# INNOVATIVE TECHNOLOGIES FOR HEALTH IN DEVELOPING COUNTRIES

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# EHAS Foundation

# Our mission

To check if a suitable and innovative use of ICT can improve the public healthcare system in remote areas of developing countries.

- Why healthcare?

- What means suitable in these contexts?

- What kind of innovations?

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# Why Healthcare?

# Sustainable Development Goals

# Health

- reduce the <u>global MMR</u> to less than 70 per 100.000 live births.

- end preventable deaths of newborns and children under-5 : reduce <u>NMR</u> to at least as low as 12 per 1.000 live births and <u>under-5 mortality</u> to at least as low as 25 per 1.000 live births.

- ensure <u>universal access</u> to sexual and reproductive health-care services.

- end the <u>epidemics</u> of AIDS, tuberculosis, malaria and neglected tropical diseases.

**3 GOOD HEALTH & WELL-BEING**

Ensure healthy lives and promote well-being for all at all ages

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# Global Health Indicators

|  | MMR | Under-5-Mortality |
|---|---|---|
| 1990 | 380 | 90 |
| 2012-2013 | 210 | 48 |
| MDG (2015) | 95 | 30 |
| SDG (2030) | 70 | 25 |

As reference, MMR in Portugal was 6.0 in 2013

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# Global Health Figures

- 289.000 maternal mortality cases and 2,8 millions of perinatal mortality cases (1 million of deaths during the first day) in 2013 [1,2].

- MMR in developing countries was <u>14 times larger</u> than in developed countries in 2013. [3]

- 40 millions of births without proper health assistance in 2012, 32 millions of them in rural areas [3].

- In rural areas of developing countries only 1 every 3 obstetric emergencies get proper and timely attention.

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# Innovation

- Develop quality, reliable, sustainable and resilient infrastructure, including regional and transborder infrastructure, to support economic development and human well-being, with a focus on affordable and equitable access for all.

- Significantly increase access to information and communications technology and strive to provide universal and affordable access to the Internet in least developed countries by 2020.

**9 INDUSTRY, INNOVATION & INFRASTRUCTURE**

Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation

# Partnership

- Enhance <u>cooperation on and access to science, technology and innovation</u>.

- Encourage and promote effective public, public-private and civil society <u>partnerships</u>.

- Enhance capacity-building support to developing countries to increase significantly the <u>availability of high-quality, timely and reliable data</u> disaggregated by income, gender, age, race, etc.



17 **PARTNERSHIPS FOR THE GOALS**

Strengthen the means of implementation and revitalize the global partnership for sustainable development

# What means suitable in these contexts?

# Rural areas

40% of the world population and 21% of the population in Latin America live in rural areas, characterized by political and geographic isolation:

- High maintenance costs of services and infrastructures due to large distances.

- Lack of infrastructure (energy, water, etc.)

- Important presence of native peoples.

- Skills shortages.

- Low population density.

# Primary healthcare



PUESTOS MÉDICOS
EN ZONAS AISLADAS

CENTROS DE SALUD
DE REFERENCIA

CONSULTORIOS

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# Health system needs

The work of EHAS started with an analysis of needs in rural healthcare systems of developing countries:

- Patients recruitment, diagnosis and correct treatment.

- Continuous training for health personnel.

- Coordination of emergencies.

- Epidemiological surveillance.

# What kind of innovations?

**Would do you understand by innovation?**

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# Innovation

Innovation can be defined as the <u>application</u> of <u>new ideas</u> to <u>improve</u> the products, processes or other aspects of an institution activities in order to better accomplish its goals.

- New ideas → usually based on R&D  (and training).

- Application

  → is a practical work (usually implies complexity).

  → can be replicated (even scalable).

- Improve → can be measured (evaluated).

# Tulasalud



- Medium HDI (0.581 in 2012) and high inequality

- MMR: indigenous population (211)/ non-indigenous (70)

# Tulasalud Scenario

Alta Verapaz (Guatemala) has 1.2 million inhabitants:

- 78% live in rural areas.

- 89% are from indigenous communities.

- 48% lives in extreme poverty.

- MMR was 273 deaths per 100.000 live births (2012)

- IMR was 14.38 deaths per 1.000 live births (2012).

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# Tulasalud Scenario

Rural population don't have access to a proper primary healthcare:

- Lack of health personnel in rural areas.

- Bad quality of roads and scarcity of transport means.

- Population without resources to reach health centers.

**Community Facilitator** is a volunteer accepted by the community who, with a small salary from    the Government, provides healthcare services.

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# Tulasalud Solution

- Consult with specialists and receive continuous training.

- Send epidemiological and clinical information.

- Community health promotion and prevention activities through distance learning sessions.





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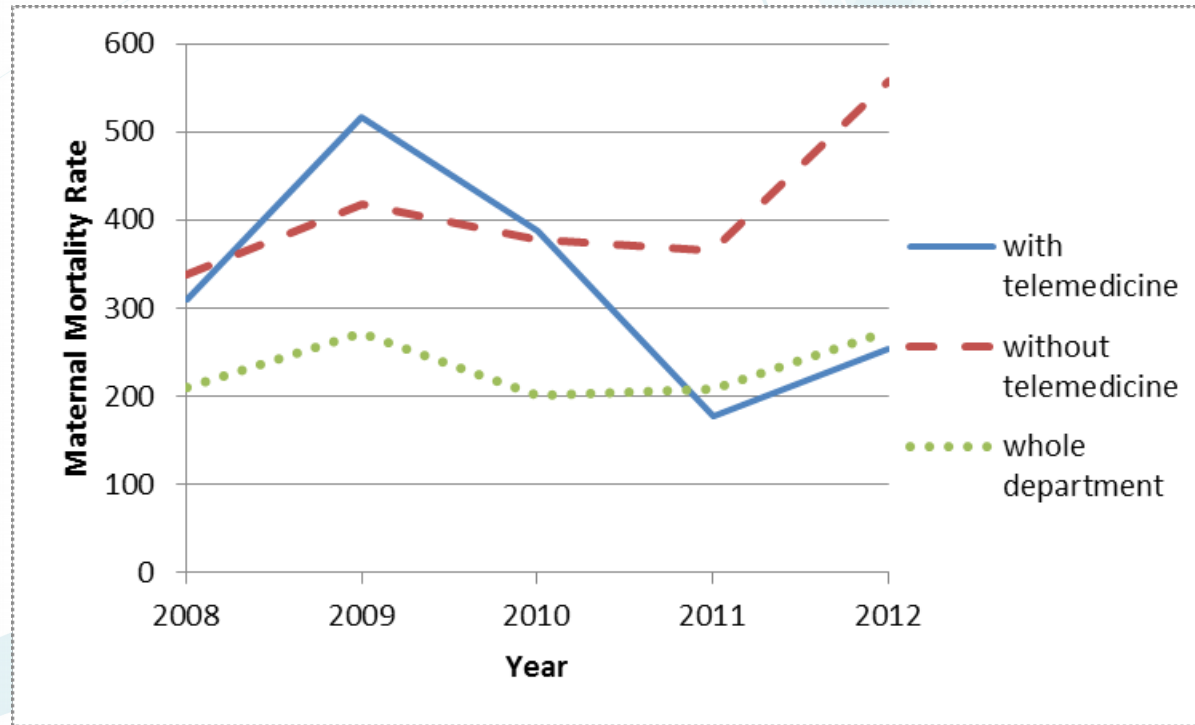EHAS
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# Tulasalud Solution

Currently **195 community tele-facilitators** cover **710 communities** and a population of approximately **330.000 people**. Since the project started (2009), the tele-CFs have carried out:

- **116.275 medical consultations** (6,783 of which were related to healthcare during pregnancy and childbirth)
- **2.014 urgent referrals** (298 and 235 classified as obstetric and pediatric "saved lives", respectively)

# Tulasalud Impact on MMR



- MMR shows a notable downward trend in the intervention group, while the opposite is the case for the control group.

- Statistical significance was verified with a p-value < 0,05.

# Tulasalud strategy

A public-private partnership:

- Tulasalud proposes a new procedure based on a new tool and additional training (provided by Tulasalud).

- The Health Ministry provides additional resources: health personnel responsible of providing remote assistance, distance lessons and health promotion activities.

- Cellular operators were involved to get affordable tariffs.

**Would you consider this solution as innovative?**

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# A step further

Main <u>causes of maternal mortality</u> in developing countries [1]:

- Hemorrhage previous or after the labor (27%).

- Gestational hypertension (14%).

- Infections (11%).

- Abortions (9%).

- Obstructed labor (7%).

- Intercurrent diseases such as anemia, diabetes, malaria or HIV causes 28% of deaths, as indirect causes.

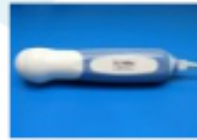**How could they be detected ahead of time?**

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# Prenatal checkups

# Healthy Pregnancy

- <u>Ultrasounds</u>: Pregnancy Due Date, vitality, multiple pregnancy, fetal position, amniotic fluid and macrosomia.

- <u>Strip tests</u>: blood (HIV, Syphilis, HB, hemoglobin, glucose, malaria) and urine (nitrites, proteins and leukocytes).





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# Healthy Pregnancy

Integration VS software/hardware development

# Healthy Pregnancy  Challenges

Along the project we have faced different types of problems that show the complexity of the initiative:

- Technical problems (software and hardware).

- Institutional changes require several years.

- Stock out of strip test at suppliers side.

- Political instability.

- Personnel rotation.

- Cultural differences.

# Healthy Pregnancy Impact

Semi-experimental study with an intervention group composed of pregnant women attended with Healthy Pregnancy technology, and a control groups composed by pregnant women attended without diagnostic tools.

Results:

- An important reduction of <u>maternal deaths</u> in the intervention group (comparing with the control group).

- An important reduction of <u>neonatal deaths</u> in the intervention group (comparing with the control group).

- Identification of the most <u>common problems</u> for maternal health in these rural areas (high prevalence of anemia).

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# Healthy Pregnancy Strategy

We have created a company in Peru - "Health Link" – that offers Regional Health Directorates (DIRESAs) the service of renting the backpack, receiving training and assuring quality control, with a cost of $45.00 per pregnant woman attended.

The INTEGRAL HEALTH INSURANCE of Peru could cover the costs of antenatal care (ultrasounds, blood and urine tests) something which so far has not been done due to lack of technology.

# Healthy Pregnancy Innovation

- Suitable and affordable technology.

- Feasible training strategy.

- Public-private partnership.

- Impact on MMR and NMR.

- It has been scaled to other departments in Guatemala (San Marcos) reaching 4.000 pregnant women in the last year.

- It is being scaled to other countries: Equatorial Guinea and Peru.

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# Future works

- Add functionalities to the ultrasound scanning software and increase integration.

- Research on automatic analysis of ultrasound images.

- Improve information exchange.

- Complete training materials.

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# References

- [1] Kassebaum NJ et al. Global, regional and national levels and causes of maternal mortality during 1990 – 2013: systematic analysis for the Global Burden of Disease Study 2013. The Lancet, Volume 384, Issue 9947, 13–19 September 2014, Pages 980 – 1004.

- [2] Haidong Wang et al. Global, regional, and national levels of neonatal, infant, and under-5 mortality during 1990 – 2013: a systematic analysis for the Global Burden of Disease Study 2013. The Lancet. Volume 384, Issue 9947, 13–19 September 2014, Pages 957–979.

- [3] Millennium Development Goals Report 2014. Edited by the United Nations. New York, 2014.

- [4] Andrés Martínez-Fernández et al. TulaSalud: an m-health system for maternal and infant mortality reduction in Guatemala. Journal of Telemedicine and Telecare 2015,  Volume 21(5), Pages  283–291,

- [5] Tulasalud: www.tulasalud.org

- [6]  Healthy Pregnancy: www.ehas.org/healthy-pregnancy/

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