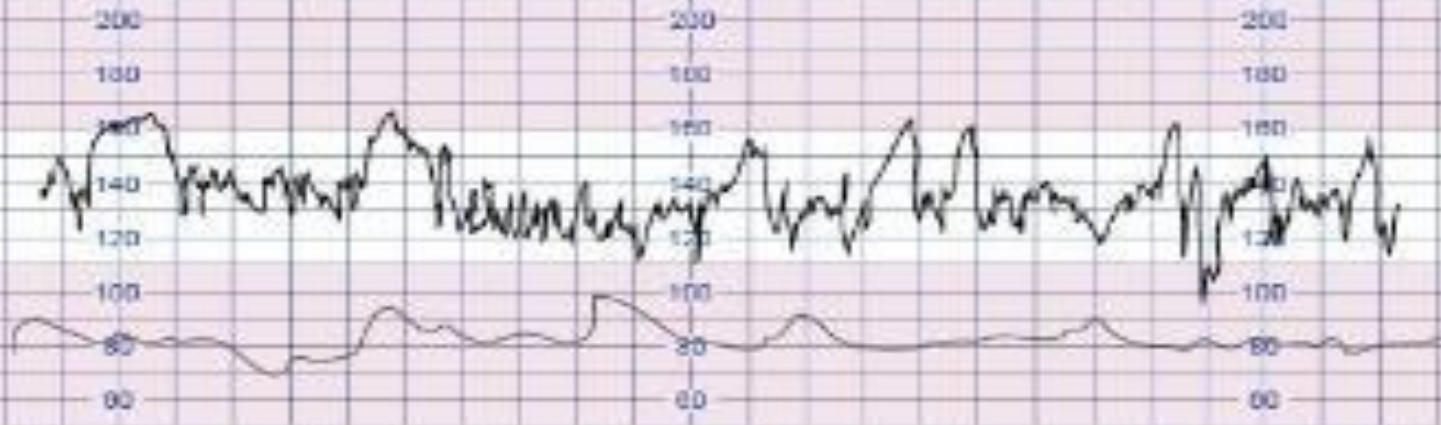


# CTG and Home monitoring in the Netherlands

Dr. Petra CAM Bakker, Obstetrician  
Amsterdam UMC, The Netherlands



02-10-2017 15:18

100  
80  
60  
40  
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DMN

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02-10-2017 15:28

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**Amsterdam UMC**  
University Medical Centers



**Is Home(Tele)monitoring standard practice  
in your country?**



Is Home(Tele)monitoring standard practice in your country?

**What comes to mind when you think of Telemonitoring (TM) and Homemonitoring (HM) in obstetrics?**



## Dutch situation in a nutshell

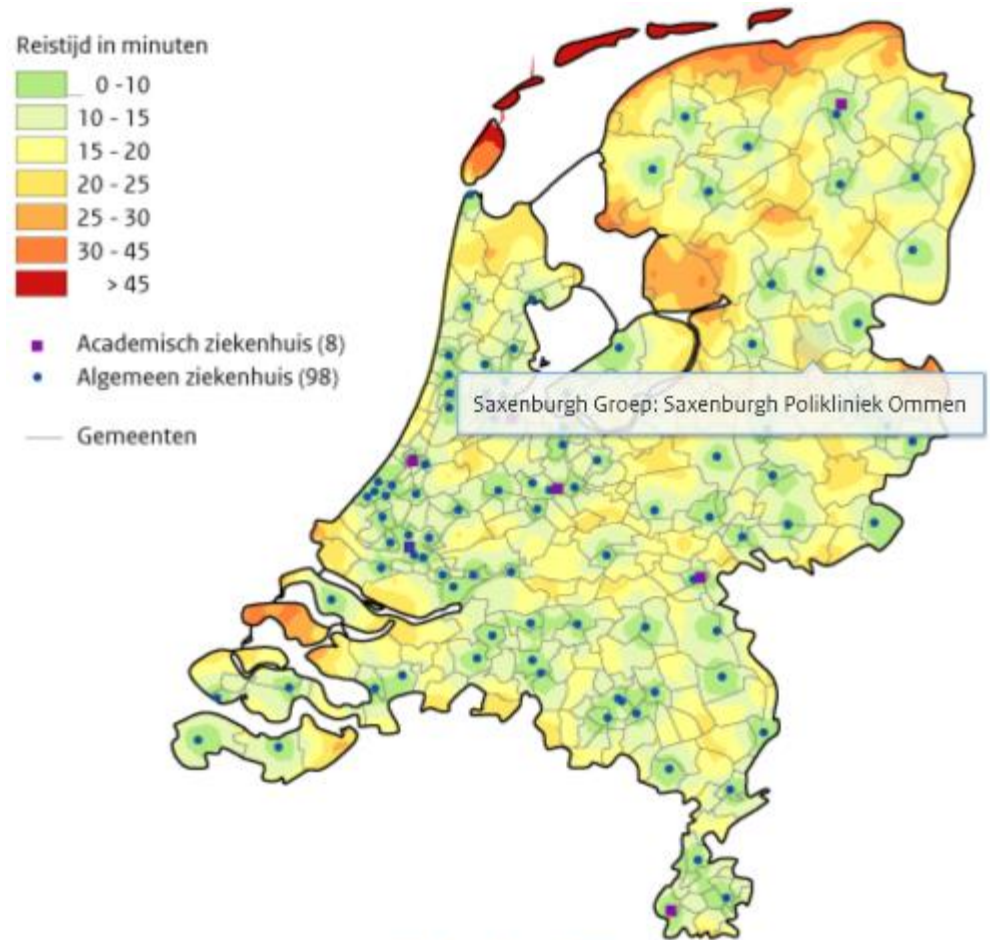
180.000 births annually

17,3 miljoen inhabitants

507 inhabitants per km<sup>2</sup>

73 hospitals



8 tertiary centers



Bron: Bereikbaarheidsanalyse door RIVM, [Drive Time Matrix](#), 2022



## Definition HM and TM

	A. Home-based monitoring	B. Telemonitoring
Definition	daily pregnancy monitoring with the help of hospital personnel traveling to the pregnant women's homes	daily pregnancy monitoring with the help of devices used by the pregnant women at home in absence of hospital personnel
Illustration		



# Examples of HM and TM

- CTG monitoring
- Digital Health platforms e.g. Angels
- Multidisciplinary consultations
- Patient portals
- Prenatal teleconsultation
- Monitoring of diabetic patients in pregnancy<sup>1</sup>
- Bluetooth spirometry in pregnant patients with Asthma<sup>2</sup>

1. Perez-Ferre N. *Int J Endocrinol.* 2010;2010:1-6

2. Zairina E. *Respirology.* 2016;21:867-74.



## Homemonitoring in the AUMC





# Home monitoring in the AUMC

- Started in 1992
- RCT; 70 patients in each arm
- Indications: hypertensive disorder, FGR, Diabetes, post term pregnancy
  
- Why?





# Homemonitoring in the AUMC

## Outcome

- Neonatal mortality and morbidity  
no significant differences<sup>1</sup>
- GA, BW, neonatal and maternal admission rate, obstetric complications:  
no significant differences between<sup>1</sup>
- Reduction antenatal costs:  
\$3558 to \$1521 per patient ( $p < 0.01$ )<sup>2</sup>

HM continued in the AUMC and the Netherlands, but without reinsurance reimbursement

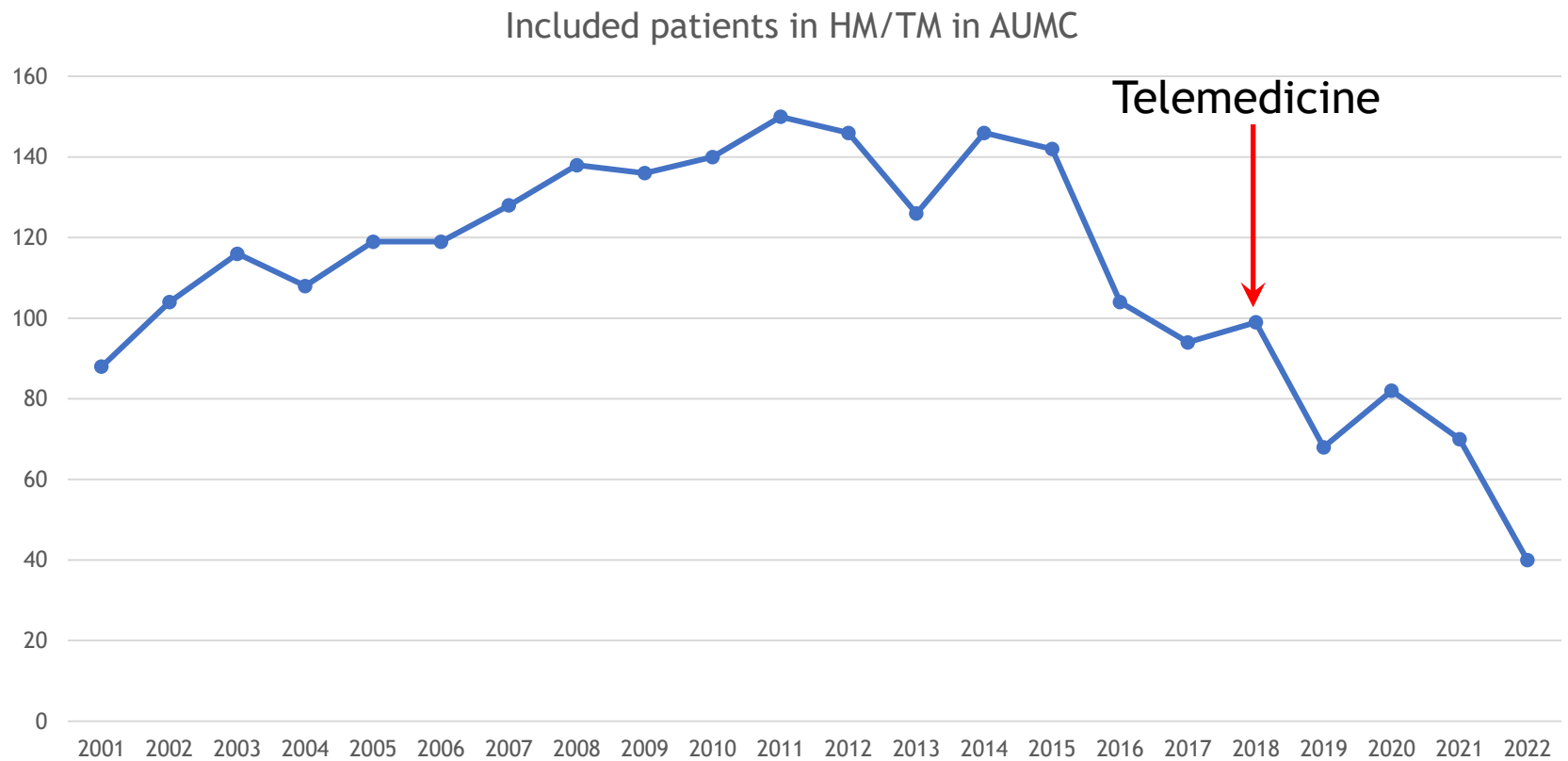
<sup>1</sup>High risk pregnancy monitored antenatally at home. W M Moninx et al. *Eur J Obstet Gynecol Reprod Biol.* 1997 Dec;75(2):147-53.

<sup>2</sup>Cost-minimization analysis of domiciliary antenatal fetal monitoring in high-risk pregnancies

E Birnie et al. *Obstet Gynecol* 1997 Jun;89(6):925-9



# Included patients over the years





## Indications over the years

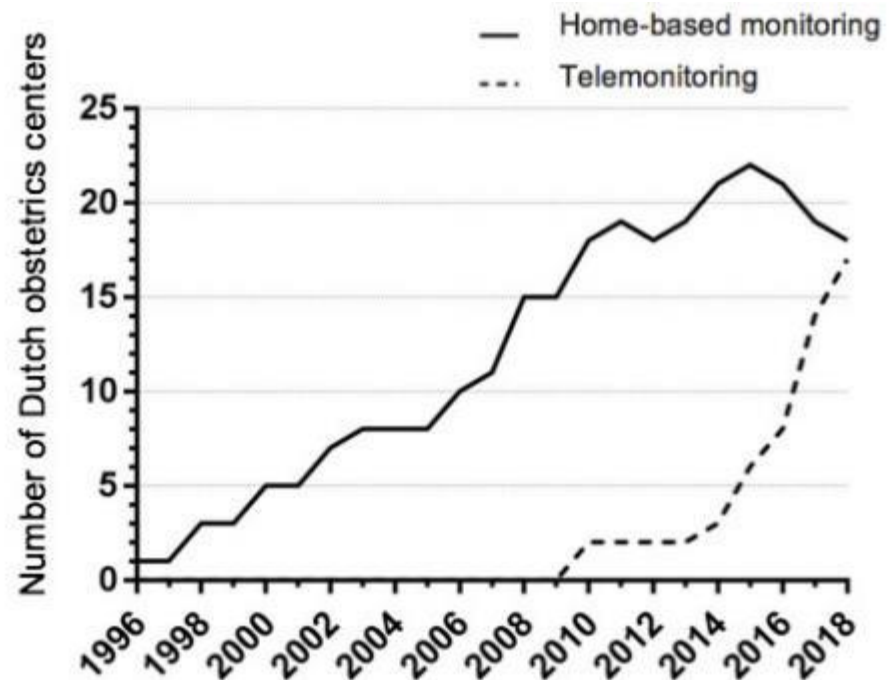
	2001	2021
Hypertensive disorders	48%	37%
PPROM	5%	26%
Fetal growth restriction	24%	13%
Fetal abnormalities	0%	10%
Diabetes	10%	0%
Other	13%	14%

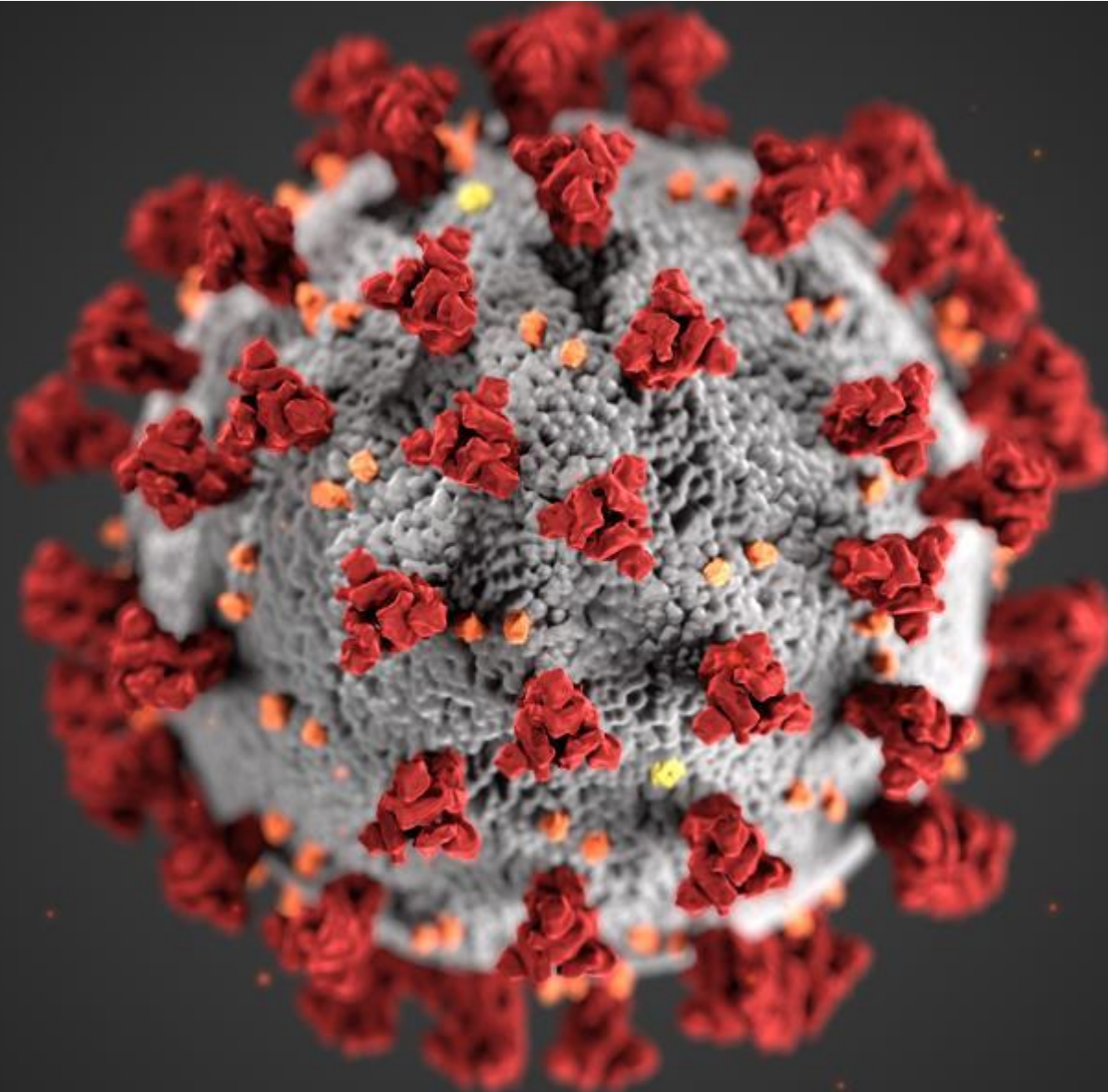
Duration of monitoring varied from 1-80 days.



# Trends in hospitals HM/TM in the Netherlands

- Homemonitoring: 26%
- Telemonitoring: 23%
- HM and TM: 11%







- Reliable internet
- Access to technology
- Digital Literacy

- Information and counseling on risks
- Disease awareness

Technology

Patient

Environment

Hospital

- Caregiver
- Home accessibility
- Distance from the hospital < 30

- Facilities for admission or consultation 24h
- Awareness of healthcare responsibilities





# Technology

Many different devices on the market

- Doppler Ultrasound and external tocodynamometer
- Non-invasive fECG (less signal loss, needs no repositioning after placement)

Blood pressure device

Temperature

Internet

Mobile phone

- Transfer data
- Report symptoms, fetal movements





- Reliable internet
- Access to technology
- Digital Literacy

- Information and counseling on risks
- Disease awareness

Technology

Patient

Environment

Hospital

- Caregiver
- Home accessibility
- Distance from the hospital < 30

- Facilities for admission or consultation 24h
- Awareness of healthcares responsibilities



- Feasible

- Satisfaction 80-100%
- Good maternal and neonatal outcome
- Self- evaluation → empowerment

Technology

Patient

Environment

Hospital

- Cost effective; 32-45%
  - 145k over 5 years<sup>1</sup>
  - 2774 euro per participant<sup>2</sup>
- Climate

- Improved access to care (rural and urban)
- Reduced antenatal visits
- Better triage and adequate referral



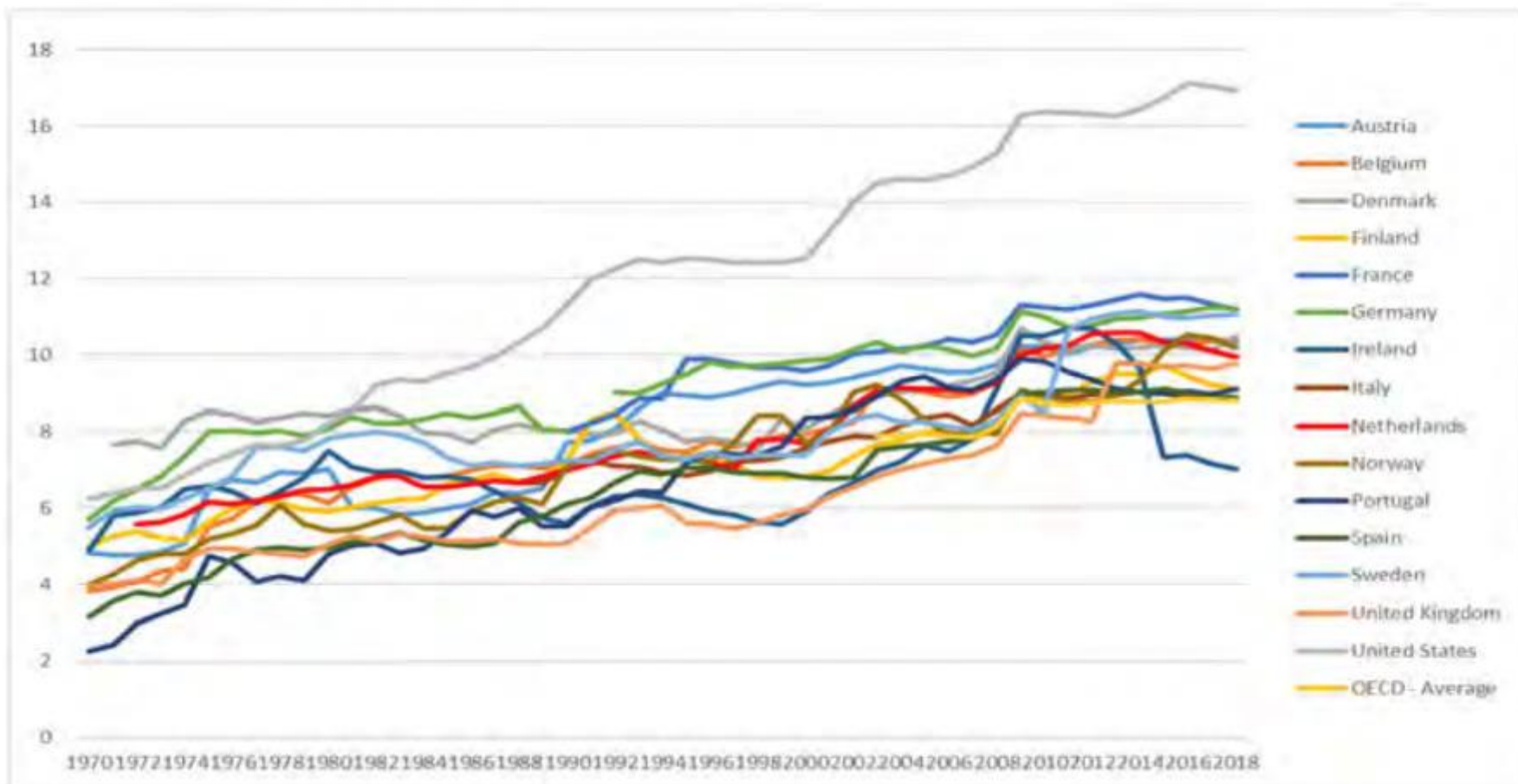
# Barriers

- Privacy violations
- Feelings of insecurity
- Mistrust
- Exclusion



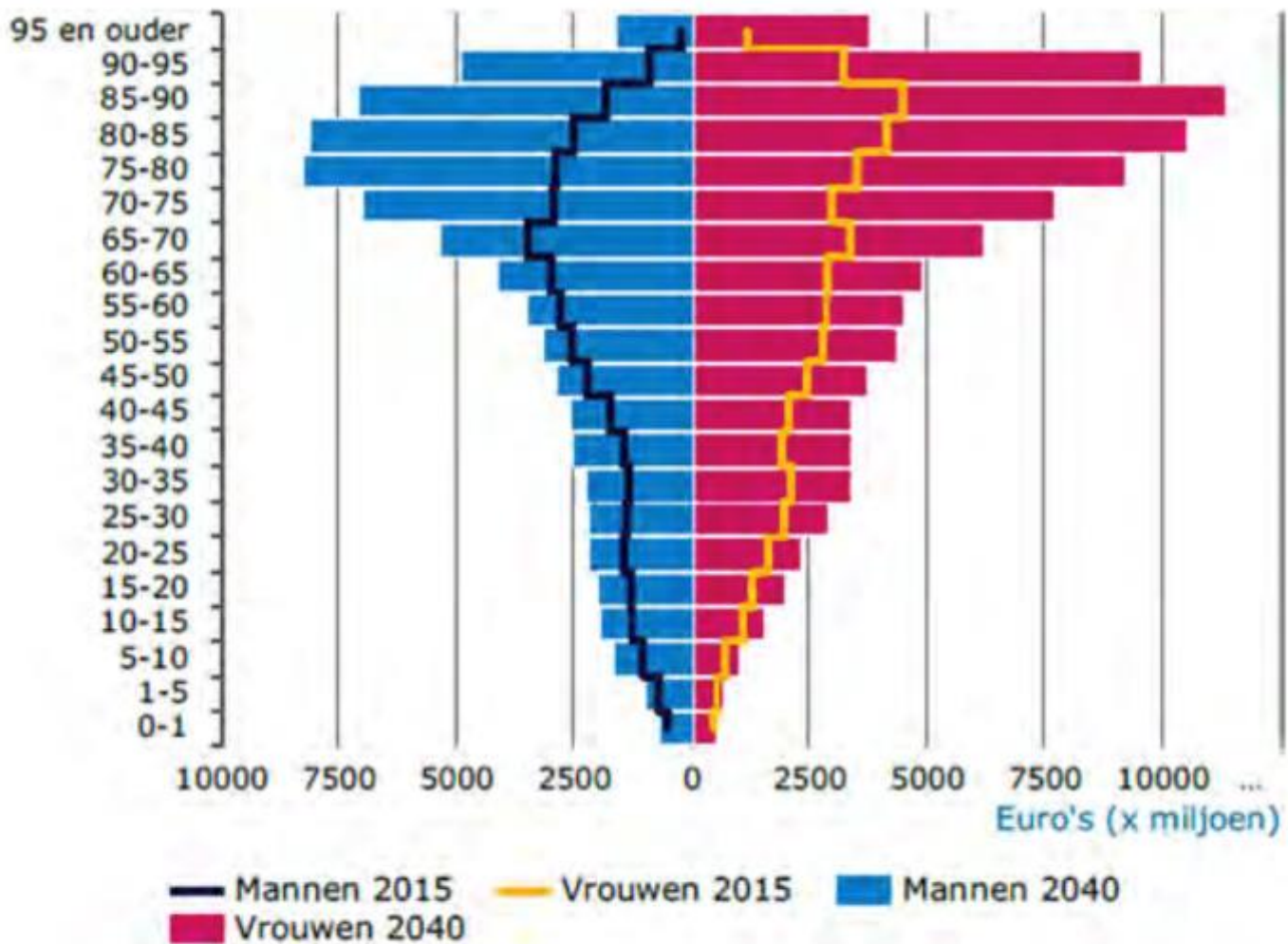
# Future developments





Bron: OESO.

<https://www.ser.nl/nl/Publicaties/zorg-voor-de-toekomst>

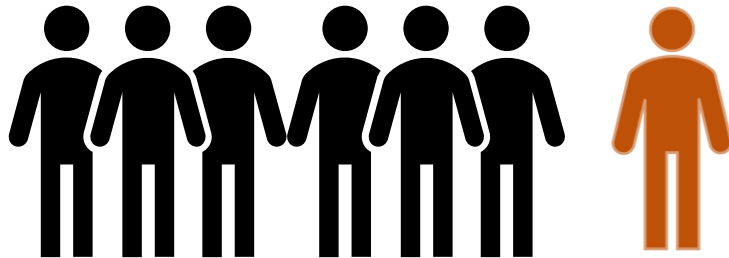


Bron: RIVM

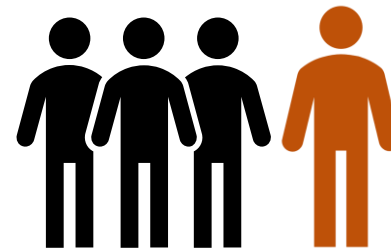


# Labor market shortage

2023



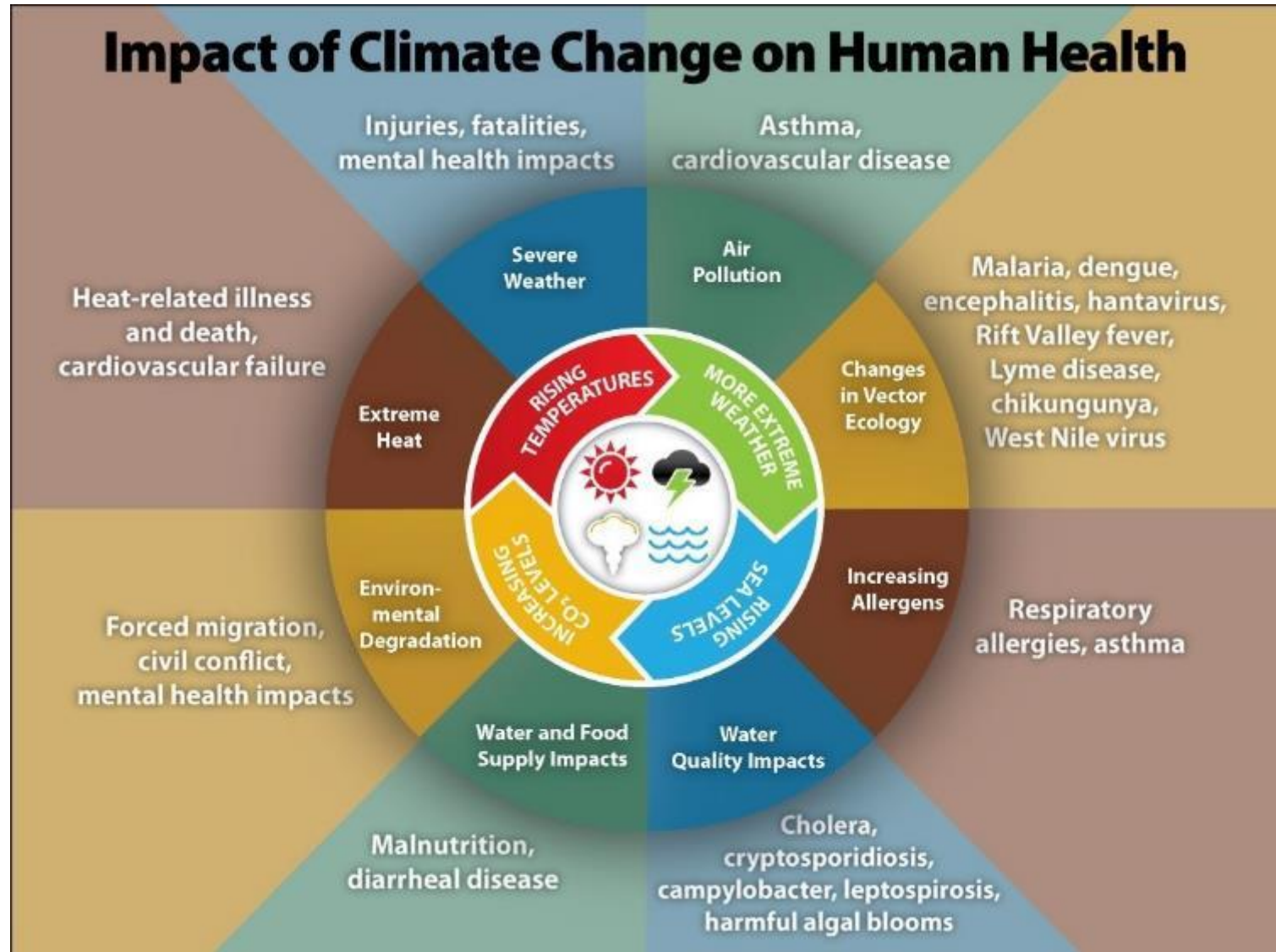
2031







# Impact of Climate Change on Human Health





# Challenges

- Privacy
- Technical development and support
- Connected to electronic patient file
- Offering inappropriate care



# Conclusion

- Avoids hospitalisation and dissatisfaction of hospital admission
- Reduces maternal stress and disrupted family life
- Proved safe and feasible
- Reduces stress on hospital ward
- Reduces costs
- Demands self-responsibility.





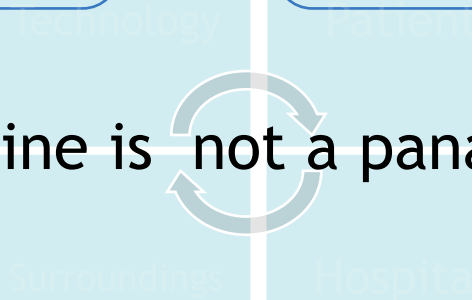
1. *Cost-effectiveness of telemonitoring for high-risk pregnant women. Buysse H et al. Int J Med Inform 2008 Jul;77(7):470-6. doi: 10.1016/j.ijmedinf.2007.08.009. Epub 2007 Oct 17.*
2. *Home telemonitoring versus hospital care in complicated pregnancies in the Netherlands: a randomised, controlled non-inferiority trial (HoTeL). Bekker MN et al. Lancet Digit Health. 2023 Mar;5(3):e116-e124.*
3. *The use and role of telemedicine in maternal fetal medicine around the world: an up-to-date review. Bruna Achtschin Fernandes et al. Health and Technology 2023. <https://doi.org/10.1007/s12553-023-00742-6>*
4. *Telemedicine for antenatal surveillance of high-risk pregnancies with ambulatory and home fetal heart rate monitoring- an update. Hod M, Kerner R. J. Perinat. Med. 31(2003) 195-200.*
5. <https://www.ser.nl/nl/Publicaties/zorg-voor-de-toekomst>
6. *Home management by remote self-monitoring in intermediate- and high-risk pregnancies: A retrospective study of 400 consecutive women. Anne Rahbek Zizzo et al. Acta Obstet Gynaecol Scand. 2021.*
7. *Perez-Ferre N. Int J Endocrinol. 2010;2010:1-6*
8. *Zairina E. Respirology. 2016;21:867-74.*
9. *High risk pregnancy monitored antenatally at home. W M Monincx et al. Eur J Obstet Gynecol Reprod Biol. 1997 Dec;75(2):147-53.*
10. *Cost-minimization analysis of domiciliary antenatal fetal monitoring in high-risk pregnancies. E Birnie et al. Obstet Gynecol 1997 Jun;89(6):925-9*



- Feasible

- Satisfaction 80-100%
- Good maternal and neonatal outcome
- Self- evaluation → empowerment

But..... Telemedicine is not a panacae for resolving health disparities



- Cost effective; 32-45%
- Klimate

- Improved access to care (rural and urban)
- Reduced antenal visits
- Beter triage and adequate referral



# Indications

- Preterm premature rupture of membranes (PPROM)
- Fetal growth restriction
- (high risk) Preeclampsia
- (Gestational) diabetes mellitus
- Reduced fetal movements
- Fetal anomaly
- History of previous fetal or neonatal loss



# Maternal and neonatal outcome

- 400 patient
    - No neonatal death related to HM
  - No seroious maternal complications
  - 18% readmittance. Median 1 episode.
  - Duration 12-30 days. Longest 192 days.
  - Satisfaction is high
  - Costreduction of 18 miljion DKK in 5 years. Reduction of 40-50%
- 
- *Home management by remote self-monitoring in intermediate- and high-risk pregnancies: A retrospective study of 400 consecutive women. Anne Rahbek Zizzo et al. Acta Obstet Gynaecol Scand. 2021.*



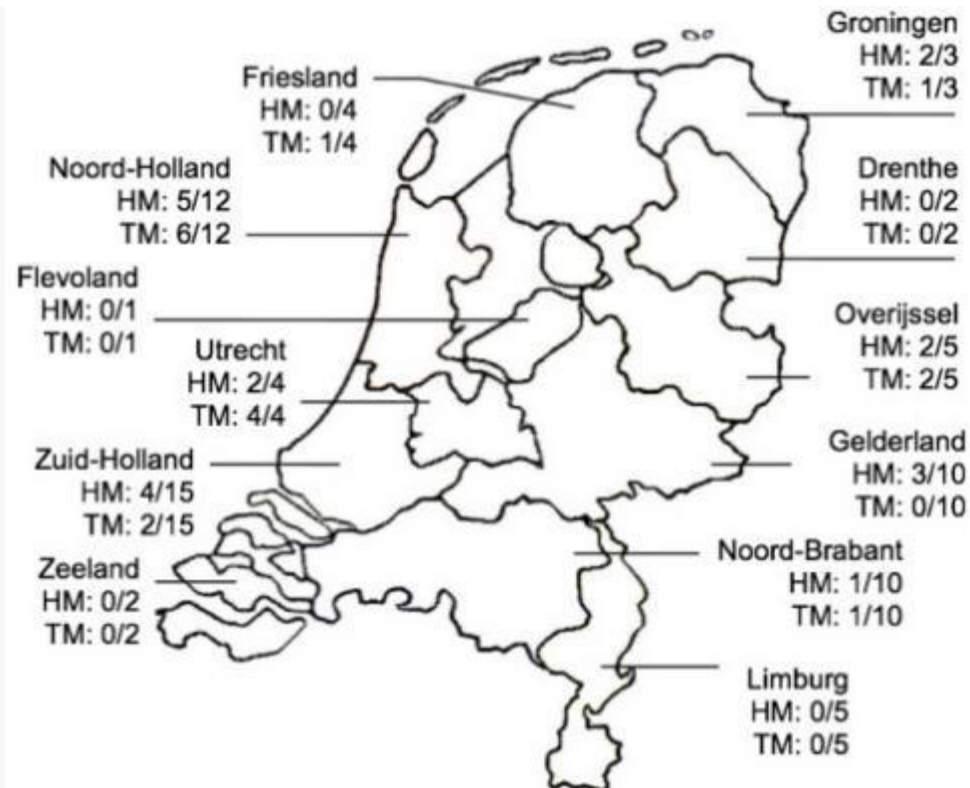


# Maternal and neonatal outcome

- 200 patients (100 each arm)
- Composit outcome: 10% reductie
- 5 SAE
  - Control group: 1 neonatal death in control group
  - Control group: 1 IUFD, 2 neonatal deaths, 1 eclampsia
  - Not study related
- >50% of study period admitted to the labour ward: 10%
- Higher score on satisfaction and participation



# Geographic distribution HM and TM in the Netherlands





# Benefits

- Patient tevredenheid
- Betere verwijzingsindicaties
- Beter bereik van patienten in rural areas
- Klimaat
- Cost effectiveness
  - 145k over 5 years<sup>1</sup>
  - 2774 euro per participant<sup>2</sup>

1. *Cost-effectiveness of telemonitoring for high-risk pregnant women. Buysse H et al. Int J Med Inform 2008 Jul;77(7):470-6. doi: 10.1016/j.ijmedinf.2007.08.009. Epub 2007 Oct 17.*
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# Kansen

- Verdere digitalisering door telemonitoring:
  - Zorg op afstand. Vooral rural area. Klimaat.
  - Zelfmanagement in de thuissituatie
- Blended care
  - Conventioneel met digitale technollgie. Draagvlak bij patienten en zorgverleners.



# Review 2022

- Telemonotoring is ook EPIC patienten contact via mijn dossier. Laagdrempelig contact met zorgverlener. Betere informatievoorziening. Empowerment van patiënte door zelf- evaluatie.
- Effectief in rural areas. But also in urban areas.
- Zorgt voor betere verwijzings indicatie van hoog risicozwangerschappen
- Kosten effectief
- Ptienten zijn tevreden
  
- Cave: Telemdicine os not a panacae for resolving health disparities

*The use and role of telemedicine in maternal fetal medicine around the world: an up-to-date review. Bruna Achtschin Fernandes et al. Health and Technology 2023. <https://doi.org/10.1007/s12553-023-00742-6>*



## Review 2003

- Feasible. Able to obtain Good quality tracings, able to upload the data.
- Access to care: improve, reduce visits to clinics, waiting times, unnecessary hospitalization
- Maternal en Neonatal outcome: No large RCT. Evidence suggests that TM is safe for high risk pregnancies. No association with an excess rate of neonatal and maternal adverse effects
- Satisfaction with care: between 80-100% for patients.
- Cost effectiveness: 32-45% reduction in gebruik techniek van cTG monitoring, less hospitalization days
- *Telemedicine for antenatal surveillance of high-risk pregnancies with ambulatory and home fetal heart rate monitoring- an update. Hod M, Kerner R. J. Perinat. Med. 31(2003) 195-200.*



# Conditions

- Reliable internet
- Access to technology, cellphone messages, WhatsApp access
- Digital literacy
  
- Caregiver
  
- Goede voorlichting en counseling aan patienten, ook over de risicos'.  
Verantwoordelijkheden en verwachtingen,
- Laag drempelig in huis komen



**Tanks for your attention**





## • Digitaal, middels bluetooth / tablet

- Veilig verzenden
- Makkelijk te bedienen
- Meerder apparaten
- Geen lange wachlijst
- Hotelstudie AUG 2016

Veiligheid

Effectiviteit

Tevredenheid

Randomisatie

Power (aantal) 400





## Hotelstudie.

Randomisatie:

Telemonitoring thuis, met alleen gebruik van S4B of opname ziekenhuis.

Inclusie criteria vanaf am 26 wk:

1. PE / hypertensie
2. IUGR
3. PPRM

