Prenatal Care for Communities and Remote Ultrasound Imaging

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October 20, 2014

Overview

Maternal and Child Health in Ghana - The Challenges

Some Health Challenges in Ghana

Parameter	Switzerland	Global	Ghana
Child mortality ratio (per 1,000 live births)-2013	4	46	78
Maternal mortality ratio (per 100,000 live births)-2013	6	210	380
Physician density (per 10,000 people)- 2005-2012	40.8	13.9	0.9

Prenatal Care in Ghana - The Challenges

Maternal Health Challenges

- Globally, there were an estimated 289,000 maternal deaths in 2013. The sub-Saharan Africa region alone accounted for 62% of these deaths [2].

- 80% of maternal deaths are due to obstetric complications such as **haemorrhage, unsafe abortion, pre-eclampsia and eclampsia and obstructed labour**.

- An estimated 74% of maternal deaths could be avoided if all women had access to the interventions for preventing or treating pregnancy and birth complications [1].
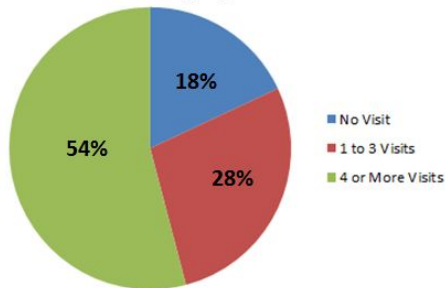
Understanding the Challenge - A Survey by Docmeup

Survey on Prenatal Care in Some Selected Rural Communities in Central Region-Ghana

- We studied women who had had pregnancies within 5 years preceeding the study
- 61 women from four (4) rural communities (where we have rolled out the Docmeup project) aged 18-44.

Understanding the Challenge - A Survey by Docmeup

Number of ANC visits by pregnant women

18%

54%

28%

- No Visit
- 1 to 3 Visits
- 4 or More Visits

Alarming!

Miscarriage rate among women who attended ANC is 1 in 12 and that of those who did not attended ANC is 1 in 2.

Understanding the Challenge - A Survey by Docmeup

Reasons for no ANC visits

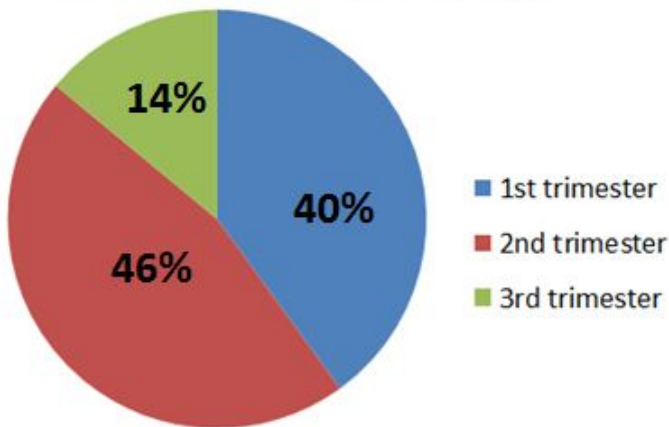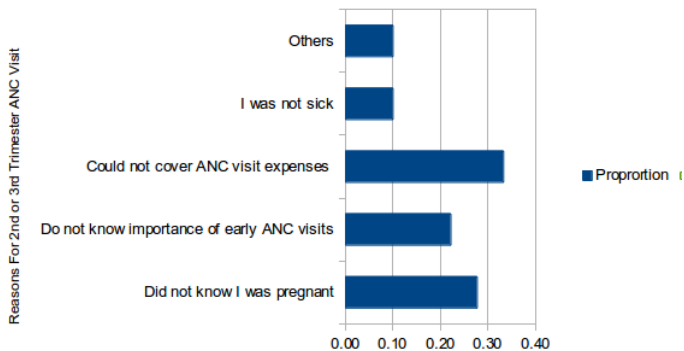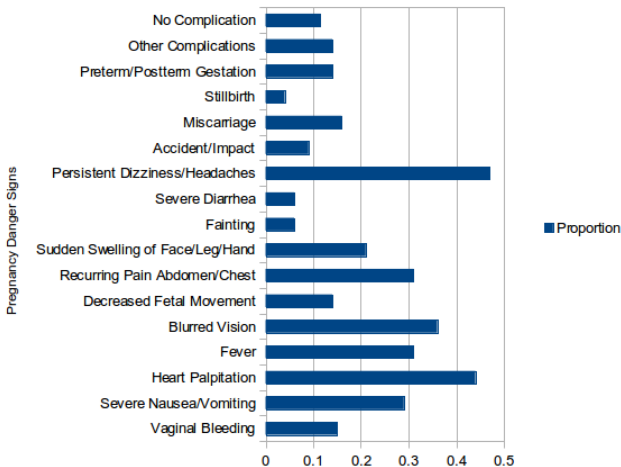# Understanding the Challenge - A survey by Docmeup

Understanding the Challenge - A Survey by Docmeup

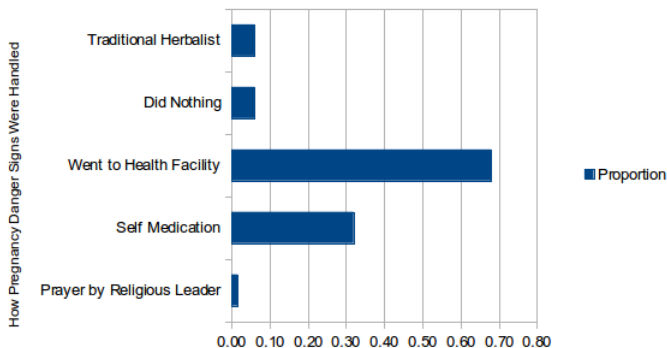**Reasons for late ANC visits**
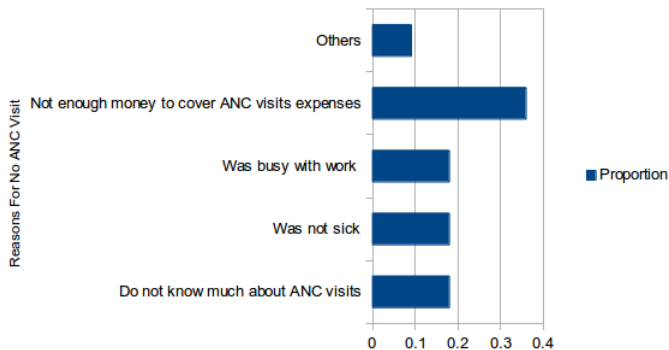
Understanding the Challenge - A Survey by Docmeup

Pregnancy complications/ Danger signs

Understanding the Challenge - A Survey by Docmeup
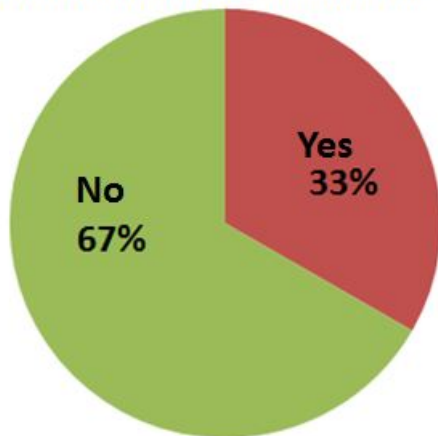

How pregnancy complications were handled

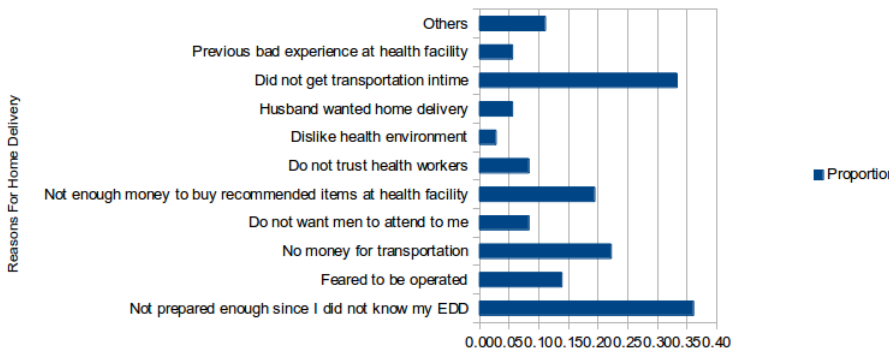# Understanding the Challenge - Dangers of Self-medication

Understanding the Challenge - A Survey by Docmeup

Birth attended by skilled attendant

Yes 33%

No 67%

Understanding the Challenge - A Survey by Docmeup

Why they deliver without a skilled attendant

The Docmeup Project - An Intervention

Activities of CHWs tackles problems of:

- lack of knowledge about importance of (early) ANC,
- self medication,
- late detection of danger signs,
- lack of knowledge about advantages of having birth attended by skilled attendants,
- late detection/reporting of pregnancy hence early ANC visits.

Monthly ultrasound scan tackles problems of:

- lack of knowledge about EDD leading to late/no planning to have birth attended by skilled attendants,
- late detection of some complications,
- burden of cost.

Impact of the Project So Far

Impact of Project

Detection of three hepatitis B pregnant patients.

Impact of the Project So Far

Impact of Project

- Early detection of an ectopic pregnancy.
- All pregnant women who get registered in first or second trimester will have minimum of 4 ANC visits.
- 70% of births to be attended by skilled attendants.

The Docmeup Project - The Way Forward

The Way Forward

- Tackling transportation and cost problems.
- Using mHealth technologies to give reminders to pregnant women about their medications, next ANC visits, EDD, etc.
- Sustainability of the project.
- Scaling up.

Appreciation

Thanks to ETH for providing seed money for the project.

Greatest Challenge

Financing the project beyond June 2015.

The Docmeup Project and Image Processing

Segmentation of Ultrasound Images Foetal Anatomic Structures

The Docmeup Project and Image Processing

Research Project Title: Segmentation of Ultrasound Images of
Foetal Anatomical Structures Using Pixel Classification.
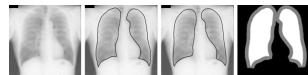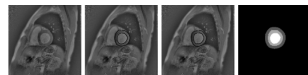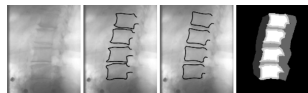
Reviewed Paper

The method was applied on spine X-ray,
cardiac MRI and thorax X-ray.
**Maximum Likelihood Shape Particle
Filtering:**
$f_t(S) = (P(I|S)^t P(S))^{\frac{1}{t}}$
$\lim_{t\to\infty} argmax_S f_t(S) = argmax_S P(I|S)$.
K-NN Classifier: $P(u|x) = \frac{k_u+1}{k+n}$

[3]

The Docmeup Project and Image Processing

Using Deformable Superellipse

$$\left(\frac{x}{a}\right)^{\frac{2}{\varepsilon}} + \left(\frac{y}{b}\right)^{\frac{2}{\varepsilon}} = 1$$

Similarity Transformations

$$Translate(l_1, l_2) : \begin{cases} x' = x + l_1 \\ y' = y + l_2 \end{cases}$$

$$Rotate(\varphi) : \begin{cases} x' = x\cos(\varphi) - y\sin(\varphi) \\ y' = x\cos(\varphi) + y\sin(\varphi) \end{cases}$$

$$Scale(f) : f = b$$

Deformation

$$Squareness(\delta) : \delta = \varepsilon$$

$$Aspect\ Ratio(xy) : xy = a/b$$

Linear tapering along y-axis(t) :

$$\begin{cases} x' = (\frac{ty}{b} + 1)x \\ y' = y \end{cases}$$

$$Squareness(\delta) : \delta = \varepsilon$$

Circular bending along y-axis(u) :

$$\begin{cases} x' = (b/u - y)\sin(\frac{x}{b/u-y}) \\ y' = b/u - (b/u - y)\cos(\frac{x}{b/u-y}) \end{cases}$$
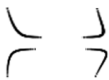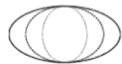
A superellipse   Bending deformation

Tapering deformation   Both applied

[4] [5]

Characterization

$$P = \{l_1,\ l_2,\ \varphi,\ f, \delta,\ xy,\ t, u\}$$

Optimization

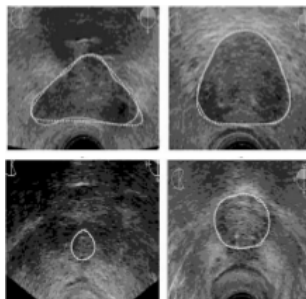Area-minimizing formulation of the squared algebraic distance:
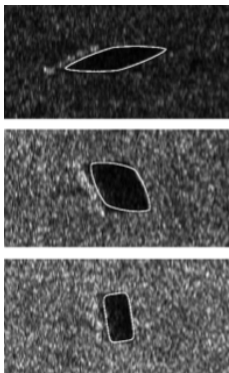
$$E = min \sum_{i=1}^{N} \left[\sqrt{ab} f(x_i, y_i; P) - 1 \right]^2$$

where

$$f(x,y) = \left(\left(\frac{x}{a}\right)^{\frac{2}{\varepsilon}} + \left(\frac{y}{b}\right)^{\frac{2}{\varepsilon}} \right)^{\varepsilon}$$

and $f(x, y; P)$ is the inside-outside function [4].

The Docmeup Project and Image Processing

[4] [6]

References

[1] Paul Hunt; Judith Bueno De Mesquita, Colchester [etc.].
Reducing maternal mortality : the contribution of the right to the highest attainable standard of health, : University of Essex. Human rights centre : with UNFPA, [2007].

[2] Trends in Maternal Mortality: Estimates by WHO, UNICEF, UNFPA, The World Bank and the United Nations Population Division [1990 to 2013].

[3] Marleen de Bruijne and Mads Nielsen, *Shape Particle Filtering for Image Segmentation*: MICCAI 2004, LNCS 3216, pp. 168175, [2004].

[4] Gong L, Pathak SD, Haynor DR, Cho PS, Kim Y, *Parametric shape modeling using deformable superellipses for prostate segmentation*. [2004] Mar;23(3):340-9. IEEE Trans Med Imaging.

[5] Maurizio Pilu , Andrew W. Fitzgibbon , Robert B. Fisher, *Training PDMs on Models: The Case of Deformable Superellipses* [1996].

References

[6] Esther Dura, Judith Bell, and Dave Lane , *Superellipse Fitting for the Recovery and Classification of Mine-Like Shapes in Sidescan Sonar Images* . IEEE Journal of Oceanic Engineering, Vol. 33, No. 4, [2008].