

# **Evaluation of the usability and perception of an intelligent home telecare system for high-risk obstetric patients: Prospective study.**

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Automated Tools for Antenatal  
Diagnosis (HADA)

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A portrait of Dr. Sara Arango Valencia, a young woman with long brown hair, smiling and wearing a white lab coat over dark scrubs. The background is a dark, out-of-focus interior space with horizontal lines and warm lighting. The text is overlaid on the left side of the image.

Dr. Sara Arango Valencia, 30 years old.  
Born in Medellín, Colombia.  
General Doctor from Universidad Pontificia Bolivariana.  
Member of the Scientific Direction in high-risk  
obstetric reference institution in Medellín.  
Winner of the scholarship for young researchers awarded by  
Ministry of Science and Technology of Colombia, 2021

Dr. Sara Arango V.  
Medicina General

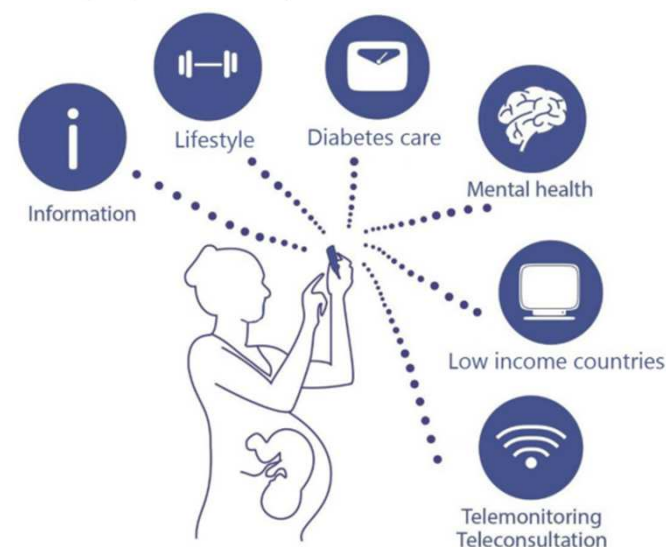


# INTRODUCTION

**Tele-monitoring of chronic conditions like Preeclampsia and Gestational Diabetes adds value in an efficient way [1-2].**

**To reduce maternal mortality in Colombia, a set of information systems was developed to help health personnel in decision-making. It contains an artificial intelligence core, based on a state machine, which, according to the variables obtained in the follow-up of the patient through prenatal controls, classifies the risk of different diseases, suggests orders, generates alerts, among others.**

**The usability and perception of an intelligent home telecare system for high-risk obstetric patients was evaluated from a high-risk obstetric reference institution in Medellín, Colombia.**



# nada

## Telehealth ecosystem for supporting the continuum of care of the pregnant women

**I-st  
Trimester**

- Education
- Identification

**II-nd  
Trimester**

- Education
- Tele orientation

**III-rd  
Trimester**

- Self Reporting
- Self Monitoring

**Birth**

- Education
- Tele Orientation
- Telemonitoring

# Web Application

For doctors, nurses, social workers, patients, doulas, etc

The screenshot displays a web application interface for a healthcare provider. The top navigation bar includes a status indicator 'Disponibile', a language selector 'Spanish', and a user profile 'Sara Medicas Arango Valencia'. The main content area is divided into several sections:

- Patient Information:** Includes a profile picture, name 'Mama Alejandro Biomedico', and contact details such as 'Cédula de ciudadanía: 10652336', 'Fecha de nacimiento: 08 octubre 1993', 'Edad: 29 años', 'EPS: Humana Vivir S.A. E.P.S.', 'Número de teléfono: (310) 270 - 2121', 'Número de celular:', 'Correo electrónico: mamaalejandrobiomedico@gmail.com', and 'Dirección: Cll 12 #59-12'.
- Información gestacional:** Displays 'semanas de gestación' (ECO: Desconocido, FUM: 30 + -6), 'fecha probable de parto' (ECO: Desconocido, FUM: 17 enero 2023), and 'ant. ginecoobstétrico: G:2, A:0, E:0, P:1, C:0, V:1'.
- Medicamentos activos:** Lists three active medications: 1. ACETILSALICILICO ACIDO 100 mg, 4 TABLETA cada 3 minutos durante 2 minutos vía ORAL; 2. CALCIO CARBONATO 600 mg, 3 TABLETA cada 3 horas durante 2 semanas vía ORAL; 3. FERROSO SULFATO 25 mg, 3 SOLUCION ORAL cada 2 horas durante 4 horas vía ORAL.
- Antecedentes personales:** Lists two personal medical history items: 1. Enfermedad tiroidea; 2. Hipertensión.
- Alergias:** No allergies are listed.
- Cálculo de riesgo:** A bar chart showing risk percentages: 3.2%, 88.5%, 23.9%, and 33.4%.
- Diagnóstico/Problemas:** Lists one diagnosis: 1. EMBARAZO OVARICO, diagnostico: secundario, Confirmado Nuevo, fecha: 27/10/2022.

The bottom navigation bar includes links for 'Historial clínico', 'Líneas de vida', 'Historial de mediciones', and 'Atención'.

Telemedicine

Clinical Decision  
Support System

Risk Profile

Interoperability

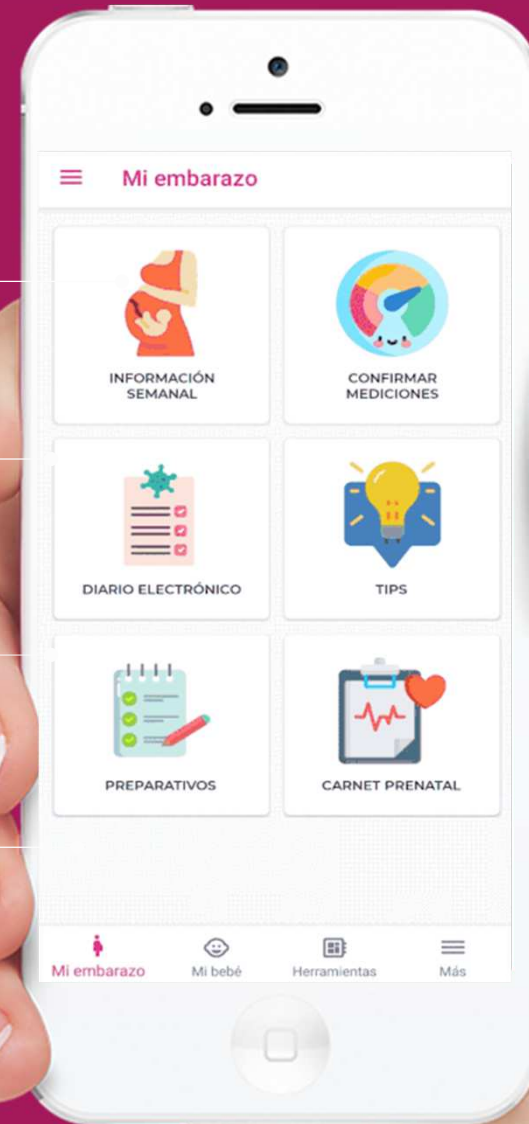
# Mobile APPLICATION

**Specific  
Education**

**Reminders / Alert**

**Report Symptoms**

**Self-monitoring**



# METHODS

**Type of study:** prospective observational study. Recruitment in October 2021 until October 2022

This study was approved by Medical University Ethics Committee. Patients involved signed informed consent prior of blood pressure, weight and glucometry measurements.

## **Inclusion criteria:**

- **Women over 18 years old with a gestational age < 36 weeks at the clinic**
- **Diagnosis of gestational diabetes (GD) and/or hypertensive disorders associated with pregnancy (THAE) without criteria of severity**
- **Wi-Fi network at home AND a cell phone with an Android ® operating system**

## **Exclusion criteria:**

- **Living outside territories selected by the researchers**
- **Fetal anomalies, Fetal Growth Restriction (FGR) II – III**
- **Needing of in-hospital management**
- **Maternal cardiac arrhythmias, acute kidney disease, pregestational diabetes**

# METHODS

The subjects were granted with access to secured platform. This platform contains an educational page with patient information about Hypertension and Diabetes in pregnancy and contact information.

Automatically loaded to mobile app, by Bluetooth technology, single measurements can be checked by patient, and sent to platform's dashboard in website, where can be visualized as trend graphics .

According to the protocol established by researchers, patients were monitored in real time and attended fortnightly telemedicine appointments with an obstetrician until the sixth postpartum week. They must attend face-to-face appointments when obstetrician indicated during whole pregnancy.

**Main outcome:** Evaluate usability and perception of an intelligent home telecare system for high-risk obstetric patients from a high-risk obstetric reference institution in Medellín through two questionnaires.

**Secondary outcome:** describe maternal and perinatal diagnoses and clinical outcomes

## **Questionnaires:**

At the end of the follow-up (sixth week postpartum) period, The Computer System Usability Questionnaire version 3 (CSUQ) [3] was applied to evaluate the usability of the software and care model created by researchers was evaluated by perception survey.

Quantitative variables are presented with means and standard deviations and qualitative variables with median and ranges.



# METHODS: Usability Survey

**Table 1. (CSUQ) Usability Survey Version 3**

**16 questions with response scale of 1 to 7, with 7 being strongly in disagreement.**

**CSQU generates 4 different scores:**

**Overall (average of the responses for items 1–16, all the items)**

**System Usefulness (SYSUSE: average of items 1–6)**

**Information Quality (INFOQUAL: average of items 7–12)**

**Interface Quality (INTERQUAL: average of items 13–15).**

English version CSUQ-V3 (Lewis, 1995).	
1	Overall, I am satisfied with how easy it is to use this system.
2	It is simple to use this system
3	I am able to complete my work quickly using this system.
4	I feel comfortable using this system.
5	It was easy to learn to use this system.
6	I believe I became productive quickly using this system.
7	The system gives error messages that clearly tell me how to fix problems.
8	Whenever I make a mistake using the system, I recover easily and quickly.
9	The information (such as on-line help, on-screen messages, and other documentation) provided with this system is clear.
10	It is easy to find the information I needed.
11	The information is effective in helping me complete my work.
12	The organization of information on the system screens is clear.
13	The interface of this system is pleasant.
14	I like using the interface of this system.
15	This system has all the functions and capabilities I expect it to have.
16	Overall, I am satisfied with this system.

# METHODS: Perception Survey

## HADA telemonitoring system perception survey

I feel satisfied with the care of the health personnel of the telemonitoring program.

I feel satisfied with the follow-up of the HADA telemonitoring program

HADA telemonitoring allowed the timely attention of my pathology

I would recommend my acquaintances to use this HADA telemonitoring system

The instructions given in the HADA telemonitoring program were easy to follow

I am satisfied with the quality of the HADA telemonitoring virtual consultation

I am satisfied with the duration of the virtual consultation

It was easy to establish and maintain the connection in virtual consultations

Taking blood pressure, weight and/or glucometry was simple

Confirmation (recording) of blood pressure, weight and/or glucometry was simple

HADA telemonitoring encouraged me to monitor and take care of my health status

The HADA telemonitoring program easily fits into my daily routine

HADA telemonitoring takes a short time per day

The HADA telemonitoring program facilitated the management of my pathology

The HADA telemonitoring program made it possible to reduce the level of anxiety generated by my illness

I felt calm when my measurements with the HADA equipment were at normal levels

The information I provided during the telemonitoring program was handled with privacy.

**Table 2. HADA telemonitoring system perception survey : 17 questions with a response scale from 1 to 5, 5 being totally satisfied, 1 being dissatisfied; that evaluates general satisfaction, the perception of self-care with monitoring, the privacy of the information and quality of care.**

# PRELIMINARY RESULTS



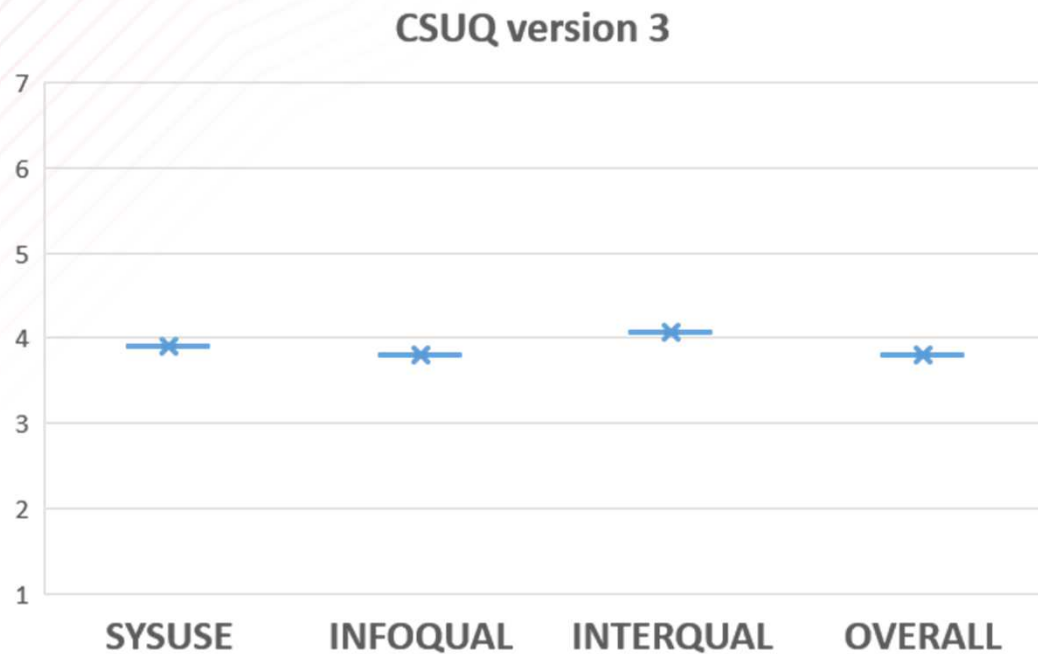
Figure 1. Patients Flowchart

n=37	
Age	29 ± SD 5.5
Educational level	Secondary: 5 (14%)
	Technical: 20 (54%)
	Graduate programs: 10 (27%)
	Posgraduate programs: 2 (5%)
Occupation	Student: 1 (2%)
	Employee: 25 (68%)
	Unemployed: 11 (30%)
Gestational age at admission (Trimester)	1st: 0 (0%)
	2nd: 3 (8%)
	3rd: 34 (92%)
Median total follow-up time	62 days IQR 34.5 (50.5 - 85)

Exclusion criteria (n=144)
Needing of in-hospital management: 48 (33%)
Living outside territories selected: 41 (28%)
Did not agree to participate as volunteer: 17 (12%)
More than 36 weeks pregnant: 16 (11%)
No internet at home: 11 (8%)
Severe fetal malformation or FGR II/III: 6 (4.5%)
No android device: 2 (1.5%)
Under 18 years old: 2 (1.5%)
Unknown gestational age: 1 (0.5%)

Table 3. Demographic Characteristics

# QUESTIONNAIRES RESULTS



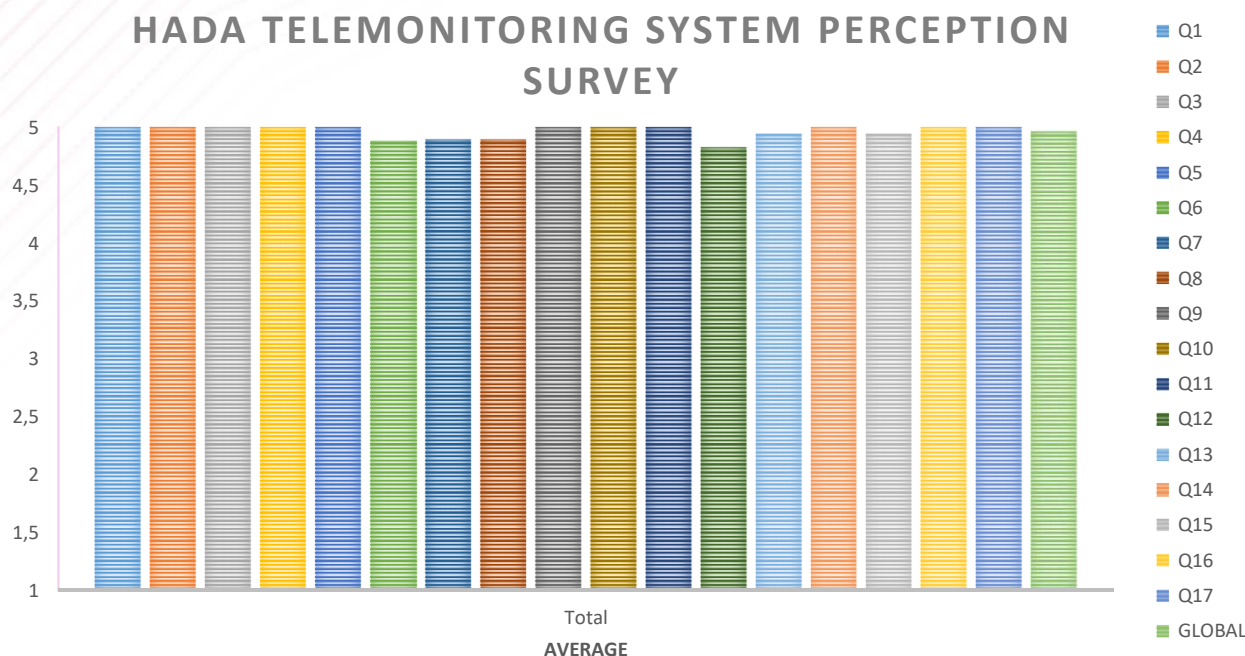
CSUQ version 3	n=36
SYSUSE: average of items 1–6	3.91 ± SD 0.24
INFOQUAL: average of items 7–12	3.8 ± SD 0.13
INTERQUAL: average of items 13–15	4.07 ± SD 0.33
Overall: average of items 1–16	3.8 ± SD 0.24

**Table 4.** Mean  $\pm$  SD values of CSUQ-16 Test and by the categories: System quality (SYSUSE), Information quality (INFOQUAL) and Interface quality (INTERQUAL). The lower score is the better performance and satisfaction.

**Figure 2.** Boxplot Score CSUQ-16 overall (score total) and by categories : System quality (SYSUSE), Information quality (INFOQUAL) and Interface quality (INTERQUAL).



# QUESTIONNAIRES RESULTS

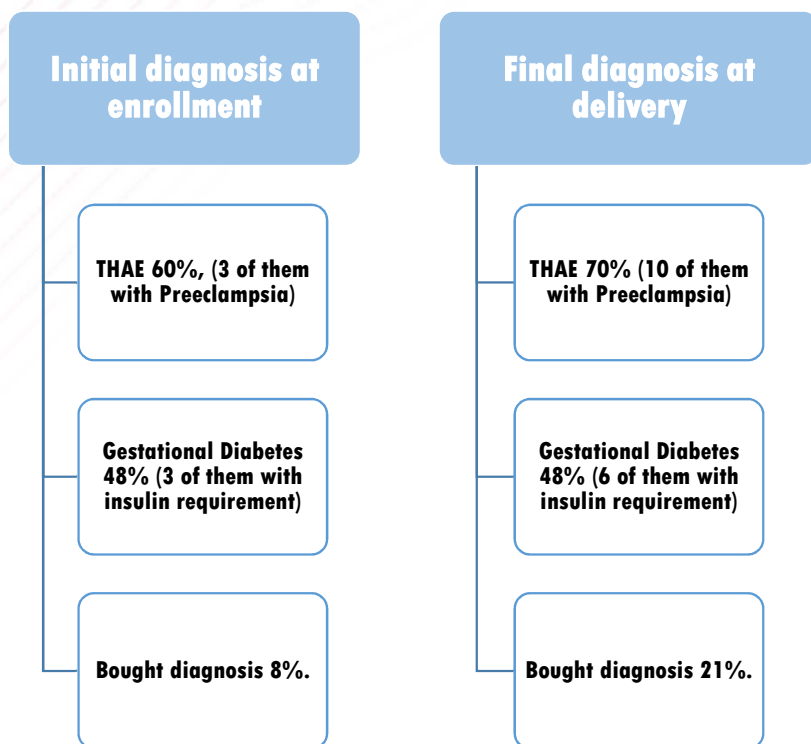


**Figure 3. Boxplot Score Satisfaction survey n=35: Average Score of Questions 1 – 17 and Global**

Question	Average	SD
Q1	5	0.3
Q2	5	0.3
Q3	5	0.17
Q4	5	0.17
Q5	5	0
Q6	4.8	0.4
Q7	4.8	0.3
Q8	4.8	0.4
Q9	5	0
Q10	5	0.4
Q11	5	0.3
Q12	4.8	0.7
Q13	4.9	0.6
Q14	5	0.17
Q15	4.9	0.2
Q16	5	0
Q17	5	0
GLOBAL	4.9	0.3

**Table 6. Score Satisfaction survey n=35: Mean  $\pm$  SD values Score of Questions 1 – 17 and Global**

# SECONDARY OUTCOMES



## \* Other comorbidities reported during follow-up:

SPP (16.2%); Gestational hypothyroidism (8%); Urinary Tract Infection (5.4%); Polyhydramnios (5.4%); Asthma (5.4%); Pregestational Hypothyroidism (2%); Hyperthyroidism (2%); Migraine (2%); Uterine myomatosis (2%); Gestational Cholestasis (2%); Placenta Praevia (2%); Lupus (2%); Epilepsy (2%); Glomerulonephritis (2%); Anemia (2%)

## Other Clinical Outcomes

### Maternal Delivery

Cesarean sections (n=20)  
Instrumental delivery (n=1)  
Espontaneous delivery (n=15)  
Unknown = 1.

### Intensive care requirements:

Maternal (n=3)  
Neonatal (n=8)

### Neonatal

Born at term (n=26)  
Preterm (n=9)  
Unknown (n=2)

### Fetal

Macrosomia (n=6)  
FGR type I (n=6)  
Small for Gestational Age (SGA) (n=1)

# DISCUSSION

**This study evaluated usability and perception of user experience with a mobile App developed for remote monitoring of patients in high-risk pregnancy.**

**In general, results of the system obtained shows an acceptance of use of the App ( $3.8 \pm 0.24$ ). General evaluation of the created care model reflects high satisfaction ( $4.9 \pm 0.3$ ).**

**When evaluating by domains, a similar value of user acceptance was also obtained (SYSUSE ( $3.91 \pm 0.24$ ), INTERQUAL ( $4.07 \pm 0.33$ ) and INFOQUAL ( $3.8 \pm 0.13$ )).**

**Since ease of use and learning of the technology can greatly influence the selection and adoption of it, the evaluation of these parameters are recognized as a strength of this study.**

**Although these results are preliminary, it can be concluded that telemonitoring in high-risk pregnant women is a promising modality.**

**Studies have focused efforts on testing the benefits of telemedicine to increase patient adherence and satisfaction, improve time control, close distance gaps and reduce inequity [4]. Studies with analytical designs are required to establish associations and changes in clinical results that support decision making in favor of implementation of these models.**

**Health providers must take into account the advantages and disadvantages of telemonitoring, and policies must evolve at the same rate as the technologies implemented.**

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THANK YOU SO MUCH!

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