

**Addressing the burden of perinatal depression
in New Zealand through innovative mobile
health (mHealth) solutions**

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Introduction

Depression during or after pregnancy, known as *perinatal depression*, is widespread in New Zealand; and the consequences are significant. Postnatal depression is the most common postpartum mental disorder, and recent findings suggest antenatal depression is even more common. Suicide is the leading cause of perinatal death in New Zealand (Perinatal and Maternal Mortality Review Committee (PMMRC) report, 2017).

Early identification and treatment of perinatal depression is intuitive and important. It leads to better outcomes for women and their children and whānau, and is more cost-effective than picking up the pieces later on.

This report focuses on the role of mobile health (mHealth) technology, such as mobile phones, tablets and applications ('apps'), to better detect perinatal depression and to deliver prevention interventions, follow-up, treatment and support.

This report has been funded through a Winston Churchill Memorial Trust 2018 Fellowship. It has been informed by my review of the literature and interviews with key personal in New Zealand and the United States (US). In April 2018 I met with researchers at the University of Washington in Seattle and the University of Illinois at Chicago. The former has a strong focus on technology in the field of mental health, and the latter makes screening efficiency a priority following a state mandate in 2008 for health care providers to screen all women for depressive symptoms during pregnancy and postnatally. See the *Acknowledgements* section for a full list of the people I met and spoke with.

Firstly, I discuss developments in electronic screening tools to detect perinatal depression symptoms. More accurate and comprehensive electronic screening tools could reduce the number of false positive cases (i.e., women who do not meet the criteria for a depression diagnosis) and thus the costs of managing false cases. I also look at the integration of tablet and mobile phone-administered screening within health care settings, which offer an efficient and convenient way to evaluate for mental health problems. I spoke with researchers at the University of Illinois at Chicago and visited an OB/GYN clinic where tablet-administered screening is being offered as part of a mental health research program.

Secondly, I explore how a remote screening process could work in New Zealand so that appropriately trained and resourced professionals can remotely contact and support pregnant women and new mothers with depression, such as through a perinatal counselling service. This may help to circumvent many of the barriers that midwives face with respect to mental health screening.

Third, I look at a mood-tracking and alert app that is aimed to better support women experiencing depressive symptoms by helping providers to respond quickly and effectively with support and referrals to mental health services, which was piloted in the US. I spoke with Dr Ian Bennett at the University of Washington in Seattle about the implementation of this app, and how it could apply to other health systems.

Finally, I discuss the use of mHealth technology in the prevention and treatment of perinatal depression. Treatment inadequacy could, in part, be better supported through online services and mobile apps that provide timely, on-demand and anonymous therapy and support. This is a new and potentially promising area, but it might not work for everyone.

This report's recommendations identify research priorities, and propose using participatory design techniques to work with women and health professionals as the first step to testing these innovations in the New Zealand context. Participatory methodologies can help identify and address barriers in the development of new technological interventions, and improve the user-centeredness of an intervention (Gordon, Henderson & Holmes et al, 2016).

I also advocate for a clear strategy on the development of mHealth in New Zealand. Technological solutions in health care will likely become more commonplace in the future, and the upscaling of such projects must be evidence-based and well implemented. Lessons need to be learned from the failed delivery of a virtual health app at Waikato District Health Board¹, which revealed the need for e-health tools to be delivered with a clear implementation plan, buy-in from providers and patients, and that the technology must be a good fit for the existing procedures and IT infrastructure.

mHealth is just one solution to better detect and treat perinatal depression; and clearly there are many wider systematic and societal issues that need to be addressed. The Government's Inquiry into Mental Health and Addiction has started a conversation about the state of New Zealand's mental health system, and there is a growing public expectation that the service gaps and barriers for women with perinatal depression must be overcome.

¹ SmartHealth review finds failed virtual health app costs taxpayers \$25.7m. New Zealand Herald, May 2018.
https://www.nzherald.co.nz/nz/news/article.cfm?c_id=1&objectid=12056920

Summary of recommendations

Government, health sector leaders, researchers and private enterprise should:

1. consider how best to strategically build evidence to inform the upscaling of mHealth services in New Zealand and to contribute to the international evidence-base for perinatal mental health
2. facilitate participatory workshops with women (from diverse backgrounds and with experience of perinatal depression) and health professionals to explore:
 - a. how tablet and mobile phone-administered mental health screening could be efficiently conducted during lead maternity carer (LMC) consultations
 - b. whether management of positive screens by a remote 'treatment team' is acceptable, feasible, and effective at supporting women with depressive symptoms
 - c. whether remote support for clinicians to better manage perinatal screening, referrals and support is acceptable, feasible, and effective
3. facilitate participatory workshops with women (from diverse backgrounds and with experience of perinatal depression) and health professionals to explore the feasibility and acceptability of a mood-tracking and alert app and clinician-facing platform, and a workable administration model
4. prioritise research that aims to better understand the acceptability of online treatments for perinatal women and their mobile literacy and phone use patterns and behaviours, particularly for non-European women
5. maintain a watching brief on evidence for online treatment and prevention for perinatal depression and the impact of promotional and education strategies to increase e-health uptake.

The case for intervention

Prevalence and impact of perinatal depression

Perinatal depression is an umbrella term that refers to depression during or after pregnancy, until one year postpartum (Ministry of Health, 2011). The *Growing Up in New Zealand* study recently reported postnatal depression rates of 8 percent, and that 11.6 percent of pregnant women are affected by depression, suggesting that depression symptoms are higher in pregnancy than in the first year following child birth. Women from non-European ethnicities in New Zealand are more likely to suffer from antenatal and postnatal depression, specifically Māori, Asian and Pacific Island peoples (Underwood, Waldie, D'Souza et al 2017; Waldie, Peterson, D'Souza et al, 2015).

Antenatal depression is associated with an increased risk of pre-term birth and low birthweight, medical complications such as preeclampsia, and is linked with delayed infant brain development (Gentile, 2017; Grote, Bridge, Gavin et al, 2010; & Waldie et al, 2015). Antenatal depression and anxiety are associated with inadequate nutrition and weight gain, increased alcohol consumption, substance use and smoking, and less frequent contact with the health system (Biaggi, Conroy, Pawlby et al, 2016). Antenatal depression is a known risk factor for postnatal depression (Underwood, Waldie, S'Souza et al, 2016).

If left untreated, postnatal depression can affect a woman's relationship and attachment with her baby, lead to negative parenting behaviours, and to suicidal thoughts and behaviour and consequent hospitalisation. In New Zealand suicide is the leading cause of maternal death. In 2015, there were 5 deaths from suicide among women that were pregnant or had a baby up to six weeks prior, out of 11 maternal deaths in total. From 2006–2014 the rate of maternal death from suicide was seven times higher in New Zealand than in the United Kingdom (PMMRC report, 2017). Māori women are over-represented in New Zealand's maternal mortality rate.

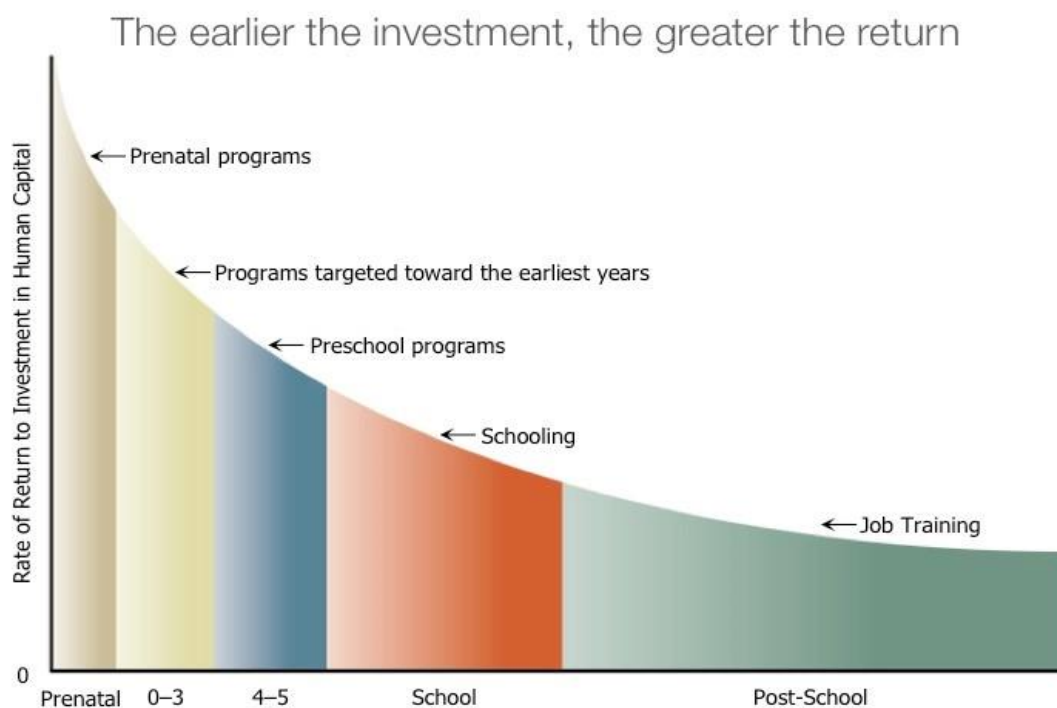
For the family and whānau, postnatal depression can mean a breakdown of the family unit, interrupted employment, relationship problems, and have an impact on the partner's mental health. Longitudinal studies have demonstrated that children of depressed parents are at risk of behavioural problems; cognitive, social and emotional developmental delays; and health effects (Ministry of Health, 2011; Weissman, 2018). These issues can be a precursor to school failure, unemployment and offending, and a long-term risk of depression and other mental illness in adulthood. Mental health problems in children may also be more severe when the mother's depression is persistent and moderate/severe (Campbell, Norris, Standfield et al, 2008; Weissman, 2018). There is also evidence that these effects may be transmitted inter-generationally to grandchildren (Weissman, 2018).

Early intervention

That we need to better address the burden of perinatal depression is a compelling argument. And we can do better. Perinatal depression is a treatable condition — with appropriate and timely intervention, more than 85 percent of women will respond to treatment (Campbell et al, 2008). Furthermore, pregnant women and new mothers have a high level of access to health services through their LMC and primary care services (e.g., immunisation visits) compared with other stages during their child-bearing years. This suggests that for most of these women there are multiple opportunities to identify and address mental health concerns.

Detecting and treating women earlier can reduce the duration and severity of perinatal depression. It means that fewer women are treated later in their illness when it is more severe, suggesting cost and resource savings for treatment. The physical impact that perinatal depression has on pregnancy and birth outcomes, and the wider personal and society impacts on women, and their children and whānau, are also considerably reduced (Campbell et al, 2008).

Early intervention leads to costs savings; and as the Heckman Curve demonstrates (see Figure 1), investment in the perinatal stage offers the greatest return. The cost savings from intervention for perinatal depression are likely to be significant. In the US, it is estimated that the two-generational annual economic cost of not treating one mother (and the costs associated with a child born to a depressed mother) with maternal depression is US\$22,647 (Diaz & Chase, 2010). In the UK it has been estimated that postnatal depression costs the region £8.1 billion per year (Bauer, Parsonage, Knapp et al, 2014).



Source: James Heckman, Nobel Laureate in Economics

Figure 1: The Heckman Curve (2017)

Current policies and services for perinatal mental health care

It is widely recognised that perinatal depression is inadequately detected and treated in New Zealand (New Zealand Guidelines Group, 2008; Rowland, Mcleod, & Froese-Burns, 2012)

There is no formal screening program for depression as part of standardised perinatal care in New Zealand, despite calls for this to be introduced.² In 2010, routine screening for postnatal depression was introduced under the Well Child Schedule, with the Patient Health Questionnaire (PHQ-3) administered postnatally at the 6-week and 3–4 month check (Ministry of Health, 2013). Other recommended practices by various bodies suggest that:

- practitioners should consider the use of the verbal 2–3 question screening tool for depression as part of routine assessment during a pregnant woman's first contact with primary care, her 'booking' visit and 6-week postnatal check (New Zealand Guidelines Group, 2008)
- lead maternity carers ask about current mental health, past mental health and family history of mental health problems at the booking visit (PMMRC, 2011)
- women with a history of serious mental illness should be referred to mental health services for monitoring and support during pregnancy, until three months postnatal (PMMRC, 2011).

However, there is no guarantee that women are receiving this basic screen or informal check for the presence of mental health concerns (Barber, 2009). A survey of 398 LMCs conducted from 2010–2011 found that a significant proportion of New Zealand's LMCs (26%) do not routinely ask about the mother's mental health, and only 60 percent identified a specific referral pathway if a woman is identified as having an existing mental health problem or being at high risk (PMMRC, 2011). A 2012/13 survey of 100 women reported that 34 percent said they were never assessed for depression by a health professional (Mothers Helpers, 2015). Furthermore, the Ministry of Health (2011) notes that perinatal depression is often not identified in Māori women in the community and are often not detected by primary health professionals. Taken together, this suggests a delay in the identification and diagnosis of depression, and that a proportion of women with perinatal depression are never identified.

Treatment of mental health problems once they are detected is an issue for New Zealand (Rowland et al, 2012). While most regions have mental health services for mothers and infants with acute mental health problems – or access to a shared service – the Ministry of Health notes that the development of these mental health services has been piecemeal and that no district health board (DHB) currently provides the full range of perinatal, infant mental health, and alcohol and other drug services (Ministry of Health, 2011).

² Submission to the Minister of Health by Mothers Helpers (February 2015); *Growing Up in New Zealand* <http://www.growingup.co.nz/en/news-and-events/news/news-2015/one-in-eight-pregnant-women-affected-by-depression.html>

Canterbury DHB operates a five-bed specialist inpatient service for mothers and babies for the Southern region; and in 2014 a specialist three-bedded Mother and Baby Unit opened, which provides inpatient care to people living in Waitemata, Auckland, Counties Manukau. But there is no similar service for those living outside of these regions.

There are also disparities in services for those with mild to moderate depression. Some DHB community services specialise in postnatal or antenatal depression, while others refer women to general practitioners (GPs) and community mental health teams (McCulloch, 2016).

mHealth for perinatal depression

The term mHealth (mobile health) refers to “*the use of mobile electronic devices such as mobile phones, computer tablets and personal digital assistants to assist in health care provisions and management*” (Pineros-Leano, Tabb, Sears et al, 2015, pp 212). Over recent years numerous mental health apps have been developed for smartphone users. The features of mobile technologies that make them particularly appropriate for providing individual-level health care relate to their mobility, high use and ownership rates, and their technological capabilities (Free, Phillips, & Galli et al, 2013).

Mobile technologies are highly integrated into everyday life – we carry mobile phones with us wherever we go, which makes intervention delivery flexible and available on-demand (Free et al, 2013). Mobile phones are not constrained by geography and are usually used privately by one individual, which makes the confidentiality of their use particularly attractive (Bakker, Kazantzis, Rickwood et al, 2016). They can also offer low cost interventions that can be delivered to large populations, for example by downloading apps or automated systems that can deliver text messages to large groups (Free et al, 2013).

New Zealand has a high rate of mobile phone use with 3.8 million mobile phones with active connections in 2017 (Statistics NZ). Smartphone use is particularly high amongst New Zealand women (and men) of child bearing age (91% of 18-34 year olds, and 78% of 35-54 year olds, own a smart phone) and over 90 percent of smartphone users report using their smartphone everyday (Research New Zealand, 2015). Research from across 59 countries also found that mobile phones are the most used device for pregnant and postnatal women, and that they commonly download apps to their mobile phones, including health-related apps (Osma, Barrera, & Ramphos, 2016).

But the use of mHealth in perinatal depression is a relatively new area. For example, while there are a myriad of apps relating to pregnancy/motherhood or mental health, in 2017 only 14 apps contained information relating to postnatal depression (Zhang, Ho, Loh et al, 2017). The following sections review the literature and some leading innovations that interface between mHealth and perinatal mental health care, including screening, prevention, follow up, and treatment. All of the examples presented in this report have a patient-clinician interface rather than relying on users to be self-motivated to seek help.

Of note, most of these examples are research studies or programs, as opposed to scaled-up mHealth interventions. This is the case for mHealth development in the health sector in general—despite hundreds of mHealth pilots, there has been insufficient program evidence to inform implementation and scale-up (Tomlinson, Rotherram-Borus, Swartz et al, 2013). In the case of mobile phone-delivered mental health interventions, this might be due to the lack of feasibility or that mobile phones are still a relatively new form of health care delivery (BinDhim, Alanazi, & Aljadhey et al, 2016).

Recommendation:

- 1. Government, health sector leaders, researchers and private enterprise should consider how best to strategically build evidence to inform the upscaling of mHealth services in New Zealand and to contribute to the international evidence-base for perinatal mental health.**

Detection

The majority of pregnant women and mothers do not volunteer information about their mental health without being prompted by a health professional (Kingston, Austin & Veldhuyzen van Zanten, 2017). A New Zealand study found that women who met the criteria for postnatal depression were more likely to say they would not seek help proactively compared to those who did not meet the criteria for depression (Health Promotion Agency, 2016). There are many reasons why women might not self-identify and seek help for perinatal depression, including:

- false reassurances from relatives and friends
- not knowing whether their symptoms are normal or not
- little knowledge of services, treatment options and their benefits
- feelings of guilt and shame
- concerns with mental health stigma and social disapproval
- difficulty disclosing feelings to health professionals
- work constraints and childcare responsibilities
- a health system that focuses on awareness promotion strategies which places the onus on women (or those close to them) to recognise symptoms and seek help.³

Provider-initiated mental health screening therefore plays an important role in women's willingness to disclose mental health problems (Kingston et al, 2015). Screening tools are widely recognised as an appropriate method to identify women with 'hidden' depression and to pick up on distress. Primarily, screens facilitate discussion between women and health professionals about mental health concerns, and what options and services are available (Campbell et al, 2008).

³Bilszta, Ericksen, Buist et al, 2010; Fonseca, Gorayeb, & Canavarro, 2015; Kingston et al, 2017.

Electronic screening

Evidence is emerging that electronic screening (e-screening) is preferred by women over paper-based screening, with women perceiving that an e-screen was not too time consuming and more private than paper-based screening, and there appears to be no difference in the degree to which women are honest (Kingston et al, 2017). Additional advantages include the ability to:

- overcome literacy and language barriers as they can be offered in multiple languages and use audio and video options
- offer more privacy – other people in the waiting area cannot see the answers on the previous screen and women can respond without having to share answers with partners for translation
- reduce errors and redundancy – avoiding human errors in tallying risk scores, information can be entered directly into the system rather than being manually entered (or results can be printed and put into records)
- provide real-time feedback and interpretation.

mHealth is enabling e-screening to become more comprehensive and therefore accurate, while simultaneously making it shorter and faster to complete compared to traditional pen and paper screens. For example, researchers I spoke to at Massachusetts General Hospital are developing a short screening app that has greater specificity than tools currently available, leading to fewer false positives and potential cost savings. The app is being informed by data gathered from women trialling a freely available smartphone app⁴ including digital versions of perinatal depression screening tools, such as the Edinburgh Postnatal Depression Scale (EPDS), as well as other measures for factors associated with perinatal disorders such as sleep disturbance, anxiety and perceived stress.

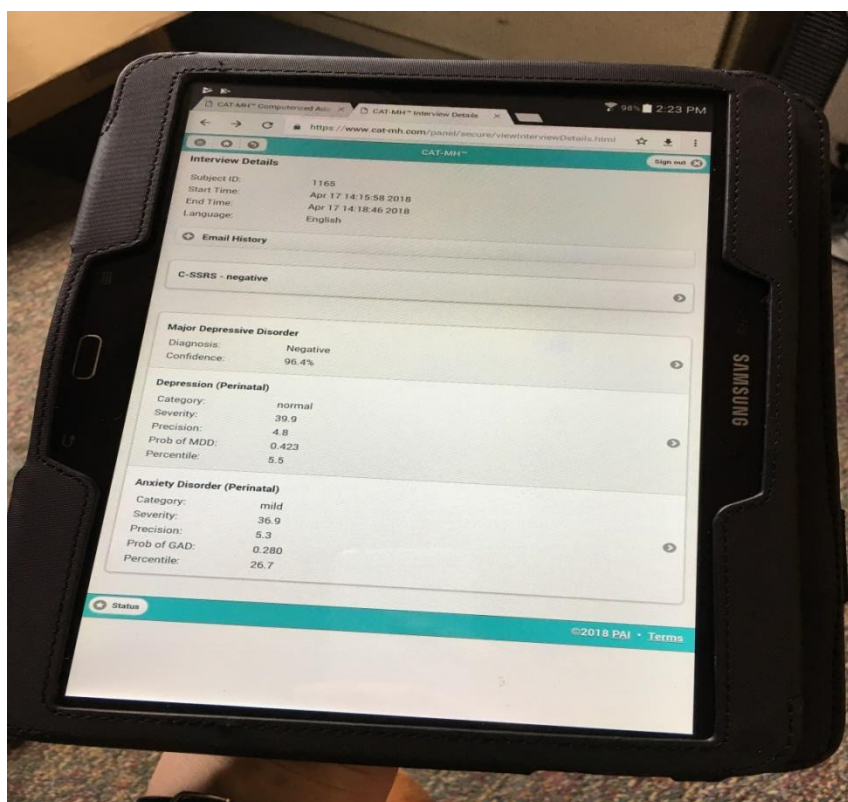
Adaptive Testing Technologies, through their clinically validated and peer reviewed computerised adaptive testing system CAT-MH™, has developed specific tests for depression, anxiety and mania for the perinatal population (Kim, Silver, & Elue et al, 2016). The basis of adaptive testing is that different individuals may receive different questions for a test or screen that are targeted to their specific impairment level. This means individuals' initial question responses are used to determine a provisional estimate of their standing on the measured trait (e.g., depression, anxiety) to be used for subsequent question selection (all which is drawn from a large bank of questions). The net result is that individuals are administered a small, optimal number of questions for a test or screen without loss of measurement accuracy (Adaptive Testing Technologies, 2018).

These highly accurate tests can be administered in less than 2 minutes each, can be used on any internet-connected device, and can interface with an electronic medical record. Importantly, the diagnostic test negates the need for women to be referred to a trained clinician for a diagnostic interview. This clearly saves time and resources, but is also more convenient for women as they do not have to travel to see a different health professional for a clinical assessment and are therefore more likely to engage, at least initially, in the treatment process.

⁴ <https://womensmentalhealth.org/posts/announcing-mgh-perinatal-depression-scale-apple-store/>

The Women's Mental Health Research Program I visited is administering CAT-MH™ at an OB/GYN clinic, the Center for Women's Health, at the University of Illinois at Chicago. The program was introduced in response to evidence that while women were getting screened at the initial booking visit, they were unlikely to be screened later in pregnancy. The program involves trained undergraduate students seeking consent from women in the waiting area to take part in a longitudinal study of mental health during pregnancy. Participating women then complete a tablet-administered screening at this visit and up to four additional times over the pregnancy and postnatally. The screening includes tests to measure the likelihood of obtaining a positive or negative diagnosis of major depressive disorder, estimate the underlying severity of the depression, and screen for suicide risk and generalised anxiety disorder. The women attending this clinic are predominately black and Latino women and 75 percent are under the poverty line.

Women with a positive screen are then asked to watch a short video with the aim of addressing mental health stigma and preparing them for the discussion with the clinician they were waiting to see. It also leads to time savings for the health professional during the consultation. Women with a positive screen are reviewed by a clinical social worker (in addition to their clinician), and where appropriate asked to participate in research examining an online intervention for depression. Follow-up is undertaken by trained administrative staff at the clinic. The results of the screen are automatically emailed to the research team but positive screens are entered manually into the patient's medical records and the research team is also responsible for notifying the clinical social worker and the women's clinician.



Summary page of the tablet-administered CAT-MH™ at the Center for Women's Health, University of Illinois at Chicago

This screening research program supports the evidence that screening in waiting areas can work well, reduce frustration, and trigger meaningful discussions during the consultation (Marcano-Belisario, Gupta, O'Donoghue et al, 2017). This particular program also highlights the benefits of an educational component to aid in mental health de-stigmatisation. The program administrators note that it would be difficult to manage the program outside of a research setting where there may be no dedicated personnel to introduce women to the screening process, or to undertake assessments for treatment options and follow-up. Clinic staff are reluctant to be responsible for a tablet for fear it will be broken, lost or stolen, with a dedicated desktop computer being a likely option for future use. Other issues identified in the literature include consideration of clinic work flow, additional burden on clinical and non-clinical staff, timing of appointments so as to avoid the screens being interrupted, and internet and wi-fi connectivity (Marcano-Belisario et al 2017; Pineros-Leano et al, 2015).

In New Zealand, most community-based LMCs are midwives, and these midwives often work independently and are unlikely to be located in settings with a dedicated waiting area and multidisciplinary and administrative staff. Mothers Helpers provides an online version of the EPDS on its website that automatically provides a risk score, with an option for women to provide their contact details so that they can be sent advice on appropriate next steps. Midwives can and do use the online EPDS with their clients via a tablet or smartphone during a consultation. Researchers at the University of Auckland are undertaking a feasibility study of an adult depression e-chat screening tool developed for GPs, with 25 community-based midwives at Greenlane Community Hospital in Auckland DHB to understand how tablet-screening can be integrated into care. One of the key challenges is how to interface e-screening with electronic health record systems.

Mobile phone-administered screening tools could also play a role. For example, a US study used a text message prompt that asked women to complete the CAT-MH™ via a secure portal, and it was found to be feasible and acceptable among perinatal women (Silver, Kim & La Porte, 2017). Screening outside of clinic time is useful as the information it provides can help clinicians prepare ahead of the session. It does however require a secure password protected system that is sophisticated enough to assess which patients have completed the screen and who have not, and to send automated reminder prompts to patients.

Remote support for depression screening and management

As noted earlier, there is no guarantee that women are receiving either the basic case finding questions (PHQ-2 or 3) or being asked to complete screening questionnaires in New Zealand. Certainly prior to 2010 when the Well Child Schedule recommended use of the EPDS at core Well Child visits, these assessments were not always carried out (Campbell et al, 2008). While some New Zealand midwives specialise, and are well trained, in mental health issues, feedback for this report is that others are reluctant to 'open Pandora's box' by asking questions about mental health with their clients due to the lack of time available for such sensitive discussions and lack of sufficient training. Even if e-screening can be completed in two minutes, it is unlikely to significantly change the length of the discussion that follows when women screen positive for depression (Campbell et al, 2008).

Midwives are also deterred by the lack of effective referral pathways or in some cases a lack of confidence that the health professional they refer to will respond helpfully. And they have a point: Cohen (2017) suggests that the failure to have referral networks and opportunities for clinical follow-up in place following positive screening has contributed to the ‘perinatal depression treatment cascade’ – the “*cumulative shortfalls in clinical recognition, initiation of treatment, adequacy of treatment, and treatment response for [perinatal] women...*” (Cox, Sowa, Meltzer-Brody et al, 2016). Cox et al (2016) found that for women who have a positive screen, only 14-16 percent receives treatment of any kind — evidence that women are clearly getting lost along the mental health process.

One solution to these problems could be to automatically share, with consent, women’s e-screen results to a remote ‘third party’ that is trained to respond to and case-manage positive screens. The e-screening would continue to be administered by an LMC or other health professional but where appropriate the treatment team would be expanded to include trained professionals, working remotely by telephone or email, whose role is to talk with women about their positive screen, discuss the findings and the options for assessment and treatment, make a referral for a clinical assessment, and undertake active follow-up. They could also administer remote care options such as text-based support, or offer coaching as part of an online treatment program, or prevention strategies.

A pared-back version of this model is being developed in New Zealand through the Mothers Helpers GP and midwife partnership program. Pregnant and postnatal women are invited to complete an online EPDS by the GP/midwife and, with consent, positive screens are sent to trained social workers and counsellors for review. Mothers Helpers reports back to the GP practice or midwife on anyone that requires medication review or crisis or maternal mental health services. This model can make referrals directly and offers a range of support services to women including a recovery program.

Feedback on this remote ‘treatment team’ model is that some women like the anonymity provided by a professional practising remotely, particularly women with mild to moderate depression. Perinatal women may find remote care an acceptable option given that telephone-based therapy has been found to be effective and acceptable with this population (Ngai & Chan, 2018; Posmontier, Neugebauer, & Stuart et al, 2016). Furthermore, since early use of brief telephone or online interventions can be an effective strategy to enhance the future uptake of mental health interventions, the remote ‘treatment team’ may help to broker the mental health process for some women – but only where the encounter is a positive one.

For a model like this to work it would need to be an 'opt-in' service for clinicians who administer screening and they will need sufficient training in order to be an active part of the service. It will likely require a 'warm-hand over' from the clinician explaining the role of the service, how it works, and that the remote professional is part of the treatment team. Women with positive screens will need to be ushered through the process given that people with depression are generally less motivated. For example, feedback for this report suggests that the initial telephone call from the remote provider may need to take place during the same consultation that the screen was administered in order to effectively engage with women. Written consent would be given by women who wish to participate, which could be facilitated by written information and a tick box on the e-screen.

Some women may still have a preference to receive their care all in one place and within an existing professional relationship. Indeed, for women with more severe depression it may be important for them to have a face-to-face conversation about any mental health concerns with a person they know. This approach also relies on LMCs or other clinicians administering screening in the first place, which is not occurring at high rates, and sufficient resourcing would need to be in place to meet any increase in the number of referrals to GPs and mental health services for clinical assessment and follow up.

A variation to this model is to provide remote assistance to clinicians to help them to better meet the needs of women. An example of this is Illinois DocAssist, which helps primary care clinicians to screen, diagnose and treat mental health problems with perinatal women through phone consultation (as well as in person). It also helps clinicians by identifying appropriate referrals and resources for their patients where their needs cannot be met in the primary care setting. DocAssist is funded through the state Medicaid agency and started to include perinatal mental health services in 2015, alongside existing services to children and adolescents. Initial workloads were 2-3 consults per month and after obtaining additional staffing resources, aims to achieve 60 consults in a 12-month period. The service is particularly successful in reaching remote regions of Illinois. Note this is not strictly a mHealth model but rather a broader form of 'telehealth'.

Recommendation:

- 2. Facilitate participatory workshops with women (from diverse backgrounds and with experience of perinatal depression) and health professionals to explore:**
 - a. how tablet and mobile phone-administered mental health screening could be efficiently conducted during LMC consultations**
 - b. whether management of positive screens by a remote 'treatment team' is acceptable, feasible, and effective at supporting women with depressive symptoms**
 - c. whether remote support for clinicians to better manage perinatal screening, referrals and support is acceptable, feasible, and effective.**

Targeted identification and support

The integration of mood-tracking technology into health care delivery has also been used to identify women with depressive symptoms. For example, a Finnish tech company, Monsenso, has developed an app that women can download and use to fill in self-assessments on a daily basis, and clinicians (using a mHealth platform) can monitor them on a regular basis and contact them if the system indicates any triggers or early warning signs for perinatal depression.⁵ This type of technology has also been used to better identify women who would benefit from increased help and support for perinatal depression symptoms, for example, women with persistent or worsening depression symptoms. This is an important distinction because women who suffer with persistent depression are particularly at risk for negative outcomes for both themselves and their children (Underwood et al, 2016; Weissman, 2018).

A recent US trial tested a mood-tracking and alert app (Ginger.io; San Francisco, California⁶) that alerted providers when participant mood symptoms worsened and prompted the provider to contact the participant (Hantsoo, Criniti, Khan et al, 2017). The trial was conducted in a prenatal clinic serving a predominately low-income and ethnic minority population. The app provides brief education on mental health, and monitors mood through the delivery of daily mood symptom surveys and longer weekly surveys.⁷ When the app detects a trend in worsening mood symptoms (or self-harm), alerts are generated for the prenatal providers through a clinic-facing monitoring dashboard.

The study found that after the eight week trial, women who used the app experienced a significant improvement in their perceived ability to manage their own health, had more contact with the providers regarding mental health, and had more referrals to mental health services, compared to women that used a standard app that connected patients to providers through a patient portal system. Furthermore, women who received an app-triggered call from the provider had significantly higher mean PHQ-9 and GAD-7 scores early in the study, indicating that the app was correctly identifying women in distress.

Author feedback for this report was that administering the app – setting women up with the app and monitoring results within a real prenatal care setting – was feasible. The providers that received alerts in this study were social workers or a clinical psychologist with experience in treating women with perinatal depression, all of whom were existing employees of the prenatal clinic. The providers spent around half an hour per day reviewing alerts and responding, with about one or two alerts per day that required a response. The system was not managed outside of clinic hours and women were told to call emergency services for assistance afterhours. Feedback from the clinic providers was that the app was practical and they valued the input of the app for their care.

⁵ Information for this report is taken from www.monsenso.com/identifying-postnatal-depression-with-mhealth-technology/ (accessed April 2018). Monsenso could not be contacted for further information so it is unclear if there is available evidence about the effectiveness of this mHealth platform, or whether it has been implemented into health care systems.

⁶ Since developing the app, Ginger.io has changed its business model to become a licensed medical provider that offers online support coaching, therapy and psychiatry.

⁷ For a full description of the app see the supplementary information to Hantsoo et al (2017).

Application of a mood-tracking and alert app in New Zealand

A mood-tracking and alert app could help address the inadequate access to treatment of perinatal depression in New Zealand. It would allow providers to be more responsive to patient needs and to provide women with responsive mental health care when it is first needed, including outside of appointments times. Further, women are not required to be proactive in seeking help (currently a barrier), as the passive monitoring of data and alerting system shifts the onus on the provider to check-in and offer extra care where appropriate. At the same time, educational and self-directed prevention strategies promoted through the app would work to reduce the number of women requiring secondary-level care from maternal mental health services.

In addition, the app could be a useful tool to help comply with the recommendations of the PMMRC (2017) for maternity care providers (or mental health services) to closely monitor Māori women who have a history of serious mental illness but are currently well. However, it is unclear how a mood-tracking and alert app would fit within kaupapa Māori or whether it would be acceptable to Māori women and Māori providers.

Feedback for this report is that it would be feasible for a mood-tracking and alert app to be practice-nurse driven, given that the GP or practice nurse team will usually undertake a clinical assessment following a positive screen or if mental health concerns have been raised. It has also been suggested that the app could be administered by a third-party; for example, through an existing perinatal telephone counselling service with additional funding and training. Both these models could support women from pregnancy and postnatally, which is important in a health system that currently provides fragmented services across the perinatal stages.

The basic functions of the app as it could apply in a GP practice and a third-party model are described in the infographic below (Figure 3).

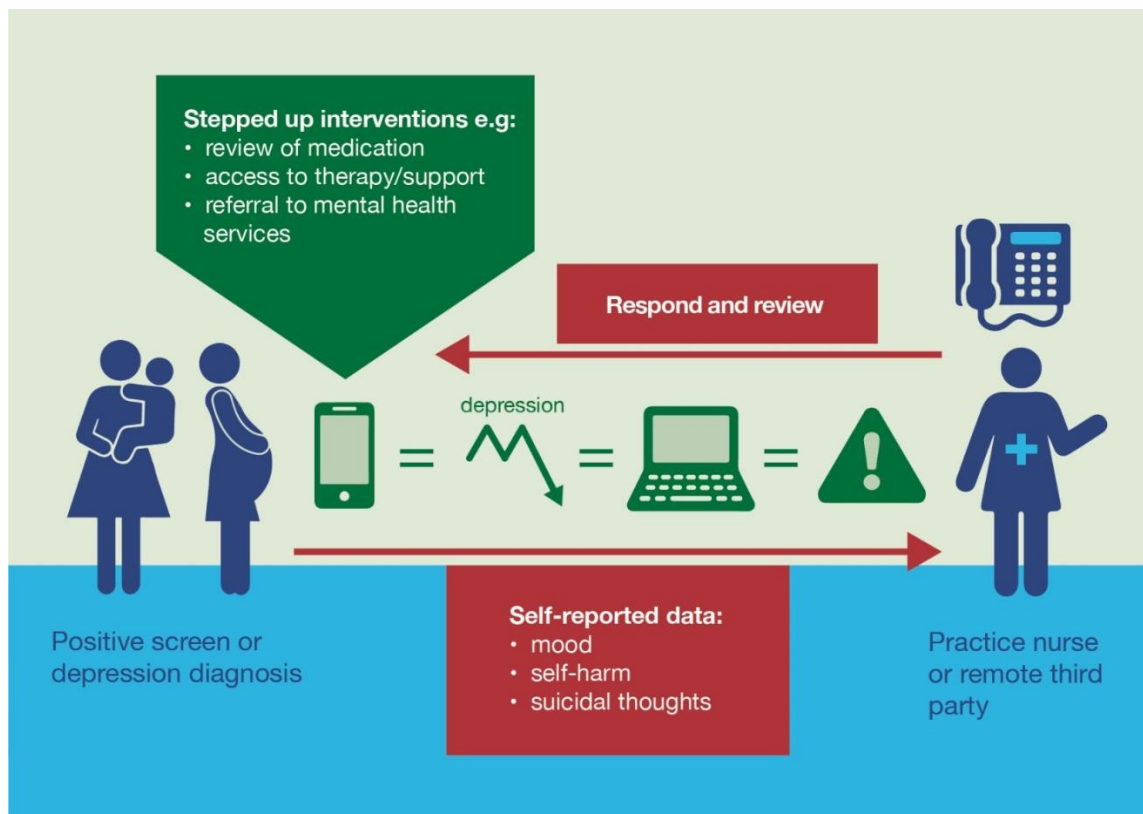


Figure 3: Mood-tracking and alert app model infographic

a. Practice nurse-managed app

In this model, GPs or practice staff seeing women with a positive screen for perinatal depression or a depression diagnosis could invite them to take part in the mood-tracking and alert app with the aim of providing them with better mental health care. The ultimate goal of the app would be for the practice nurse to respond to app alerts and, where indicated, work with women to provide increased care; for example, consultation with the GP about starting or reviewing medication, accessing therapy, or making a referral to mental health service for mothers and infants.

The main advantages of the practice nurse-managed model is that it focuses aspects of perinatal mental health management into primary care services, which generally enables people to have better access to mental health services and therefore helps close the treatment gap. It is also likely that the practice nurse or others who respond to alerts will already have a therapeutic relationship with the person, which may increase the chance of better outcomes. This model could also be linked with, or administered through, patient portals where this service is available.

The main disadvantages are that not all GP practices have a practice nurse and women who do not have a good relationship with their GP practice maybe unlikely to want to manage their depression through the practice. Practice staff would need training and additional time to administer the app (e.g., setting women up with the app and to review and respond to alerts) and opportunities to recoup funding for this type of work.

b. Remotely administer app through a third party

The basic functions of the mood-tracking and alert app are similar to the model outlined above (see infographic). However, app alerts would be directed to a 'third party', such as a perinatal telephone counselling service, and the third party would be responsible for reviewing and responding to alerts. Staff reviewing and responding to alerts would be appropriately trained in counselling or mental health support and have access to all local and national social support and mental health services. This might include, for example, social workers, counsellors or mental health nurses. Women could be invited to use the app by their LMC, GP or WellChild provider.

Feedback suggests that the main advantages of an app administered by a remote third party is that women may prefer the anonymous nature of the service at least for the initial stages, while at the same time working remotely is unlikely to create any extra barriers that prevent staff from building rapport and a trusting relationship with women. When responding to alerts, staff might be better resourced to spend more time talking to women about their situation or options for further support. Importantly, this model could also address service gaps for mild and moderate depression by providing prevention and treatment support, such as brief over-the-phone interventions or text-based support.

To succeed, this model of operation would likely need to overcome several significant difficulties. The main disadvantages are that it would heavily rely on the buy-in and support by other health professionals to encourage women to use the app in the first place; and women who need access to further care would have an additional hurdle to overcome by using a third party. For example, if a medication review was warranted the third party would need to make a referral to the GP and rely on the practice to respond accordingly. There would likely be concerns about third party access to patient information, data security and privacy that would need to be assessed and managed.

Recommendation:

- 3. Facilitate participatory workshops with women (from diverse backgrounds and with experience of perinatal depression) and health professionals to explore the feasibility and acceptability of a mood-tracking and alert app and clinician-facing platform, and a workable administration model.**

Prevention

There is an argument to focus on providing accessible evidence-based help to pregnant and postpartum women to prevent depression given the low rates of women that access treatment and support. Prevention strategies delivered through mHealth have the potential for high reach at low cost, and they can be tailored based on the initial input data from the user to target particular risk and protective factors that may influence the onset of perinatal depression. Some examples of prevention apps are described below.

- a. In New Zealand the University of Waikato recently developed and piloted with 88 pregnant women the Positively Pregnant app, which provides an interactive, individualised programme to help women meet the challenges of pregnancy and transition to parenthood, to prevent distress during pregnancy and postnatally. It includes tools for self-assessment, taking inventory of the mother's strengths, stressors, support, strategies for coping, health behaviours, and more. From each of these, she receives feedback with links to New Zealand resources and information. Other modules include guides for talking or thinking about plans for things such as parenting, birth, finances, and family traditions.⁸A revised version of the app is due to be released in November 2018.
- b. In 2017 the Australian Government launched the MumSpace⁹ website and with it the MindMum app, which *"helps new mothers to track their mood, calm themselves with guided relaxation and plan enjoyable activities, learning strategies to improve their relationships and build confidence in parenting"*
- c. Researchers at the University of Illinois at Chicago recently trialled the Sunnyside postpartum depression prevention intervention, where women with depressive symptoms were assigned to either a self-directed online Cognitive Behavioural Therapy (CBT) arm or peer supported version of the site. Sunnyside is a mobile accessible web intervention consisting of 16 perinatal lessons, 3 postpartum booster lessons and 4 tools. Lessons provide didactic content such as behavioral activation, cognitive restructuring, managing anxiety and coping. The trial found that women in both groups demonstrated high levels of adherence, both in number of logins and completion of content, and both groups exhibited decreased depression scores (Duffecy et al, in print).

The success of preventative interventions such as these may be that women who wish to take part are especially motivated to self-care, and may be worried about developing depression and eager to find a solution or a way to avoid it. Apps that are targeted at pregnant women through pregnancy apps or websites are also likely to attract women that are technologically literate and already use health-related apps. Apps offered to women by their LMC or other health professional as tools they can use to support women, or as an adjunct to other support, could have broader uptake.

⁸ <https://www.waikato.ac.nz/news-events/media/2017/introducing-the-new-app-for-pregnant-women>.

All enquiries should be directed to carrie.barber@waikato.ac.nz.

⁹ <http://www.health.gov.au/internet/ministers/publishing.nsf/Content/health-mediarel-yr2017-hunt108.htm>

Treatment and support

mHealth interventions accessed via a mobile phone – including text support or internet-based therapy – address some of the traditional barriers to accessing face-to-face therapies such as a lack of access to services, child care, lack of time, social stigma and shame, mobility or transportation barriers, and cost. For pregnant and postnatal women these services, at least in theory, provide a service-on-demand intervention that can work around the schedule of looking after a baby or children, and which could be private, free and anonymous. Online interventions are tipped as a solution to long wait times and lack of accessible treatment services, and to relieve the high demand for therapists and treatment providers.

Online interventions are treatments that are accessed by the internet, including via email, apps and websites. Two recent systematic reviews of online interventions identified a small number of robust studies that were effective in the management of depression, concluding that online interventions for perinatal depression are promising but are part of a still developing field (Ashton, 2016; Lee, Denison, Hor et al, 2016). Most of these studies focused on the postnatal period however, and included an element of interaction with a therapist or other health professional as part of the intervention.

A popular example of an online intervention is the Australian-based app MumMoodBooster, which administers a self-directed CBT treatment program for women with perinatal depression. It includes six interactive online treatment sessions complemented by low-intensity telephone counselling. A randomised controlled trial of the app found that it was effective at reducing depressive symptoms, was highly acceptable to perinatal women, and that women found the coaching element to be helpful (Milgrom, Danaher, Gemmill et al, 2016). The efficacy of the app compared to face-to-face treatment is the subject of a current clinical trial.

Research on the use of online interventions for depression in the general population is less optimistic about their future. A recent Australian study found that most respondents (85.7%) preferred face-to-face services over online health services, although a large proportion of participants (39.6%) reported an intention to use online health services if they experienced mental health problems in the future (March, Day, & Ritchie et al, 2018). As-yet-unpublished research in the US found that a significant majority of people are concerned about whether online therapy is effective; others are unsure whether online therapy is more or less effective than face-to-face therapy, and concerned that online therapy will not be tailored enough to meet their needs. But some respondents in rural areas felt that online interventions had advantages in terms of privacy (personal correspondence, Dr Par Arian). This suggests a need to better promote online mental health services, and develop strategies to increase confidence, familiarity and exposure to new internet-based interventions to encourage the actual use of such services.

Human contact appears to be an important component of effective online intervention, which Lee et al (2016) argues does not necessarily address the financial burden of therapy or wait list delay that these interventions are purported to overcome. Feedback for this report is that, at a minimum, effective online treatments need to have a 'coaching element', which could be face-to-face discussions, online chat or telephone-based. Online peer support groups may also increase adherence to an intervention as well as circumvent therapy costs and wait lists (Duffecy, in print). Contact via video appears to be less popular, possibly because it can be perceived as more intrusive and difficult to build rapport. It is possible that women with mild depression might respond to fully self-directed online therapy (i.e., no coaching element) as they may be less likely to find such interventions overwhelming and disengage.

We do not yet understand how to make online therapy appealing to perinatal women. It is likely that online interventions are useful for specific audiences only, for example those that are first time mothers, mobile and IT literate, and have higher education and social-economic status. Health care apps in general have a large reach but typical app usage is about two weeks, which poses a significant challenge to reducing attrition rates. Perinatal online interventions therefore need to be based on user-centred design, with consideration for how perinatal women use their phones, especially around looking after a baby and children.

Online interventions are very expensive to develop and require ongoing maintenance costs. Users have high expectations about the visual aspects of an app and tend to dismiss apps that are not 'polished enough' as amateur and ineffective. Researchers I spoke with tend to favour online websites as opposed to native apps as it avoids the need to develop two versions (iOS and Android) and corresponding updates. Further challenges are posed by the fast-changing landscape of mHealth as technology develops, and social connectedness and ways of using technology change. This creates difficulties when delivering evidence-based interventions within a traditional medical model that takes time to acquire evidence through a systematic and peer-reviewed process.

There is concern that there is no way to get immediate help and assistance from an online programme when a woman has suicide ideation or indicates that she is at risk of harming herself or her baby. Furthermore, privacy and security need to be carefully considered as part of the development process, for example women are likely to want alerts on their mobile phone to be hidden when the phone is locked so as to avoid others viewing it. Online interventions will need password protection and clinician-facing platforms or devices will require encryption.

Given that the evidence regarding the efficacy of online interventions is small, although promising; further research is needed to build this evidence-base and our understanding of their potential up-take, and how potential risks can be managed. Although appealing in its cost-effectiveness for women and the health system, it does not currently represent a stand-alone intervention option for the majority of women. Any implementation of online treatments would require sufficient follow-up and a stepped-up care approach for those women that do not wish to participate in online therapy, for those that do not find it effective, or for women who struggled to engage with online interventions.

Recommendations:

- 4. Prioritise research that aims to better understand the acceptability of online treatments for perinatal women and their mobile literacy and phone use patterns and behaviours, particularly for non-European women.**
- 5. Maintain a watching brief on evidence for online treatment and prevention for perinatal depression and the impact of promotional and education strategies to increase e-health uptake.**

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