the unborn baby can also be given a name in this profile.

“baby-ised” into a dancing, sleeping, sporty or thumb-sucking individual. Technology and the human imagination combine to form the “cyborg foetus” [20,28]. In the following quote, Jenny discusses how her baby’s personality develops in her imagination after the sexing ultrasound:

Jenny, 41 (prenatal interview): “finding out that she was a girl probably changes things dramatically...because then she starts to take on a personality in your own mind...first of all there’s those flutters and it’s just really exciting because it’s like more reinforcement...that it’s there and happening. And then when your, your belly’s big enough to start to see rippling and you start to give it, the baby, more of a type. Like active or whatever”.

Ultrasound images function as a form of “mediated realism” and the foetus is imagined into action—playing a guitar, giggling, thinking or resting. In addition, by “playing with” ultrasound images through apps like *Pimp My Ultrasound* particular gendered expectations for the mother and father, as well as gendered performances from the baby boy and/or baby girl are articulated [42]. This is part of the “fetishization” of the foetus, as Petchesky states: “Indeed, the very idea of “bonding” based on a photographic image implies a fetish: the investment of erotic feelings in a fantasy” [43] (p. 277). This fetishising of the foetus works to create both baby and mother. In a press release for an Australian 3D/4D ultrasound company, it is also suggested that the bonding experience of a 3D ultrasound helps to responsabilise women to care for themselves during pregnancy: “He [owner, Ray Jordan] adds that studies have shown that after using 3D ultrasound mothers took better care of themselves” [44]. It would not be unreasonable to suggest that apps like *Pimp My Ultrasound* may also help to responsabilise women by encouraging them to bond with their foetus, assign a gender, and create a “social identity” for them. Other apps also “baby-ise” via real-life images of foetuses attached to detailed descriptions of current foetal development. These apps are now part of the (bio)technological environment which constructs the contemporary foetal identity and meanings surrounding it.

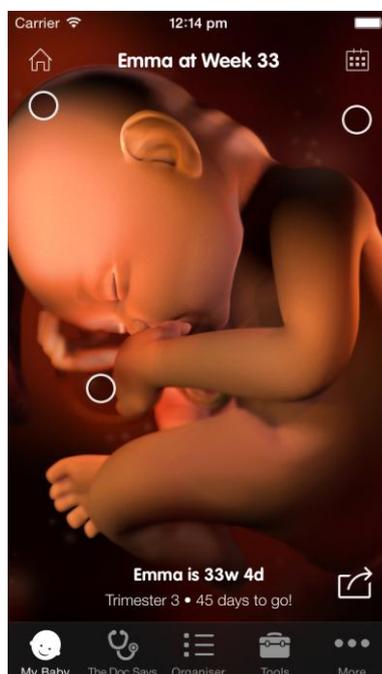
8. Sprout Pregnancy

Pregnancy Sprout Lite [45] is temporally tailored and encourages users to track their baby’s progress. This app allows social media interaction where users can share progress on Facebook and “Email notes and development information”. It is both strange and fascinating that *Sprout* enables the user to upload 3D images of what her foetus would look like at various stages of her pregnancy, complete with a personalised name (see Figure 1, below). Miriam Stoppard’s app [37] has a similar feature which allows the user to view the foetus’ development throughout the pregnancy, but it goes one step further by allowing the user to imagine what it is like to be the foetus in her womb. The user can record sound clips and play them back with distortion to imitate the sound of her voice to the baby in the womb. It also allows the user to take photographs which are distorted according to how the baby would view the image through their developing eyes. In this way, the foetus is not only personalised, but the mother is encouraged to embody the foetus from a sensory perspective.

The user of the *Sprout* app can also share her baby’s kicks on Facebook and later, she can post contraction information during her labour. These features “baby-ise” the foetus and the social media connectivity gives the *Sprout* app a new layer of meaning by socialising the unborn baby and its activities, allowing other Facebook users to characterise the unborn baby, “like” the images and/or

follow its progress before it is even born. This means that the app functions to extend the pregnancy experience beyond the pregnant subject making the pregnancy a more social event, just as 3D/4D ultrasounds and the *Pimp My Ultrasound* app do.

Figure 1. Screenshot from *Sprout* app which reveals a very humanised image of a foetus who appears to be sleeping and sucking its thumb. Despite not being born yet, the foetus has already been named Emma. Source: Med ART Studios (with permission to use image).



The *Sprout* app also includes a “Doctor Visit Planner” which encourages the user to take up the role of the expert patient with functions such as “Create a list of questions for your doctor” and “Record your doctor’s answers” [45]. The “Doctor Says” section encourages healthy behaviour via different recommendations which relate to diet, exercise, symptoms and concerns. Miriam Stoppard’s app [37] also provides information on “Looking after your body and mind” and detailed information on diet which is presented as primarily for the sake of the baby, rather than the mother. This section of the app is entitled: “Eating for my baby” and presents healthiness as central to “being-for-intimate-others”. By connecting the app’s functions to medical authority and expertise meaningful connections are made between medicine and the organisation of the body. Ettorre [7] (p. 246) developed the term “reproductive asceticism” to represent the ways in which pregnant women are expected to manage, monitor and control their bodies for the sake of the foetus. I argue that comprehensive pregnancy apps like this one represent a digitalised organisation of reproductive asceticism.

Encouragement to perform the expert patient role and ideal, healthy citizen is also invoked via *Sprout*’s Kick counter to record baby’s kicks, the Contraction timer to reliably record contractions, and the weight tracker which ensures regular recording and tracking of weight gain during pregnancy. Each of these features increase awareness of the pregnancy, make the app performative and also allow the app to extend beyond the pregnant subject, to function as an extension of the available spaces for health responsabilisation and recording of relevant data, playing a role in the development of maternity as an exercise in data management.

9. Baby Connect

As I have argued, apps are a mechanism with which individuals can pursue the “will to health” [46] as they offer possibilities of improving, reshaping, enhancing and optimising pregnancy and motherhood. During my research I found that some women approach pregnancy and motherhood as a project. If such is the case, this new range of tools and devices offers them new ways to professionally and technically adapt to such a project. The significance of these technologies lies in their extra level of functionality where they become tools which women engage with in order to enact or embody the “good” mother, the “yummy mummy” [47] or ideologies of mothering such as intensive mothering [17]. Devices such as smartphone apps offer mothers a new way to implement different forms of parenting, expertise and self-discipline. smartphone apps provide a new form of expertise which allows mothers to delegate mundane “administrative” tasks or to calculate specific practices, then carry them out, and in some cases, track or record these practices. I argue these changes are turning motherhood into an administrative and self-calculable activity.

Baby Connect [48] is an extremely comprehensive activity tracking app for mothers which includes trending charts, graphical reports, medicine and vaccine timers and notifications, weekly averages, file export capabilities and unlimited data allowances. This “data” can include information on feeding, diapers, sleeping, breastmilk pumping, temperature, games played, mood, pictures and even GPS locations (see Figure 2). This data can also be formatted and emailed as reports to spouses, nannies or doctors, or it can be used to compare with previous daily or weekly averages in order to identify trends. The app is accessible anywhere there is an internet connection, via the online account which is able to synchronise data from multiple devices.

Figure 2. Screenshot from *Baby Connect* app indicating various facts about baby Adrien, including his age, when he last nursed, the status of his last nappy, the length of his last sleep and his mood: “Adrien is Happy”. Any of these features could be posted on Facebook or sent to other synchronised devices. Source: Seacloud Software (with permission to use image).



Baby Connect is marketed as both a tool of convenience and as a way for working mums to feel connected and up-to-date with their children's activities, health and development, allowing "you to exchange information in real time with your spouse, babysitter, nanny or daycare wherever they are" [48]. This can even include alerts when specific behaviours or data are recorded. As noted above, the recording of data and reminder capabilities create another way for mothers who view child raising as a "project" to engage in a professionalised entrepreneurial engagement with motherhood where they can expertly keep track of their children according to data sets, and even if they are delegating particular tasks to other carers, they remain in control of what is recorded, what is concerning (alerts) and what particular activities the child engages in.

Writing about *Baby Connect* in *The Atlantic*, Mya Frazier claims that the app's greatest innovation: "has been in charting and analyzing children's data, in the process making parenthood a more quantifiable, science-based endeavour" [49] (p. 28). This is a fascinating throwback to G. Stanley Hall's concept of "scientific" mothering. As part of Hall's Child Study movement, mothers were encouraged to study their children, take notes on their behaviour, and compare observations with other mothers thus serving as providers of data for the experts [50]. The introduction of baby-tracking apps allows the resurfacing of "scientific" mothering where mothers are able to gather data in order to better track and understand their child's development, and even share this with other mothers or medical staff.

The use of particular devices and techniques for collecting data, rather than relying on the "subjective" accounts or competence of the mother, privileges "objective" scientifically recorded data in the care or management of children in a time when biocitizenship is becoming increasingly implicated with new medical technologies [51,52]. In line with discussions of "cyborg-ification"—where the distinction between human and machine is increasingly blurred—I argue that apps form a digital proxy for subjective medical accounts. This suggests subjective accounts have been replaced by objective medical calculations via devices, producing a new form of calculability. This instrumentalises the body in a particular way according to a particular set of measurement devices and calculations.

In her article, Frazier interviews one mother who consistently uses *Baby Connect*, arguing that the app allows parents "to debug your baby for problems" [49] (p. 28). Again this references the metaphor of human as machine and the concept of the cyborg. As Brown and Webster argue, this mother's management of her son via his data set is part of today's modern reflexive project:

Today, maintaining the body is a problem of technological apprehension or capture requiring the production of new systems for codification, storage, accessibility and distribution. The object of maintenance and care then is no longer simply the individual body, but representations or traces of the body in globalized systems of information and data management. [32] (pp. 80–81).

Just as Brown and Webster suggest, it is not enough to simply rely on your own (or your child's) digital data sets, it is useful to view these data sets in a specific context. Soon this will be possible as forthcoming versions of the app will enable parents to compare with other children in more detail, offering a new digitalised way of posing the question "Is my child normal"?

The dictates of the expert patient ideal suggest that patients must have expert knowledge of their health and, for mothers, this includes knowledge of their child's health and development status. It would therefore not be surprising if mothers choose to use apps like *Baby Connect* as part of their

“performance” of both good mothering and the expert patient ideal. In particular, as noted above, the connection of these apps to social media allows mothers to share a digital performance of their mothering. Whether this performance could take on a competitive character remains a question for further research.

Another conceivable use for such tracking apps is their integration into childcare centres as a way of providing a digital version of a “day book” which many centres already provide for parents. This could include information on what was eaten, if there were any illnesses, complaints or concerns. The features of *Baby Connect* suggest it could support a variant of “helicopter parenting”, which is defined as controlling and over-involved parenting [53,54]. In the case of apps such as *Baby Connect*, the over-involvement in children’s activities could be viewed as an “off-site” version of helicopter parenting, where the “hovering” is performed digitally.

Miller and Rose argue the mobilisation of discourse does not occur through manipulation or domination, but by “forming connections between human passions, hopes, and anxieties, and very specific features of goods” [55] (p. 144). As the above discussion indicates, these hopes and aspirations influence concerns over childhood health and development leading to the creation of apps like *Baby Connect*. In addition, a new category of toys, games and software has recently emerged which focuses on infant development, targeting aspiring middle-class parents. The discourse of “infant brain science” has meant that gendered toys are often rejected in favour of “educational toys” fostering imagination, creativity, social skills and education [56]. Infant brain science focuses on the critical learning period of infant to three years of age [57]. Apps like *Baby Connect* can act to reassure parents that their children are being adequately stimulated whilst in the care of others. In addition, there are apps that focus specifically on intellectual stimulation for infants, drawing on the discourse of Infant Brain Science, such as *Baby Guide First Year* [58] and the *Baby Brain Development Guide* [59] which are both temporally tailored towards a normative framework of developmental cues and expectations. These apps could ease parental anxiety over their inability to supply constant intellectual stimulation as they provide games, visual items and tasks, but their temporally tailored format could in turn raise concerns over speed of development if a child were to fall behind the “normal” timeframes. These apps and the discourse of “infant brain science” encourage a specifically classed version of “professionalised mothering” aimed at increasing childhood intelligence and accomplishment according to neuroscientific principles [39].

10. Ebluebook

The Australian state of New South Wales’s (NSW) Ministry of Health have digitalised the “Blue Book” which is a folder of information that mothers are given during pregnancy in order to record information about their prenatal visits, the health of the baby in utero and the development and health of the baby postnatally. This *ebluebook* app is personalised and temporally tailored and includes a version of *Save the Date* (another NSW Ministry of Health app) with reminders for immunisations, health checks, growth charts and information on development.

The app claims to give parents easy and convenient access to their child’s health records no matter where they are. The deployment of discourses of convenience and mobility produces new expectations that parents regularly update the book and, as “mobile” subjects, always be able to monitor and access their child’s health history. Because child health is “put back in the hands of the consumer” [60] (pp. 5–6)

convenience and mobility are tied to empowerment, but also to responsibility. The app serves to responsabilise parents for their children's health monitoring and developmental requirements and if parents do choose to share the *ebluebook* data with their health care provider it allows that provider to discipline parents who have missed developmental health checks such as immunisations. Therefore this device can work as a tool for surveillance and discipline as well as convenience.

The *ebluebook* app also encourages parents as consumer-citizens to develop specific scientific and medical understandings of their children's growth and development, what Rose and Novas [29] would term "informational citizenship". This biomedical literacy encourages particular behaviours and monitoring such as the regular measuring of height and weight in order to compare to norms or averages, and promotes alignment with government regulations for immunisations. These outcomes align in order to emphasise the dual role of the mother as both a good citizen and an expert proxy patient for her child/children.

Brown and Webster argue that electronic patient records maintain the body "both as an individual physical entity and as an abstract informational artefact" [32] (p. 81). Therefore the *ebluebook* could be seen as a new mobilisation of the body, another digital artifact just like the digitalised identity of the foetus and child on social media [52]. The implication of a digital identity means we now also measure ourselves (and our intimate others) according to digitalised health data and our social media presence, which also creates a measurable version of our "likeability".

11. Pregnancy Apps for Men?

There are far fewer apps related to pregnancy (and parenting) for men than for women and it is important to note that these apps are marketed in a very similar way to pregnancy books for men, focusing on humour and tidbitisation of information [61,62]. They also tend to be significantly gender stereotyped and somewhat patronising. For example, *mPregnancy—for men with pregnant women* includes:

great illustrations of how the baby develops and describes the size in terms that men understand e.g., similar to the size of a football, or a bottle of beer [63].

The app appeals to traditionally masculine-gendered activities such as providing information on how to prepare a nursery, and dealing with finances and insurance. There are no pregnancy apps on the market (that I have found) that provide this kind of information for women, even though many women would undertake these tasks regardless of whether or not they have a male partner and could find the inclusion of such information quite useful.

The app *Pregnant Dad* shares some features with *mPregnancy* including being marketed humorously as an app for "surviving pregnancy as a father-to-be" [64]. *New Dad—Pregnancy for Dads* app also appeals in this way with: "insightful and humorous descriptions" [65]. Just like many pregnancy texts for men, pregnancy apps deploy humour in an attempt to tone down the serious nature of the information, whilst also simplifying it; men are seen as the "bumbling assistants" [62]. In contrast, guidebooks and apps for women are often directly marketed as serious expert guides for the responsabilised expectant woman, albeit with the odd exception [66]. The *Pregnant Dad* app again specifies the digestibility of information: "Sliced in 2–3 bits per week it has the right amount of

information for us men to follow” [64] and another, *New Dad* emphasises this tidbitisation of information: “Surprise your wife with tidbits of information about the development of your baby” [65].

The *New Dad* app also focuses on the woman’s experience, emphasising the importance of keeping her “comfortable and happy” and even includes a “‘keep your wife happy’ widget” [65]. These kinds of inclusions remind us of the traditional man/woman split of rationality *versus* emotionality. Men, who are more rational, need to be given information on how to keep their emotional wives happy! The features of these apps for men suggest a particular role for men during pregnancy, one which is “backgrounded”, as Sunderland argues in relation to parenting magazines [62,67]. A male partner’s role in pregnancy and parenting is still discussed, or in the case of apps “designed”, in a somewhat condescending or patronising manner. Men are constructed as being barely capable of their “supporting role” and need all the help they can muster, including humorous, simplified tidbits of information, and reminders about what being a good partner (and good dad) involves. Together, these features render fathering an issue of “keeping up appearances” for the female partner, rather than any serious attempt at engaging in the careful work of parenting. This is merely “surface” work which suggests what men are supposed to be doing (impressing mum) and prompts them, with the aid of a push notification, to do exactly that!

These features are reminiscent of the nature of many support resources for men with pregnant partners, suggesting that although parenting and fathering appear to be “changing” in terms of policy and sociocultural practices and expectations (including more involved dads and more dads as primary carers), the mechanisms and devices to support these changes, such as apps, are lagging behind. In their book “Constructing Fatherhood”, Lupton & Barclay argue that whilst women are encouraged to seek advice and information on pregnancy and mothering, these continue to be seen as essential components of femininity:

not as split from womanhood as fatherhood may sometimes be split from manhood. Men and women, therefore, are negotiating parenting arrangements in a context in which it is still considered that the mother is more important to her child’s welfare than the father and “instinctively” possess a greater capacity for nurturance [61] (p. 147).

This perspective is noticeable in the ways in which these apps for men target specific masculinised behaviours (such as preparing a nursery and dealing with finances) separately from parenting behaviours, and also play on the belief that men have no innate knowledge or intuition when it comes to being a parent and nurturing a child. As this article has demonstrated, apps marketed for maternal subjects are designed instead, to target responsabilisation or what I call “being-for-intimate-others”.

12. Conclusions

A range of research has considered the collection of resources drawn upon during the transition to motherhood, which include self-help books, magazines, friends and relatives and the internet. Smartphones and apps, along with other forms of digital health technology, must now be incorporated with these other resources and are deserving of further research. As this article suggests, smartphone apps and social media sites may represent a particular way for women to engage with the neoliberal project of responsabilisation. The health-conscious pregnant or maternal subject is now likely to view

apps and social media sites as a means to improve and monitor their pregnancies, health and their children's development and health. From this perspective, apps in particular are claimed to be empowering technologies which enable women to take control of their experiences and whilst doing so, this enables them to more efficiently enact the expert patient role. This in turn works as a display of competence as a good mother, or mother-to-be. These apps also work to represent the unborn as already a baby (or child) which has implications for pregnant women. These women are not simply acting for the self but also for the unborn "other", referred herein as "being-for-intimate-others".

I argue that devices such as apps and social media platforms that discuss pregnancy and parenting may be appealing because, when mothering is so intensive (as Hays [17] suggests), these technologies allow for the possibility of delegating responsibility for certain calculations, reminders and tasks. This supposedly makes mothering easier because there is no need to remind oneself if it is possible to rely on the push notification or "push responsabilisation" as I have characterised it. But this pushiness is not necessarily always convenient and rather than being a pleasant reminder, could develop into a rude intrusion. Nevertheless these devices are becoming more common and certainly offer us a way to conceptualise different ways of pulling back from intensive mothering in order to be a more "relaxed" mother. Some apps and social media platforms also allow women to share experiences with each other which can be supportive and comforting.

Apps are representative of something uniquely distinctive about the way we order, engage with and reshape our bodies and biology today. They are reflective of a wider set of cultural and social changes in the understanding of our identity, our "lifestyle" and our body. Apps format motherhood and pregnancy in a new way, instituting new rules into new devices and offering templates which actively shape meanings and practices. Apps also represent a "tidbitisation" of information which is delivered directly into the user's intimate sphere, no matter where they are. This "device-ification" of mothering purports to turn it into an administrative and calculable activity, valuing data over subjective experiences and changing the meaning of what it is to mother and be a mother. Apps and social media platforms that facilitate the portrayal of the unborn and the sharing of pregnancy and parenting experiences are also representative of the contemporary intersection between social media, medical advice, expectations of self-management and notions of convenience. They create new social relations and valuing practices, such as "likeability" on Facebook, which have the potential to alter our understandings of health and identity.

Future research should consider the multiplicity of women's engagement with these apps across the transition to first-time motherhood and for parents attempting to manage child health. It would also be useful to conduct more research on the possible inconvenience of apps. Clearly the "pushiness" of push responsabilisation would not always be convenient and could develop as an intrusion into people's daily routines. It would be productive to direct focus onto the lived experiences associated with apps rather than lauding or criticising the content of apps. Further questions to consider in an empirical study include: Who adopts these apps and why? Who rejects these apps and why? Are push notifications ignored, considered obtrusive or do they prompt specific practices or actions? How are apps and social media sites used by pregnant women and first-time parents? How do apps and social media sites maintain, reproduce or challenge pre-existing gender inequalities in parenting?

Acknowledgments

I am grateful to my supervisor, Kane Race, whose advice on this area of my research was always insightful and productive.

Conflicts of Interest

The author declares no conflict of interest.

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