Journal of the International Society for Telemedicine and eHealth

Editors

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Journal of the International Society for Telemedicine and eHealth

Special Theme: Women in eHealth
(The papers in this compilation were originally published in JISfTeH 2015, vol 3.)

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WOMEN IN EHEALTH GUEST EDITORIAL

Make It Happen

"Make it happen" was the theme of the International Women's Day in 2015. This slogan is very appropriate for this special issue of the Journal of the International Society for Telemedicine and eHealth (JISfTeH) that, for the first time, brings women in eHealth to the mainstream discussion.

It is true that this is not a new subject. We have all witnessed campaigns, government promises, social movements, and initiatives aiming at raising awareness for gender inequalities and prospects for women in several areas, and most recently in Information and Communication Technologies (ICTs).

The United Nations system has been advocating for women's rights, women studies, and gender equality for a long time, as part of its policy across all continents. The 4th World Conference on Women: Action for Equality, Development and Peace, held in Beijing in 1995, highlighted the importance of gender equality and empowerment of women through ICT. Nevertheless, 20 years on, we still know that ICT impacts men and women in different ways.

Following the Beijing Declaration, the World Health Organization (WHO) has strengthened its work towards gender equity and human rights and is steadily raising awareness of norms, values, and inequalities related to the role of gender in perpetuating disease, disability, and even death, and are encouraging changes in society to fight gender as a barrier to good health.

However, women continue to have fewer opportunities to receive basic education and therefore fewer opportunities to benefit from the information society. This reflects the statement from the International Telecommunication Union (ITU) showing that the number of girls choosing careers in technology-related fields is declining worldwide.

The ability of women to take advantage of ICT greatly depends on prevailing policies and an enabling environment to extend the ICT infrastructure to where they live. Inequality impacts women in both developed and developing countries, but disadvantaged communities suffer more from these disparities. In most cases, women are excluded from social and economic opportunities created by ICT, depriving them of the potential active role in their lives and their families alike.

There are many examples where women have benefited from ICT in education, health, commerce, etc., but the majority of these platforms are designed and implemented for women as recipients, without their full participation in the conceptualization, design and development of these solutions, which makes these programmes less appropriate to their needs. Also, women as innovators and creators of ICT-based solutions is still lagging, as they have not been given enough opportunity to access educational and training programmes, let alone job opportunities.

It is therefore an obligation to accelerate the efforts made by policy- and decision-makers, civil society, professional associations, scholars, NGOs, and development partners, including the private sector, to break down barriers in ICT and to include women and girls in the process.

It is also necessary to strengthen ongoing initiatives and support local solutions with local content in local languages. Most of all it is important to raise awareness in society to better understand the needs and trends in the sector.

Let us not forget to put into practice the commitments previously made at UN conferences and summits, particularly the World Conferences on Women over the last 20 years, as well as the seminar on Women in Engineering Leadership held in Kuala Lumpur in 2014.

We should all be prepared to relate the power of ICT to support sustainable development and contribute to closing both the digital divide and the gender gap.

However, the central point in this issue of the JISfTeH is to address how digital technologies can be appropriately used to create participatory governance

models that enable socially and economically marginalised women in local contexts to gain centre stage in their own lives.

Therefore, this is not only a justification to raise awareness for this problem based on evidence presented in the articles in this issue of the Journal, but also it is time to move forward to take initiatives and create opportunities for women and girls. It means cultural shifts in education anytime, anywhere for everyone, and how to make it happen.

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GUEST EDITORIAL

eHealth: Investing in Women

Four key areas of women's engagement in eHealth

A scan of the papers in this theme issue of the journal shows good coverage of the four domains of women's engagement in eHealth, as outlined in the WeHealth framework, and adopted by the Working Group on Women (WoW) of the International Society for Telemedicine and eHealth (ISfTeH), namely: leaders and policy makers; providers; developers of eHealth tools; and, of course, beneficiaries.

Our colleagues from WHO (Al Shorbaji and Ungerer) in their guest editorial begin and end their piece with a call to "make it happen" for women in eHealth, referring to the need to translate advocacy gains on behalf of women, as evidenced by resolutions and declarations, into concrete benefits on the ground. Touré continues in this vein, citing the exponential growth in uptake of ICT tools and services in developing countries, and the report of WHO and ITU on eHealth innovation for women's and children's health. She urges the adoption of a gender-related perspective in all aspects of the eHealth enterprise.

Invited commentary by Mechael explores women's leadership in the application of the telephone, and later mobile phones, for social purposes and specifically health. In "Coming full circle" she traces the position of women's leadership in mHealth – dominant in the early phases of the field, less so during its exponential growth period, and its recent re-emergence. Her suggestion to address gender and women's empowerment in mHealth projects, we trust, will become a routine feature of all health technology-related initiatives, much like the ever-present environmental impact assessment in project descriptions.

Green, drawing from her own experience at HingX, espouses the importance of not re-inventing the wheel, but rather breaking down the silos in information and knowledge portals on eHealth, by finding a common denominator that enables sharing and reuse of information and knowledge resources.

The contributed papers are a "tour d'horizon" of the application domain, ranging from telemedicine for diabetic care (Kleinbreil et al.) through health workforce development (Perez-Chavolla et al.) to eHealth services for pregnant women (Lemaire et al., and Ayson Rivero et al.), and an overarching report on Women in eHealth (Thouvenot and Holmes).

Women leaders in eHealth

In 2014, an important event in the sidelines of the UN General Assembly was recognition of female leadership in eHealth in the naming by the ITU of Dr. Christine Kaseba, First Lady of Zambia at the time, as its Ambassador for eHealth. But, leadership of women in eHealth is not always high profile. It can be the muted, but methodical and persevering effort of a few committed women. There are two major telemedicine programmes running in Mongolia. Both led by female physicians – one a cardiologist, the other a gynaecologist. Both initiatives have spanned a broad spectrum of activities – finding funding through development partners, leading to national engagement and the development of a national eHealth strategy in 2009; capacity building through pre-service and in-service training programs; knowledge sharing including the inauguration of an annual telemedicine conference, now international in scope; and most important, empowering health in Mongolia and extending health services to the previously unreached. As Margaret Mead put it "Never doubt that a small group of thoughtful, committed citizens can change the world; indeed, it's the only thing that ever has."

The power of nursing and nurses

Nursing epitomises the theme of women as providers - empowered by eHealth tools and services. It is our thesis that this is the key to wide-spread adoption

and scale up of eHealth. Nurses reach more inhabitants of the planet than any other professional category of health worker. And the International Council of Nurses (ICN), with its 134 national associations on six continents and a gargantuan membership of a healthy fraction of the 19+ million nurses worldwide, can serve as a launch pad for global scale-up of telemedicine and eHealth services. Through this same reach to people, nurses can extend the benefits of this great enabler to the largest number of beneficiaries (including women). Nursing and its practitioners can thus become a "force multiplier" in the dream of weaving eHealth into the fabric of the health system.

Global programmes recognise the importance of women actors

It is no coincidence that the Millennium Development Goals lay emphasis on gender equality and the empowerment of women (MDG3) and improvement of maternal health (MDG5). In addition, one of the critical factors to reducing child mortality (MDG4) is education of mothers. A strong statement on the importance of women's health is the UN Secretary General's "Every woman every child initiative", where the theme was earlier underscored in overarching recommendation 1 of the WHO Commission on the Social Determinants of Health – *"Improve the well-being of girls and women and the circumstances in which their children are born ..."* [1] Gender equality and women's empowerment continues into the Post 2015 Agenda, as one of the topics for the Sustainable Development Goals.

Conclusion

Every article in this special theme issue is authored, or co-authored, by a woman. Our hopes and expectations for the issue are that it inspires more women to engage in eHealth – in all aspects of the endeavour; as leaders, educators, developers, and beneficiaries and for male actors in the entire eHealth ecosystem to support that engagement. Nurses as a professional, and most heavily subscribed, category of the health workers are a major force for widespread adoption of eHealth. The eHealth community should leverage this "force multiplier" by investing even more in women.

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Reference

1. CSDH (2008). Closing the gap in a generation: health equity through action on the social determinants of health. Final Report of the Commission on Social Determinants of Health. Geneva, World Health Organization, 2008.

GUEST EDITORIAL

Finding A Common Denominator

It's not a secret that the world of eHealth is pretty chaotic. It's saturated with information, yet it's not easy to find useful pieces of knowledge. Field experts are consistently talking about the need for knowledge dissemination, active collaboration, engagement of stakeholders, empowering local communities and supporting capacity development. Despite a call for reusability of existing resources, donor organizations continue to invest huge sums of money, often in parallel, into information sharing portals that operate in silos. These systems take time and money to develop, and often cease to exist after funding runs out. Additionally, if we consider all of the best intentions to build knowledge sharing portals we have learned at the very least that the "if we build it they will come" approach simply doesn't work. Today's reality of eHealth is such that there are no incentives to share information.

At the same time, when it comes to team collaboration, we see it as a separate domain, and in the donor-driven world we are used to the status quo. We all are accustomed to using multiple tools to work with our teams. To create and publish a simple report, distributed teams typically use about five different tools – email, Wiki, Google Drive, calendar, and ListServ. In summary, there is no public awareness that knowledge management and collaboration should be part of one cohesive process that includes finding and adopting reusable information, creating new content, gathering input, coordinating activities and publishing results. So, what can be done?

Simple Math

When I was studying applied mathematics, I was taught that if a formula results in an answer that is not simple – it's probably wrong. Applied mathematics is a very beautiful science, and I admire this from the perspective of a woman - it describes various complex processes with straightforward and elegant formulae. Some of my friends who were working as math tutors

had a simple test for pupils on adding fractions. Finding a common denominator was a basic skill required to move forward with lessons.

I believe that one of the challenges we face in the world of eHealth is that organizations and initiatives continue operating in their segregated section – they continue dividing the global world of knowledge into fractions. To move forward, we should seek simple and elegant solutions; we need to consolidate knowledge and collaboration, to bring people together and to find that common denominator.

Leave it to the professionals

It has been three years since I got the exciting opportunity to work on a global knowledge management system for health ICT, known today as HingX (pronounced Hinge – eX). Our approach to community-driven development brought amazing results: over 20,000 people from 180 countries come to HingX to find information, share knowledge and collaborate. One thing we learned in the process is that technology is just a tool. The success of any initiative is mostly dependent on people and process. The purpose of good technology is to make an existing process more effective, to enable people to do their job better. One of the conceptual differences of HingX from other initiatives that come and go in the world of eHealth is that our sole focus is on making stellar enterprise technology for all. When a project manager doesn't have to worry about different knowledge management and collaboration tools, but rather spends his or her energy on core business activities, the results will benefit all: an increased success rate of eHealth initiatives around the world.

What's Next?

To make things work, we need to challenge the status quo. In a world that thrives on reinventing the wheel, it will not be an easy task, yet I remain optimistic. We

will see more sustainable initiatives and improved local capacity when we treat knowledge as a product of collaboration, so sharing it will become a natural continuation of an existing process. The next evolutionary step will be a fusion between knowledge management and community collaboration into knowledge collaboration.

In addition, I also believe that we should think outside of the "eHealth box" and see how we can reuse knowledge created in other industries, such as finance and agriculture. Lines between technology verticals are getting more and more blurred, so we should embrace integration, common environment, and a model that we've all learned from our childhood that "sharing is caring".

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GUEST EDITORIAL

Women in eHealth

The recent United Nations Millennium Development Goals (MDG) report indicates that globally the number of children under five years of age fell from 12 million in 1999 to 6.9 million in 2011. The global rate of decline has accelerated in recent years: from 1.8 per annum during 1990-2000 to 3.2% during 2000-2001. Despite this change, the world is unlikely to achieve the MDG 4 target: "reduce by two-thirds, between 1990 and 2015, the under five mortality rate."

While the proportion of births attended by skilled health care workers has increased globally, fewer than 50% of births are attended in most African countries. Despite a significant reduction in the number of maternal deaths, from an estimated 543,000 in 1990 to 287,000 in 2010, the rate of decline is just over half that which is needed to achieve the MDG 5 target: "reduce by three-quarters, between 1990 and 2015, the maternal mortality rate."

On the other hand, the world has witnessed a revolution in the increased uptake of information and communication technologies (ICT) with access to wireless broadband networks and services in developing countries, with improved access to health care services. This has provided new avenues to provide vital health information and promote women and children's health. There is no doubt that ICT-enabled solutions have improved better informed-decisions, whether by women themselves or health-care professionals. Advances in eHealth applications are providing pregnant women, mothers and young children with better health care services and advice.

As part of the ongoing commitment to eHealth, WHO and the ITU have also jointly published a report on *eHealth and innovation in women and children's health.* This report compiles information from 64 of the 75 Commissions on Information and Accountability for Women's and Children's Health (CoIA) in countries which together have 98% of the world's maternal and infant mortality. These countries have responded to a detailed survey about the many ways in which the use of ICTs, and in particular

eHealth, help reduce that global burden. The report highlights what has been achieved and identifies barriers to progress. It will help governments and development partners identify where further investment is required. For the first time, it provides a systematic overview of where each country's strengths and weaknesses are in implementing ICTs for women and children's health, through a collection of Country Insights.

This report shows how, on a daily basis, eHealth innovations are improving access to care and assisting women to take control of their own health. It is encouraging to see that mobile phone service providers are becoming more active in supporting initiatives in mHealth and mLearning as well as development in general and to addressing the needs of women in particular.

Gender-related perspectives on issues such as phone ownership, access, privacy, and content have been reviewed, and the argument made that ICTs and broadband, as key enablers of development, can play a central role by furnishing new tools and solutions to address core gender gaps.

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COMING FULL CIRCLE: THE ROLE OF WOMEN IN eHEALTH

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The contributions of women to eHealth in low- and middle-income countries (LMIC) throughout its historical evolution have been multi-dimensional and multi-disciplinary. They have served pivotal roles as champions, pioneers, innovators, policy-makers, implementers, evaluators, and most-importantly and most-often overlooked, as the primary users and beneficiaries of eHealth. mHealth as a sub-field within the broader field of eHealth was largely catalysed through the contributions of a handful of female pioneers, namely Rose Donna from DataDyne, Holly Ladd from SatelLife, Claire Thwaites from the Vodafone Foundation, and Deb Levine from the YTH or Youth+Tech+Health. Their work dates back to the late 1990s and early 2000s and ranged from data collection and access to medical protocols through Personal Digital Assistants (PDAs) to mobilising Mobile Network Operator (MNO) engagement in health to promoting safer sex practices among youth and evaluating its impact. There was a moment in time when mHealth was just starting to gain traction in 2008 when there were only women in the field and entire conference panels on the use of mobile technology for health formed around them.

Since that time, the contributions and engagement of women has been obscured by the rapid growth of the field as well as a recent decline in the numbers of women pursuing careers in technology. This is not a new phenomenon and the pendulum is swinging back in favour of women's leadership and engagement as e- and mHealth increasingly become part and parcel of how health services are being delivered in LMICs where the majority of the beneficiaries and health workforce is female.

A relevant parallel can be drawn to the history of fixed-line telephones which took an extended period of time to find a common use for the device because it did not have a perceived "clear and agreed purpose".[1] When fixed-line telephones were first introduced, social purposes were viewed as an "inappropriate use" of the technology,[1] which was overcome by society's imposition of its own uses. The extended use of fixed-line telephones to social purposes was largely undertaken by women to overcome isolation and distance, particularly in rural areas in the United States.[1] This shift from a business tool to a social device led to the mass consumption of fixed-line telephones.

While the health domain is comprised of women, technology is often viewed as a masculine domain. Similar to fixed-line telephony mobile phones were initially acquired by men for professional purposes in most LMICs. Feminist research has evidenced that power and powerlessness are reflected by the design and mastery of technology.[2] Along with design and manipulation of technology, wage work is also affiliated more closely with men whereby the likelihood is stronger that they will be engaged in using a range of technologies to more efficiently accomplish work-related tasks.[2] More recent in its development, feminist theories of technology explore the domestication process as it specifically relates to gender. Judy Wajcman constructed a framework that explores the influence of male versus female interests in the design and use of technology.[2]

With most e- and mHealth programmes in LMICs focused on maternal, newborn, and child health (MNCH), with the primary target beneficiaries as pregnant women, mothers, and mothers-in-law, a greater focus on gender in the design and implementation of such programs is needed.[3] Having recognised the gender imbalances between design and use in mHealth, the mHealth Alliance set out to address this specific issue and developed Addressing Gender and Women's Empowerment in mHealth for MNCH: An Analytical Framework.[3] (Figure 1) The purpose of the framework is to provide an outline through which to analyse and understand gaps and issues related to gender, and develop appropriate interventions to achieve sustainable health and empowerment outcomes.[3] The framework examines three key questions within mHealth interventions:
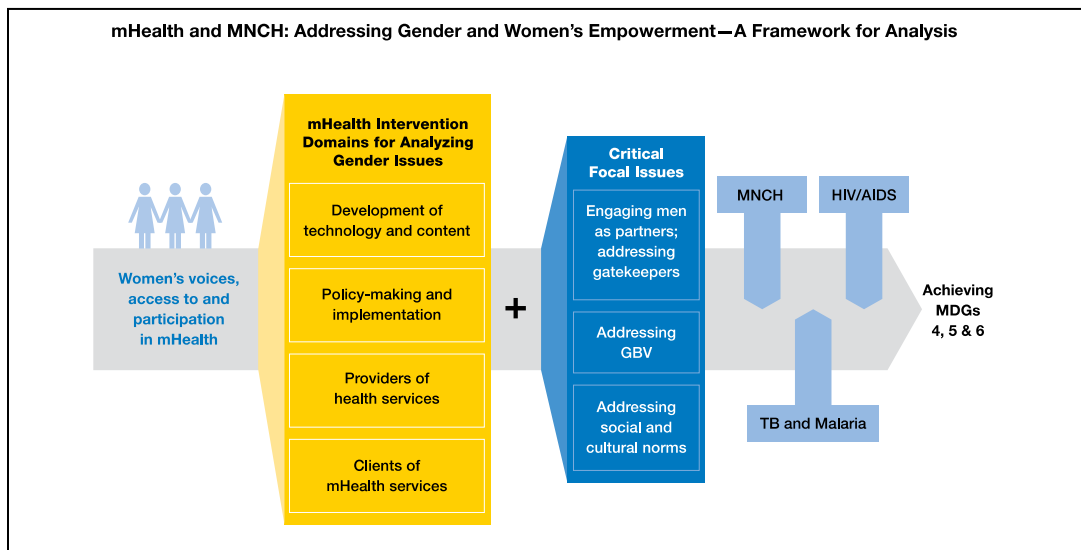
Figure 1. mHealth and maternal, newborn and children's health framework.

1. *What are the key barriers, implications and positive or negative consequences, related to gender and women's empowerment within specific mHealth interventions and solutions?*

2. *How do mobile phones and related technologies address gender issues and empower women?*

3. *How does successfully addressing gender issues and empowerment of women by mHealth contribute to improved health outcomes in a given mHealth intervention?*

Practitioners, academics, researchers and policy makers can apply this framework to understand the gender dynamics and implications of e- and mHealth interventions. As e- and mHealth converge into digital health and gain momentum and traction in LMICs, there will be a resurgence in female leaders, greater parity in their engagement in policy development and implementation, and more attention to the important role they play in the design, use, and policy making aspects of technology integration within the health system. It is not enough to acknowledge that women have played and continue to play an important role in e- and mHealth, their effective and meaningful engagement is necessary to ensuring the improved health outcomes the world needs.

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References

1. Lasen A. *The social shaping of fixed and mobile networks: a historical comparison*. Surrey, University Of Surrey: Digital World Research Centre, 2001.
2. Wajcman J. Feminist theories of technology" in *Handbook of science and technology studies*. S Jasanoff S, Markle GE, Petersen JC, Pinch T. London, Sage Publications, 1995.
3. Deshmukh M, Mechael P. "Addressing gender and women's empowerment" In *mHealth for MNCH: an analytical framework*. Washington, DC: mHealth Alliance, 2013.

WOMEN AND EHEALTH 2010 – 2015. FROM THE STUDY TO THE WOMEN OBSERVATORY FOR EHEALTH

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Abstract

Improving access to information and communication technologies (ICT) and making these services affordable to all are prerequisites to their efficient and sustainable use in healthcare and eHealth. Women worldwide still face barriers that keep them away from innovation and limit their taking full advantage of eHealth and telemedicine. To help address these barriers, Millennia2015, an initiative of the Destree Institute, conducted the Women and eHealth Study 2010 – 2012 (*We*Health) to identify barriers and trends in the emerging arena of Women, Health and ICT. The study proposed a set of solutions to the identified barriers, including a mapping of Women's involvement in eHealth. Forging ahead on the Study's proposals, the new Millennia2025 Foundation "Women and Innovation", a Public Utility Foundation, and its partners, have developed Action Plans to ensure the full participation of women in eHealth and telemedicine. These Plans include diverse initiatives, such as the *We*Observatory, which provides support to 15 *We*Health projects in 11 countries, *We*Telemed, *We*Blog, *We*MOOCs, *We*Patients, *We*Library, and two mobile multilingual applications: UniversalNurses and UniversalWomen, available in six languages. Improving the role of women in eHealth requires commitment and effort, and the Millennia2025 Foundation is committed to accelerating women's access to innovation and technologies for health around the world.

Keywords: eHealth; women; telemedicine; mHealth; innovation.

Introduction

The Foundation Millennia2025 Women and Innovation, PuF, is the pursuance of the Millennia2015 "Women actors of development for the global challenges", a foresight research process launched in 2007 by the Destree Institute, a European pluralist research centre, based in Wallonia, Belgium. The Institute is an NGO official partner of UNESCO (the United Nations Educational, Scientific and Cultural Organization) with consultative status and has had a special consultative status with the United Nations Economic and Social Council since August 2012. The Millennia2025 Foundation is committed to highlight the crucial role of women in global health, eHealth and telemedicine, as well as their unrecognized capacity as builders of alternative futures.

What is "Women and eHealth" at Millennia2015?

In August 2010, Millennia2015 created the International Working Group "Women and eHealth" to explore the area at the intersection of Women, Health and Information and Communication Technologies (ICTs), named *We*Health (Figure 1).[1] Since its launch, *We*Health has grown steadily to include more than 800 members from 65 countries.

The topic of women and eHealth has been gaining international recognition through various presentations at international conferences and publications. To better understand women's access to ICT and the use they make of these technologies for health, the Working Group conducted a study on these topics among its members, covering the 2010-2012 period.
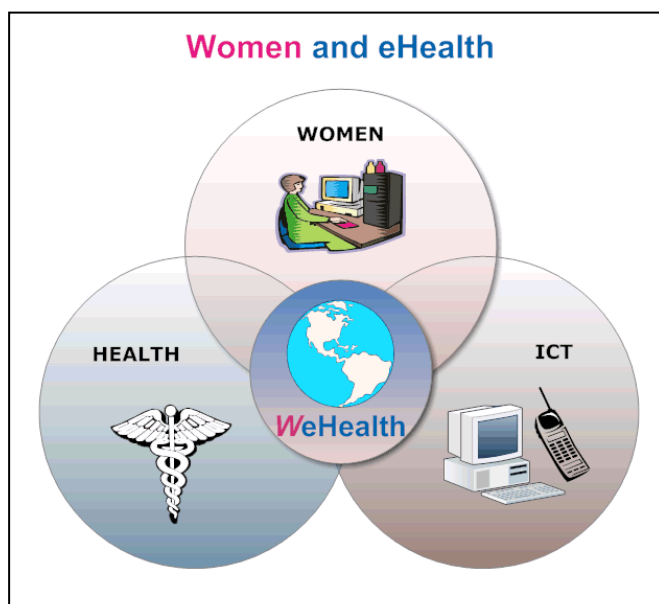
Figure 1: Research areas covered by *We*Health.

Why "Women and eHealth"?

The information provided by *We*Health members in the study acknowledges that access to and use of ICTs for health by women is a fundamental need and an essential factor contributing to their empowerment. One of the drivers is to promote the idea that it is a human right for women to benefit from mobile and mHealth applications during pregnancy and the early ages of their children. Non-economic benefits of these technologies include more rapid and effective communication in areas of conflict, during disasters, and support to women during their pregnancies.

The Women and eHealth Study 2010 – 2012

The Millennia2015 Women and eHealth study 2010-2012 highlights a set of barriers, solutions and trends in the emerging arena of Women, Health and Technologies.[2] The study considered various dimensions of the roles of women in ICT such as beneficiaries, health care providers and advocacy workers. Data gathered were generated through a two-year intensive information exchange among a network of 534 voluntary members in 62 countries, 2,500 emails, 82 Skype conferences, 175 publications, 15 conferences, 99 online interviews in 13 countries, and collaborations with 27 organizations. A list of 99

selected publications covering the themes of Women, Health and ICTs has been published. The study results were presented at Medetel, 10 April 2013, the annual conference organized by the ISfTeH in Luxembourg. Some of the key findings are discussed below.

Barriers and challenges include educating and training women on ICT usage, addressing illiteracy and disability, and ensuring that services are delivered in their own languages and dialects. The cost and complexity of devices can also be a hindrance to usage. ICT solutions cannot solve overall health issues, particularly for those living in more isolated areas. These technologies are still unaffordable and often too complex for the level of education and technical skills of many potential users. In addition, continued service after a pilot project has been completed and is no longer subsidized is problematic. These technologies must be adapted to conditions such as refugee camps, conflict situations, natural disasters, and areas with unreliable power supply.

Most women who received health related SMS messages on their mobile phones preferred to have messages delivered by voice, using voice commands. Long-term sustainability remains problematic, as devices and ICT applications are constantly evolving and proliferating. For women in developing countries, having access to the appropriate technology with basic functionalities, such as SMS, might be more effective in the long-term, than ensuring their access to the latest innovations. In the absence of continuous education and empowerment, this has major consequences on the access and use of new solutions by women.

Telemedicine remains a "male" dominated sector at all levels: medical, technical, and engineering. Women are beneficiaries as patients where such services are made available, yet just a few female doctors, nurses or midwives are trained and active in telemedicine services.

Local solutions where energy is scarce or unreliable have been found, such as using solar or wind power generation. Young girls in Africa have found a urine-based solution to provide enough energy for mobile phones. Women appreciate and use traditional technological tools that prove practical. For example, radios and television continue to play a major role in the dissemination of health information and should be incorporated with mobile phones and Internet services to reach more women. Mobiles, tablets, and other

electronic devices show interesting results, but remain limited to pilot projects that hardly expand at national and regional levels.

Free Call Lines were also emphasised as a need to enable women to reach health centres and health service workers. These lines can in particular to support women living in difficult situations, such as domestic violence, natural disasters, conflict areas, and as refugees. Access to broadband and eHealth services, available through cloud computing systems, is considered key to women to facilitate the exchange of digital images, accelerate diagnostics, and decision-making in urgent contexts, particularly during pregnancy.

The most cited health areas of interest for women receiving regular health information via ICTs were: maternal and child health, family health, disease control, HIV/AIDS, malaria, cancer and vaccination. Access to ICTs can have a profound effect on women with disabilities or who experience issues related to aging and mobility.

As major emerging trends, women are recognised to be active users of social media and blogs to gain access to health information, even prior to consulting health professionals. Technologies are causing an impressive shift into a new paradigm where women, whatever their roles, have better access to health information. As a result, doctors are no longer the sole repositories of medical information.

Who are the "Women in eHealth"? – Mapping Women's involvement in eHealth

Based on the data collected, the study has considered four dimensions of the roles of women in eHealth:

- *Women as Beneficiaries*: Women are at the core of family healthcare in communities and have the greatest need to have access to and use ICTs for their personal health and that of their family members.
- *Women as Healthcare Professionals*: Women are at the frontline of family care in their role as healthcare workers in communities. They require ICTs to facilitate effective communication with other healthcare workers, with doctors, and patients.
- *Women as ICT professionals*: Women are among the engineers and technicians who develop innovative and adapted devices and applications to help reach the most isolated environments and communities.

- *Women as Leaders*: Women advocate at all levels, from raising new opportunities to partnering with the private sector, collaborating and networking, improving funding mechanisms, and leading eHealth initiatives in communities.

Since 2013, two new dimensions were proposed at various international conferences to be taken into consideration:[3]

- *Women in Media as journalists,* in particular those active in social media: Women are influential on the web, and 85% of Pinterest users are women. They are active bloggers, sharing opinions and stories, shaking ideas and communicating new solutions.
- *Women as Educators or Mentors,* to educate young girls in technologies: Education and mentoring are very powerful instruments to motivate girls to study engineering, telecommunication or informatics. Women reaching high-level positions in the industry provide an incentive for young girls by giving the positive image of exciting jobs.

From the Women and eHealth Study 2010 – 2012 to the Women Observatory for eHealth

The Women and eHealth study highlighted barriers and challenges to take into consideration after 2012. The creation of the Women Observatory for eHealth at the Millennia2025 Foundation (*We*Observatory hereafter) encouraged development of specific Action Plans for the 2012–2017 period, with the objective to provide concrete eHealth solutions to women, in partnership with Connecting Nurses and Connecting Midwives. Some of these specific activities are highlighted below.

Education and Training

Educating and training women on ICT usage are two main areas of concern mentioned often in interviews and reports. Other major impediments that limit the ability of women to use ICTs are illiteracy and disabilities. In order to expand education and learning, the Intelligence MOOCs Commons for Women and eHealth of the WeObservatory (*We*MOOCs) provides an annual selection of free Massive Online Courses (MOOCs) in English, French and Spanish, developed by the most famous universities and academics.[4] The MOOCs included in the *We*MOOCs are scanned and selected by specialized advisors and members of the

Foundation, and cover three of the six UN official languages: English, French and Spanish.

In 2014, the advisors identified and selected 72 MOOCs in English, and a handful of courses in the Other two languages, covering various topics of interest to women, such as nutrition, nanotechnologies, diabetes, epidemics, AIDS, and nursing. In 2015, the number of selected courses increased to a total of 340, of which 276 were in English, 28 in French and 36 in Spanish. The courses were selected from 21 different MOOC platforms and are being imparted by diverse institutions from 18 countries in America (6), Europe (8), Asia (2), the Middle East (1), and Oceania (1). Through the *We*MOOCs, the *We*Observatory offers a unique platform to improve education and training in eHealth and telemedicine.

Languages and Dialects

It is important for women that eHealth services are delivered in their own languages and dialects. This encompasses all kind of eHealth activities, including but not limited to mHealth, telemedicine, EMR, and SMSs. In partnership with UniversalDoctor, the *We*Observatory has developed mobile applications for nurses, midwives and pregnant women. The applications UniversalNurses and UniversalWomen are available in six languages to support multilingualism and common understanding between nurses, midwives and their patients.[5,6] UniversalDoctor was recently awarded at the UN World Summit Award in Abu Dhabi.

Cost, Complexity and Sustainability

In most instances, ICT solutions do not satisfy women's needs, particularly for those living in rural communities or remote areas. Long-term sustainability remains problematic, as devices and ICT applications are constantly evolving and proliferating.

To help address these issues, the *We*Observatory is committed to support projects on the Care Challenge platform, and provides technical and financial support for digital inclusion solutions.[7] Cost, complexity and sustainability are integrated at each level of project development and implementation. Selected projects cover various health areas and topics, such as mental health, HIV, ePrevention programs, mWounds apps, foot diabetes, video training, child diabetes, maternal health, emergencies during natural disasters, research

on the elderly and telehealth, as well as mobile multilingual applications.[8] They cover all ages of patients' lives, from birth, childhood, adolescence, adulthood to the elderly. With 15 eHealth projects in

10 countries in 3 languages, 2 mHealth applications in 6 languages, the *We*Observatory constitutes a unique platform of innovation driven by nurses and midwives for their patients. To date, 7 projects have developed innovative tools and services.[9] The Blog of the *We*Observatory (*We*Blog), launched in October 2014, provides regular news on the projects, publications and international events.[10]

Telemedicine

Telemedicine remains an area with an insufficient number of women health professionals, leaders, IT designers, and beneficiaries. To address this gap, the Global Network of Women in Telemedicine (*We*Telemed) was initiated as an Action Plan with the vision to constitute a powerful demonstration of women empowerment for Millennia2015.[11] *We*Telemed was launched in Panama, at the conference on "Digital Inclusion for Health and Sustainable Development".[12] Since the launch, 251 members from 38 countries have registered, and constitute a dynamic group of women and men involved in telemedicine.

*We*Telemed gives particular attention to women addressing the needs of women living in remote areas, refugee camps or in areas of conflict where telemedicine services may constitute an alternative to local health centres, which are often non-operational under such conditions. Medical specialties such as gynaecology, maternal and children health, dermatology, reproductive health, neurology, radiology, dermatology, infectious diseases, emergency surgery and services are primarily targeted, as an increased number of female health care providers are needed to deliver healthcare to women via telehealth.

Since its launch, *We*Telemed has been presented at various conferences, including the Millennia2015 International Conference, held at UNESCO in Paris in December 2012. Each conference provides an opportunity to expand the network, include new members and enrich our work. In 2013 and 2014, *We*Telemed was presented at the OCAPROCE NGO's Forum in Geneva (September 2013), the Women's

Leader Forum in New York (September 2013 and 2014), in partnership with Advanced Development for Africa Foundation, and the *We*Observatory Round Table, Geneva, in May 2014.[12]

Emerging Trends

Among the emerging trends identified in the study, the use of social media was the most prominent in the area of eHealth. As noted above, women are active users of social media, blogs, and twitter to gain access to and share health information, even prior to consulting health professionals. This is a new paradigm where doctors are no longer the sole repositories of medical information.

Other trends have emerged since 2013, such as Patient Empowerment and eHealth. The *We*Observatory developed the Patients Commons for eHealth (*We*Patients), to support Patient Empowerment in Self-Management of Chronic Conditions in three languages, English, French and Spanish. The objective is to raise awareness of behavioural change models and tools that can be applied to improve patient adherence and health outcomes. *We*Patients includes a selection of eHealth projects focused on Patient Empowerment along the ages of life, resources, publications and patient's stories.[13]

The future Women Library for eHealth (*We*Library, under development) will provide access to articles and publications related to women involved in eHealth and telemedicine. Currently, access to 99 selected publications listed in the Women and eHealth Study 2010-2012, as well as links to recent publications are already made available.[14] This section will be periodically updated and worthy of being consulted.

Conclusion

The Women and eHealth Study 2010 – 2012 (*We*Health) contributed to explore a new area of investigation, at the intersection of Women, Health and ICTs, and has highlighted a set of barriers and challenges, innovative solutions and emerging trends. The *We*Observatory, the *We*Blog, *We*Telemed and the *We*MOOCs constitute the initial Action Plans of the Foundation Millennia2025, PuF, to support access to and use of eHealth and telemedicine for and by women around the world. In 2015 – 2016, the Library for Women and eHealth (*We*Library) and the Patients

Commons for eHealth (*We*Patients) will ensure that all women receive special attention in the access to and use of eHealth and telemedicine.

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Conflict of Interest
The authors declare no conflicts of interest.

References

1. Millennia. International Working Group "Women and eHealth". Available at: http://www.millennia2015.org/Women_and_eHealth accessed 8 March 2015.
2. Thouvenot VI, Holmes K. Closing the Gender and Digital Gaps to Improve Women's Health. Results of the Women and eHealth Study 2010 – 2012: 14 Key Findings and 6 Action Plans. Namur, Belgium: Millennia2015.org; 2013. Available at: http://www.millennia2015.org/files/files/M15_Documents/Millennia2015_WeHealth_Key_Findings_and_Action_plans_2012.pdf accessed 8 March 2015.
3. Millennia. Women and eHealth study 2010-2012. Available at: http://www.millennia2015.org/Women_and_eHealth accessed 8 March 2015.
4. The Intelligence MOOCs Commons for Women and eHealth of the *We*Observatory (*We*MOOCs). Available at: http://www.millennia2015.org/moocs accessed 8 March 2015.

5. UniversalNurses. Multilingual patient communication tool for nurses and maternal health issues. Available at: http://www.u-nurses.com/ accessed 8 March 2015.

6. UniversalWoman. Multilngual communication for pregnancy, childbirth. Available at: http://www.u-women.com/ accessed 8 March 2015.

7. The Care Challenge platform. Available at: http://www.care-challenge.com/ accessed 8 March 2015.

8. Millennia2015. Selected projects. Available at http://www.millennia2015.org/WeObs_Selected_Projects accessed 8 March 2015.

9. Millennia2015. Achievements. Available at: http://www.millennia2015.org/weobs_achievements accessed 8 March 2015

10. WeObservatory Blog. Available at: www.weobservatory.com accessed 8 March 2015.

11. WeTelemed, Global Network of Women in Telemedicine Available at: http://www.millennia2015.org/WeTelemed accessed 8 March 2015.

12. Millennia2015. Digital Inclusion for Health and Sustainable Development. Available at: http://www.millennia2015.org/Mujeres_ICTs_Panama accessed 8 March 2015.

13. Millennia2015. The Patients Commons for eHealth (WePatients) Available at: http://www.millennia2015.org/WePatients accessed 8 March 2015.

14. Millennia2015. Women and eHealth Study 2010 - 1012. List of selected references. Available at: http://www.millennia2015.org/files/files/WeHealth_Research/wehealth_list_of_references.pdf accessed 8 March 2015.

ZERO MOTHERS DIE: A GLOBAL PROJECT TO REDUCE MATERNAL AND NEWBORN MORTALITY THROUGH THE SYSTEMATIC APPLICATION OF MOBILE HEALTH AND ICT

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Abstract

With almost 300,000 women and six million children under-five continuing to die each year, it is imperative that we start applying the innovation and progress made in the private sector to reducing these unacceptably high mortality rates in developing nations. Launched in September 2014 at the United Nations Headquarters during the Women Leaders Forum, Zero Mothers Die is a unique global public-private partnership to systematically deploy mobile technology and ICT solutions to reduce maternal and newborn mortality. Zero Mothers Die seeks to bring mobile health solutions to pregnant women to increase their access to healthy pregnancy information and emergency care, as well as empower healthcare workers through capacity-building in the area of maternal, newborn and child health. The aim of Zero Mothers Die is to facilitate the delivery of innovation and low-resource technology for healthcare into nations where maternal and child mortality rates remain high, by constantly updating the Zero Mothers Die project model components and supporting countries in convening local public-private partnerships to implement Zero Mothers Die initiatives in their country.

Keywords: eHealth; mobile health; mHealth; maternal mortality; newborn; maternal health; ICT.

Introduction

As the deadline quickly approaches for achieving Millennium Development Goals (MDGs) 4 (Reduce Child Mortality) and 5 (Improve Maternal Health), these remain a priority for many countries. Despite current efforts, maternal and child mortality remain unacceptably high around the world, with 800 women dying every day from pregnancy and childbirth related complications, with 289,000 women dying in 2013 alone.[1] Twenty-four percent of deaths in pregnant and post-partum women are attributable to Human Immunodeficiency Virus (HIV) in Sub-Saharan Africa. Almost all of these maternal deaths (99%) occur in developing countries, and most could have been prevented.[2] In addition to the plight of pregnant women, children under the age of five face dire circumstances after birth. In 2012, 6.6 million children under the age of five died, with 44% of all child deaths occurring within the first month of life and more than three million of these deaths being due to conditions that could be prevented or treated with access to simple, affordable interventions.[3]

According to a report by the Institute for Health Metrics and Evaluation,[4] it is estimated that only 13 developing countries will achieve MDG 5a (reduce by three quarters, between 1990 and 2015, the maternal mortality ratio). An estimated 31 countries are predicted to achieve MDG 4a (reduce by two thirds, between 1990 and 2015, the under-five mortality rate). Only nine of these countries will achieve both MDGs 4a and 5a. Of the 75 countries with the highest burden of maternal and child mortality, 25 have made insufficient or no progress in reducing maternal deaths

and 13 show no progress in reducing under-five mortality.[5]

In parallel to these sobering facts, there is an increasingly high potential for Information and Communication Technologies (ICT) to improve health. Given the expansion of telecommunication networks and penetration of mobile phones in rural areas in developing countries, this gives rise to the possibility of connecting previously unconnected women to healthcare through mobile health (mHealth). Mobile phone networks cover 96% of the world's population, with 77% of mobile subscriptions held by nearly 90% of the population in low- and middle-income countries.[6]

mHealth initiatives cover a wide range of activities, including data collection, disease surveillance, health promotion, diagnostic support, disaster response, and remote patient monitoring. However, there is specific evidence of mHealth's positive impact in maternal health: in 2014, a mobile maternal health initiative in Zanzibar identified that mobile phone interventions significantly increased the proportion of women receiving antenatal care during pregnancy.[7] Receiving antenatal care (ANC), and attending at least four ANC visits, is one of the most important factors for saving women's lives according to the World Health Organization (WHO). Further evidence shows that mHealth tools can help minimise time barriers and facilitate urgent care, as well as support health promotion through mobile messaging services.

Systematically applying eHealth solutions to reduce maternal and newborn mortality is the primary aim of Zero Mothers Die, a unique public-private partnership initiative that seeks to bring mobile health solutions to pregnant women to increase their access to healthy pregnancy information and emergency care.[8]

Zero Mothers Die: A solution applying eHealth to help achieve MDGs 4 and 5

Launched in September 2014 at the United Nations Headquarters during the Women Leaders Forum, an official side event of the UN General Assembly, Zero Mothers Die has attracted a variety of partners from different sectors in order to build a strong global partnership covering all aspects of the project. At the global level, Zero Mothers Die is led by the Zero Mothers Die Consortium consisting of two foundations, Advanced Development for Africa (http://www.adaorganization.net/) and Millennia2025 'Women and Innovation', a Public Utility Foundation,

(http://www.millennia2015.org/millennia2025_foundation), and a private sector company UniversalDoctor Project (http://www.universaldoctor.com/). Zero Mothers Die is supported by key technical partners, including the Joint United Nations Programme on HIV and AIDS (UNAIDS), Airtel, Global Partnerships Forum and The People's Vision. At the country level, local Zero Mothers Die partnerships are developed to lead the design and implementation of the project directly on the ground, with key support from UNAIDS country offices.

Within the global framework of the UN MDGs, the Zero Mothers Die partnership aims to support the achievement of MDGs 4 and 5, by reducing maternal and child mortality through the expanded access and use of eHealth. By increasing access to ICT to achieve its goals, this partnership in turn supports the achievement of Target 8F within MDG 8: "In cooperation with the private sector, make available the benefits of new technologies, especially information and communications".[9]

Methods

Zero Mothers Die presents a project model containing six mobile-based components targeting maternal and newborn health. These project components include: 1) A mobile messaging service delivering maternal, newborn and child health information to pregnant women and new mothers through voice / text messages in their local languages; 2) systematic distribution of mobile phones to vulnerable and unconnected pregnant women to increase their access to healthcare information; 3) an allocation of free airtime during each month of their pregnancy, restricted for calls only to their assigned healthcare worker or facility to enable communication, particularly during emergencies; 4) capacity-building and training of healthcare workers using ICT and digital tools; 5) mobile money savings scheme to increase access to skilled care during childbirth; and 6) a solar power mobile phone charger to provide green energy for the charging of their mobile phones and enable financial empowerment through a business generation scheme. This project model is presented to governments as a comprehensive mobile maternal health initiative, however it is necessary that it is then adapted and tailored to the needs and contexts on the ground in each country. Zero Mothers Die does not advise a one-size fits all approach, but rather a tailored

approach to ensure the project design meets the requirements of the country.

With these components, the project's key objectives are to: a) Reduce maternal health complications and maternal mortality, and raise prevention of mother-to-child transmission of HIV (PMTCT); b) accelerate mobile phone ownership and use by vulnerable pregnant women, particularly low-resource women in rural or isolated communities and without access to mobile phones, in order to reduce the mobile phone gender gap; and c) educate, train, and ensure capacity-building of healthcare workers using mobile devices preloaded with up-to-date training materials and content to improve maternal and child health in their communities. In addition, the projects provide digital tools to support and enable healthcare workers to collect patient data if a government health information management system is in place, thereby contributing to overall health system strengthening.

The guiding principles of the overall project are sustainability and scalability through local ownership, integration within local health ecosystems and health information management systems to support health system strengthening, and identifying inclusive business models to ensure continuation of the project. Each country of implementation has a local project lead organisation, which then engages the relevant local Ministries (Health, Telecommunications, Family and Welfare, etc.) and technical partners in the project processes of formulation, design and implementation, in order to secure their buy-in and local ownership and ensure sustainability (beyond initial funding) as well as scale up.

Results

Implementation Phases 2014 – 2017
Zero Mothers Die was officially launched at the fourth annual Women Leaders Forum, an official event of the 68th Session of the United Nations General Assembly in New York City, organized by Advanced Development for Africa in partnership with the Global Partnerships Forum, Global Digital He@lth Initiative, UNAIDS and International Telecommunications Union, with support from Yoo Soon-taek (wife of Secretary General Ban Ki-moon), Cherie Blair, Dr. Christine Kaseba-Sata (former First Lady of Zambia), and Sylvia Bongo Ondimba (First Lady of Gabon).

Ghana was chosen, in consultation with the major

technical partners, as the first country for implementation of Zero Mothers Die as it is one of the UNAIDS Global Plan countries.[10] The Country Director of the UNAIDS Ghana office was the initial lead for bringing the Ministry of Health (MOH) and other government and local UN agencies on board as country partners in the process. Several major stakeholder meetings and technical visits for "Zero Mothers Die Ghana" have taken place between the Zero Mothers Die Consortium and the following partner agencies: Office of the First Lady, Ministry of Health (several components, but mainly from Ghana Health Service (GHS)), Family Health Division, and National AIDS/STI Control Programme, Ghana AIDS Commission, Ministry of Communication, National Communication Agency, Greater Accra Regional Ministry, Municipality of Accra, Accra Regional Health Service, AirTel Ghana, UNAIDS, World Health Organization, United Nations International Children's Emergency Fund (UNICEF), UNAIDS-Geneva and Partners.

Dr. Afisah Zakariah, Director of Policy, Planning, Monitoring and Evaluation at the Ministry of Health, was appointed as the lead for the Zero Mothers Die Planning and Task Team within the MOH to lead the preparation and implementation phases of Zero Mothers Die Ghana in three districts of Greater Accra. Given the restricted amount of funding available for the first phase, an initial implementation has been planned for six sub-districts in Greater Accra (GA South). GHS has now taken on the lead of operationalising the Zero Mothers Die Ghana implementation plan under the leadership of Dr. Anthony Ofosu, in cooperation with Airtel. Pending on-going technical discussions between the partners to operationalise the project, the launch of the initial implementation phase is set to take place within 2015.

Gabon has been identified as the second country for implementation, in close partnership with the foundation of the First Lady (Fondation Sylvia Bongo Ondimba, FSBO), who is leading project design and formulation on the ground with various in-country partners.

Formulation phases are currently underway in Mali and Nigeria, with Rwanda and Zambia identified as follow up countries whose Ministers expressed keen interest in bringing the Zero Mothers Die initiative to their country.

Conclusion

With almost 300,000 women and six million children under-five continuing to die each year, it is imperative that we start applying the innovation and progress made in the private sector to reducing these unacceptably high mortality rates in developing nations. Zero Mothers Die is a continuously evolving initiative, seeking support from the private sector to contribute in-kind their core competencies to support the cause of bringing mother and child deaths down to zero. Zero Mothers Die's aim is to facilitate the delivery of innovation and low-resource technology for healthcare into nations where maternal and child mortality rates remain high, by constantly updating the components of the Zero Mothers Die project model, and supporting countries in convening local public-private partnerships to implement Zero Mothers Die initiatives in their country.

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References

1. Zaba B, Calvert C, Marston M, et al. Effect of HIV infection on pregnancy-related mortality in sub-Saharan Africa: secondary analyses of pooled community based data from the network for Analysing Longitudinal Population-based HIV/AIDS data on Africa (ALPHA). *Lancet* 2013;381(9879):1763–1771.

2. World Health Organization. (2014). Maternal mortality fact sheet N°348. Available at: http://www.who.int/mediacentre/factsheets/fs348/en/index.html accessed 15 March 2015.

3. World Health Organization. (2014). Children: reducing mortality fact sheet N°178. Available at: http://www.who.int/mediacentre/factsheets/fs178/en/ accessed 15 March 2015.

4. Lozano R, Wang H, Foreman KJ, et al. Progress towards Millennium Development Goals 4 and 5 on maternal and child mortality: an updated systematic analysis. *Lancet* 2011;378(9797):1139–1165.

5. Countdown to 2015 Maternal, Newborn and Child Survival. (2012). Building a future for women and children: The 2012 Report. Available at: http://www.unicef.org/eapro/Countdown_to_2015.pdf accessed 15 March 2015.

6. International Telecommunications Union (ITU). (2013). *The World in 2013: ICT Facts and Figures.* Available at: http://www.itu.int/en/ITU-D/Statistics/Documents/facts/ICTFactsFigures2013.pdf accessed 15 March 2015.

7. Lund S, Nielson BB, Hemed M, et al. Mobile phones improve antenatal care attendance in Zanzibar: a cluster randomized controlled trial. *BMC Preg Childbirth* 2014;14:29.

8. Zero Mothers Die. (2014). Available at: http://www.zeromothersdie.org accessed 15 March 2015.

9. Millennium Development Goals Indicators: The official United Nations site for the MDGs Indicators. (2008). Available at: http://mdgs.un.org/unsd/mdg/host.aspx?Content=indicators/officiallist.htm accessed 15 March 2015.

10. Joint United Nations Programme on HIV/AIDS. (2014). Global Plan towards the Elimination of new HIV infections among children by 2015 and keeping their mothers alive. Available at: http://www.zero-hiv.org accessed 15 March 2015

ANTENATAL EXERCISE PROGRAMME USING MOTION-BASED GAMES: A PILOT STUDY AMONG EXPECTANT MOTHERS IN SELECTED RURAL AREAS IN THE PHILIPPINES

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Abstract

A structured exercise programme was designed that incorporates motion-based video games to decrease anxiety and depression among pregnant women. A pilot study determined its viability. Methods: A 2-group pre- post-test experiment was done on 16 pregnant women who met study criteria. Eight underwent the structured exercise programme twice a week for a month (intervention), and eight did not (control). The State Trait Anxiety Inventory (STAI) and the Hospital Anxiety and Depression Scale (HADS) were adapted and used to determine participants' anxiety and depression scores, respectively. Results: Significant improvement in the participants' mean anxiety 48.50 to 42.88 (p=0.029) and depression 11.50 to 7.63 (p=0.022) scores were found after the exercise programme. No changes were noted in the control group, HADS (p=0.196) and STAI (p=0.714) confirming the strength of the scores of the experimental group. Conclusion: The results suggest the exercise programme can be a valid approach to decrease anxiety and depression among pregnant women. We recommend replication of this study to other geographical areas with more samples to establish generalizability.

Keywords: Anxiety; depression; antepartum; exergames; motion-based; eHealth.

Introduction

Physiological and structural adaptations during pregnancy are natural yet challenging episodes, as they are accompanied by serious health concerns and complications that can lead to changes in the mental state of some women. It has been reported that up to 19% of women experience depressive symptoms at some point during pregnancy,[1] while 17.7% manifest anxiety symptoms.[2] Pregnant women may be particularly disadvantaged, as these symptoms may interfere with their ability to self-care during pregnancy. Previous literature also emphasises that these symptoms may have detrimental effects on the foetus and newborn.[3-6]

There is substantial literature showing that exercise serves as a commendable solution to ease, if not totally eradicate, several health concerns during pregnancy. However, there are few studies about the amount and type of exercise appropriate for pregnant women. Traditionally, pregnant women have been advised to restrict intense exercise due to concerns for the health of the mother and her foetus, which include overheating, impaired delivery of oxygen and nutrients to the foetus, and premature labour. A recent study showed that many women opt to continue exercise programmes during pregnancy due to awareness of its beneficial effects on health.[7]

The increasing impact of technological advances is evident in several aspects of exercise programmes. Presently, the new trend in exercise involves the use of motion-based gaming consoles like Xbox Kinect. As this applies information and communication technologies (ICT) for Health this is an example of eHealth. The Xbox Kinect provides an interesting way to exercise as it tracks the person's movement and

allows their actions to be translated to an on-screen avatar.

No study could be found showing adverse effects of moderate intensity exercise to the mother or foetus during pregnancy.[8] This supports investigation of the effect of motion-based game exercise on anxiety and depression levels among pregnant women, which is yet to be explored. This pilot study aimed to evaluate the viability of applying motion-based exercise in decreasing the anxiety and depression level among pregnant women in their last trimester. There is an increasing need to advance our understanding on how technologies can function as an adjunct to medical treatments in addressing perinatal distress.

Methods

A study was designed to assess whether the exercise programme could become a valid programme to reduce anxiety and depression among pregnant women in selected rural areas in the Philippines. Sixteen (16) participants were randomly selected using computer-generated numbers from a pool of pregnant women who met study selection criteria: 1) aged 23 years and above, 2) in their second or third trimester, 3) normal (not at-risk) pregnancy - as certified by the city obstetric-gynaecologist (OB/GYN), and 4) willing to participate in the study for a month. Participants were randomly divided into intervention and control groups.

The pilot study was conducted in a comfortable and enclosed room provided by the local health facility. Informed consent was obtained and a briefing provided to participants prior to the study. Participants were then given a set of pre-tests that included the State Trait Anxiety Inventory (STAI)[9] and the Hospital Anxiety and Depression Scale (HADS).[10] The intervention group then underwent a series of motion-based exercise activities twice a week for one month. The control group received the usual health teaching about pregnancy and prenatal check-ups. At the end of the month, the same set of tests were given to both groups.

Motion-based exercise
The motion-based exercise programme was designed with the assistance of an OB/GYN (Table 1). A session normally lasted for an hour, which included breathing exercises, breaks, exposure to three Xbox Kinect games, and health monitoring. Lectures about

pregnancy were also given. The programme was validated by the municipal OB/GYN.

Table 1. Antepartum motion-based exercise programme.

	Time	Activity
Day 1		
Session total: 1 hr 30 min	25 min	Orientation to pilot study and Informed consent
	30 min	Health assessment Pre-test: STAI + HADS
	5 min	Warm up + breathing exercise
	10 min	Xbox Kinect: Leedmees
	5 min	Break
	10 min	Xbox Kinect: Self-Defence Training Camp - Balance Exercise
	5 min	Cool down + health monitoring
Days 2-7		
Session total: 1 hour	5 min	Health assessment
	10 min	Lecture
	5 min	Warm up + breathing exercise
	10 min	Xbox Kinect: Leedmees
	5 min	Break
	10 min	Xbox Kinect: Self-Defence Training Camp - Balance Exercise
	10 min	Xbox Kinect: Disney Adventure
	5 min	Cool down + health monitoring
Day 8		
Session total: 1 hr 30 min	5 min	Health assessment
	10 min	Lecture
	5 min	Warm up + breathing exercise
	10 min	Xbox Kinect: Leedmees
	5 min	Break
	10 min	Xbox Kinect: Self-Defence Training Camp - Balance Exercise
	10 min	Xbox Kinect: Disney Adventure
	5 min	Cool down + health monitoring
	30 min	Post-test: STAI + HADS

Research Measures
Two tests of anxiety and depression were used, STAI and HADS. The STAI is a widely used tool to measure anxiety, and was developed by psychologists Spielberg, Lushene, Vagg and Jacobs in 1983. The STAI questionnaire consists of 20 items, which can be graded using a 4-point Likert scale.[10] HADS was de-

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veloped by Zigmond and Smith (1983). The questionnaire consists of 14 items comprising two subscales of seven items. Each component is measured on a scale of 0 (not at all) to 3 (very much).[11]

The study was approved by the ethics committee of the institution. The medical practitioner and the head of the city also granted permission for the pilot study. The entire study was conducted with the assistance of an OB/GYN medical practitioner from the municipal health office. Tokens were given to the participants for successful completion of the exercise programme.

Data Analysis

Statistical analysis was by two tailed paired t-tests with alpha set at 5% using SPSS version 22.

Results

Data analysis showed significant improvement in the participants' anxiety and depression scores after participating in the exercise programme (Table 2). In the intervention group the scores improved significantly after exercise. HADS (p=0.022) and STAI (p=0.029).

Table 2. Pre and post-test scores of HADS and STAI for intervention and control groups (* p<0.05).

Groups		Mean	
		Pre-test	Post-test
Control	HADS	9.87	8.50
	STAI	56.00	53.88
Interventi on	HADS	11.50	7.63*
	STAI	48.50	42.88*

Discussion

This pilot study assessed whether an exercise programme using motion-based games was effective in improving anxiety and depression in pregnant women. The structured programme used an Xbox Kinect for the motion-based games, and spanned 1 month. The pre-test and post-test scores are good indications that the exercise programme can be used to improve anti-partum anxiety and depression.

Many factors are believed to contribute to the success of the programme, and were classified as intrinsic – that is the physiologic processes that occur within a person's body, and extrinsic – that is the experiential effects that a motion-based game provides to the participants. Existing research underpins the benefits of physical activity to reduce anxiety. Studies have reported that physical activity is indirectly associated with the risk of symptoms of depression and anxiety.[11,12] People of different ages and situations who participated in various types of exercise programme have been seen to have improvements in their mental health related quality of life. Additionally, the precise relationship between mental health-related quality of life and physical activity may lie in the complex process of human physiology.[13] This includes increases in norepinephrine transmission, serotonin, and endorphins.

Motion-based games, particularly 'exergames', combine physical exertion with casual gaming.[14] These types of games have been documented to boost the experience of physical activities.[15] Games provide personal reinforcement to players.[11] When the player practices autonomy[11,16] – that is choosing the game they typically enjoy – they easily get engaged and finally immersed in gaming.[13,17,18] The main process behind this exercise programme is the concomitant physical exertion or exercise and gaming; participants are exerting effort to exercise, yet their consciousness is dwelling in the content of another activity (i.e., the game). This is easy to promote since a wide variety of exergames are available in the market, and players can choose to play them at home, alone, or in groups.[11]

Conclusion

This study aimed to test the effects of a motion-based exergame programme on the anxiety and depression scores of pregnant women from selected rural areas of the Philippines. Results revealed that participants from the intervention group improved their anxiety and depression. The study should be replicated in other geographic areas and with larger samples to establish generalisability of the approach.

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References

1. Gaynes BN, Gavin N, Meltzer-Brody S, et al. Perinatal depression: prevalence, screening accuracy, and screening outcomes. *Evid Rep Technol Assess (Summ)* 2005 Feb;(119):1–8.
2. Chan CY, Lee AM, Lam SK, et al. Antenatal anxiety in the first trimester: Risk factors and effects on anxiety and depression in the third trimester and 6-week postpartum. *OJ Psych* 2013; 3(3):301-310.
3. Field T, Diego M, Hernandez-Reif M. Prenatal depression effects on the fetus and newborn: a review. *Infant Behav Dev* 2006 ;29(3):445-455.
4. Field T, Diego M, Hernandez-Reif M, et al. Comorbid depression and anxiety effects on pregnancy and neonatal outcome. *Infant Behav Dev* 2010;33(1):23–29.
5. Figueiredo B, Pacheco A, Costa R, Conde A, Teixeira C. Mother's anxiety and depression during the third pregnancy trimester and neonate's mother versus stranger's face/voice visual preference. *Early Hum Dev* 2010;86(8):479–485.
6. Van den Bergh BRH, Mulder EJH, Mennes M, Glover V. Antenatal maternal anxiety and stress and the neurobehavioural development of the fetus and child: links and possible mechanisms. A review. *Neurosci Biobehav Rev* 2005;29(2):237–258.
7. Hammer RL, Perkins J, Parr R. Exercise during the childbearing year. *J Perinatal Educ* 2000;9(1):1–14.
8. Lokey EA, Tran ZV, Wells CL, Myers BC, Tran AC. Effects of physical exercise on pregnancy outcomes: a meta-analytic review. *Med Sci Sports Exerc* 1991;23(11):1234–1239.
9. Spielberger C. *Manual for the State-Trait Anxiety Inventory*. rev. ed. Palo Alto (CA), Consulting Psychologists Press, 1983.
10. Zigmond AS, Snaith RP. The hospital anxiety and depression scale. *Acta Psychiatr Scand* 1983;67(6):361-370.
11. Rosenberg D, Depp CA, Vahia IV, et al. Exergames for subsyndromal depression in older adults: A pilot study of a novel intervention. *Am J Geriatr Psychiatry* 2010;18(3):221–226.
12. Salguero A, Martínez-García R, Molinero O, Márquez S. Physical activity, quality of life and symptoms of depression in community-dwelling and institutionalized older adults. *Arch Gerontol Geriat* 2011;53(2):152–157.
13. Van Uffelen JGZ, van Gellecum YR, Burton NW, Peeters G, Heesch KC, Brown WJ. Sitting-time, physical activity, and depressive symptoms in mid-aged women. *Am J Prev Med* 2013;45(3):276–281.
14. Oh Y, Yang SP. Defining exergames & exergaming. Meaningful play. 2010 Conference Paper; Michigan State University, East Lansing (MI): 2010.
15. Song H, Kim J, Lee KM. Virtual vs. real body in exergames: Reducing social physique anxiety in exercise experiences. *Comp Human Behav* 2014;36:282–5.
16. Mellecker RR, McManus AM. Active video games and physical activity recommendations: A comparison of the Gamercize Stepper, XBOX Kinect and XaviX J-Mat. *J Sci Med Sport* 2014;17(3):288–292.
17. Mills A, Rosenberg M, Stratton G, et al. The effect of exergaming on vascular function in children. *J Pediatr* 2013;163(3):806–810.
18. Gunter GA, Kenny RF, Vick EH. Taking educational games seriously: using the RETAIN model to design endogenous fantasy into standalone educational games. *Educat Technol Res Devel* 2008;56(5-6):511–537.

WOMEN IN SCIENCE AND ENGINEERING: STUDENTS, PROFESSIONALS AND AUTHORS

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Abstract

In recent years several studies have been published analysing the ratio of male to female authors of published articles in various scientific disciplines over the decades. There is a big difference among disciplines. This paper will present and analyse these differences. There is not only a difference in the total number of papers and articles with women as authors but also whether there are only women authors, women as first or last author, etc. In engineering an important area is also represented by patents. The ratio of men and women in this particular area is much more striking. Looking at academic institutions there are interesting analyses concerning the percentage of full professors. There is a statistically significant decrease in the number of women completing undergraduate study over postgraduate study, and women occupy lower positions in research up to senior researchers or full professors. These numbers vary across continents, with fewer women full professors in the European Union than in the United States. We will present information about the percentage of women researchers in fields related to telemedicine and eHealth, in particular medicine and nursing care in contrast to engineering and medical informatics. The differences are also significant. These numbers correlate to a certain extent with authorship.

Keywords: engineering education; telemedicine; authorship; research; woman researcher; gender.

Introduction

Several studies have recently reported on the proportion of men and women in various scientific disciplines and professions.[1-3] They have been followed by discussions in conferences and professional societies. We have decided to investigate this issue in the area of telemedicine and eHealth. Since it is on the border between STEM (science, technology, engineering, and mathematics) and life sciences, we have compared these fields. Telemedicine and eHealth are not followed as separate disciplines in education and jobs, thus are not present in statistics. We have searched for data on education, professions and authorship in STEM and life sciences. For more detailed analysis we have formulated several questions that could help us identify the causes of disproportions in particular in career development. The questions are as follows:

- What are the results in STEM subjects at primary and secondary schools?
- Do we have any explanation of these differences?
- What is the temporal development from university study to senior research position?
- What is the distribution of women and men in various fields?
- Does the ratio in authorship correspond to the number of researchers in the given fields?

Methods

To gain better insight, we first looked at: 1) the information and statistics about primary and secondary education, 2) the distribution of applicants to universities across disciplines, 3) comparison of the ratio of women and men in various jobs, and the issue of vertical segregation, 4) female authorship of journal articles, conference papers, and patents and women's roles as journal Editors, Associate Editors, and Board

Members. The data presented are derived from review of relevant literature.

Results and Discussion

Are there gender gaps in education?
The data presented in this section are based on studies and statistics published by the European Commission,[1] the OECD,[2] and the American Association of University Women.[3] In elementary, middle, and high school in the USA, girls and boys take mathematics and science courses in roughly equal numbers, and about as many girls as boys leave high school prepared to pursue science and engineering majors in college.[3] The situation is almost the same in Europe and Asia.[1,2] However, already at primary schools we can find differences in attitudes, in particular of parents and teachers. These differences are more obvious at secondary schools.

Parents can give their sons and daughters equal support and encouragement for all of their school work and aspirations for their future. The results of the OECD programme for international student assessment (PISA) show that this does not always happen.[2] In all countries and economies that surveyed the parents of students who sat the PISA test, parents were more likely to expect their sons, rather than their daughters, to work in a science, technology, engineering or mathematics field – even when their 15-year-old boys and girls perform at the same level in mathematics. Teachers can help by becoming more aware of their own gender biases that may affect how they award marks to students.

The analysis of results shows that girls and boys in the top-performing countries achieve comparable scores because they are strongly motivated to be the best. These results strongly suggest that gender gaps in school performance are not determined by innate differences in ability. Although boys are significantly more likely than girls to be less engaged with school and have lower skills and poorer academic achievement, they finally succeed in studying STEM courses. In higher education and beyond, young women are under-represented in the fields of mathematics, physical science and computing. However, when we analyse the statistics in detail we see that the gender gaps in education are widening. Why? The studies have highlighted an interesting finding: there is lack of self-confidence among girls.

In the large majority of countries and economies that participate in PISA, among high-performing students, girls do worse than boys in mathematics and in no country do they outperform boys at this level.[2] In general, girls have less self-confidence than boys in their ability to solve mathematics or science problems. It is particularly obvious when the students are required to "think like scientists". In that case girls underperform considerably compared to boys. This gender difference may be related to students´ self-confidence. When students are more self-confident, they give themselves the freedom to fail, to engage in the trial-and-error processes that are fundamental to acquiring knowledge in mathematics and science.[2]

The OECD study shows interesting variations in differences between boys and girls when solving different types of tasks.[2] The results are rather worrying. While girls´ lower performance in mathematics and science among the highest-achieving students may reflect lower levels of self-confidence and higher level of anxiety, the differences in levels of self-confidence and anxiety between boys and girls are greater than differences in mathematics and science performance. The study shows results of inquiries among 15-year old boys and girls about careers in computing and engineering on one side and health services on the other side. On average, there are almost four times as many boys as girls who expect to work in engineering and computing. In contrast the proportion of girls planning to work in health services is approximately 9% higher than boys. Another interesting statistic shows expectations of parents about their children´s career. Concerning STEM occupations, there is a significant gender gap. In all countries parents expect that the boys will be more likely than girls to work in STEM occupations (the smallest difference is 7%, the largest is 33%).

A wealth of research has examined how self-beliefs are formed and the key role played by both interpersonal and intrapersonal comparisons.[2,3] Students´ beliefs about their own competence in mathematics are related to how well they perform compared to their classmates, and also to how well they perform in mathematics compared to their performance in other subjects. Because girls tend to perform so well in reading, they may, unconsciously, believe that they are underperforming in other subjects. As a result, they have less confidence in other subjects, like mathematics, which in turn, could under-

mine their performance. In such situations, the role of teachers and parents is irreplaceable and must be positive and supportive. One way at schools is using cognitive-activation strategies in mathematics.[2,3]

Women in science and engineering study and jobs

Although the number of women in science and engineering is growing, men continue to outnumber women, especially in higher positions of the professions. Yet fewer women than men pursue the STEM majors. Most people associate science and mathematical fields with "male" and humanities and arts fields with "female". Implicit bias is common, even among individuals who actively reject these stereotypes. This bias not only affects individuals´ attitudes toward others but may also influence girls´ and women´s likelihood cultivating their own interest in mathematics and science. Not only are people more likely to associate mathematics and science with men than with women, people often hold negative opinions of women in "masculine" positions, like scientists or engineers. Research profiled in the report by Hill et al. shows that people judge women to be less competent than men in "male" jobs unless they are clearly successful in their work.[3]

The teaching profession up to secondary education is dominated by women. The proportion of women educators declines as the level of education increases and also changes with the taught subject. In STEM courses the share of men is usually higher than in humanities, for example. The proportion of women as teachers in individual levels of education is 97% in early childhood education, 83% in primary education, 68% in lower secondary education, 56% in upper secondary education, and 41% at the tertiary level.[2]

In the European Union, the share of women in total employment reached 45% in 2010, but women made up 53% of tertiary educated people who were employed as professionals or technicians. However, only 32% of scientists and engineers were women. Although the proportion of female researchers has been growing, the gender imbalance in the research population increases with age.[1,10]

When looking at American statistics we can see that at high schools the girls earned more credits in mathematics and science than boys (the study presented data from 1990 till 2005).[3] In evaluation of grade point average this difference is even more obvious. Although results of girls at high schools are encouraging, when entering college and later university the ratio changes, in some fields rather dramatically. Statistics of 2006 show that 29% of all male freshmen (1st year students), compared with only 15 percent of all female freshmen, planned to major in a STEM field. The gender disparity in plans to major is even more significant when the biological sciences are not included. More than 20% of male students planned to major in engineering, computer science, or the physical sciences, compared with only about 5% of females.[3]

Despite the still relatively small percentages of women majoring in some STEM fields, the overall proportion of STEM bachelor´s degrees awarded to women has increased dramatically during the past four decades, although women´s representation varies by field. In 2006, women earned the majority of bachelor´s degrees in biology, one-half of bachelor´s degrees in chemistry, and nearly one-half in mathematics. Women earned a much smaller proportion of bachelor´s degrees in physics, engineering, and computer science. The report shows statistics over 40 years (1966 – 2006). In biology, chemistry, physics and engineering the percentage of women bachelor´s degrees were growing, but were decreasing slightly in mathematics. The decline in computer science, from a peak of 36% in 1986 to only 20% in 2006, is significant.[3]

Of course, the absolute numbers vary across disciplines. We present numbers of graduates from the year 2007 in several disciplines that are close to telemedicine and eHealth: biology, 48,001 women and 31,347 men; computer science, 7,944 women and 34,652 men; and electrical engineering, 2,109 women and 16,438 men.[3]

Doctoral degree recipients

Women´s representation among doctoral degree recipients in STEM fields also has improved in the last 40 years. The most impressive increase is in biology from 12% to 47%. However, even in computer science, engineering and physics the percentage improved from 0 or nearly 0, to almost 20 percent. These numbers are very similar both for Europe and the United States.[1,2]

The changes in STEM professions almost copy the changes in STEM degree recipients. In almost all areas there has been continuous increase from 1960 to 2000. Only in mathematics and computer science has there been a drop of 5% between 1990 and 2000 (from 35%

to 30%). Among workers who hold doctorates, men represent a clear majority in all STEM fields. In the academic workforce, women´s representation varies by discipline as well as tenure status. In 2005, 40% of full-time faculty in degree-granting colleges and universities in the U.S. were women.

However, women's representation in STEM disciplines was statistically significantly lower. Women made up less than one-quarter of the faculty in computer and information sciences (22%), mathematics (19%), the physical sciences (18%) and engineering (12%). In the life sciences, an area in which many people assume that women have achieved parity, women made up only 34% of the faculty. In all cases women were better represented in lower faculty ranks than in higher ranks among STEM faculty in four-year colleges and universities.[1,3] In Europe the proportion of women among full professors is highest in the humanities and the social sciences, 28.4% and 19.4%, respectively and lowest in engineering and technology at 7.9%. These numbers lead to discussion on horizontal and vertical segregation.[1]

Horizontal and vertical segregation are terms expressing differences in representation of females and males in disciplines and in hierarchy. Horizontal segregation means different representation of men and women in individual disciplines and sectors. Women are more frequently active in the so-called soft disciplines (humanities and social sciences) and employed mostly in governmental (37%) and non-profit (38%) sectors. In the entrepreneurial sector there are only 15% of females in research and development. There is great contrast between soft disciplines (43% of female researchers) and engineering (12% of female researchers).[1]

Vertical segregation expresses concentration of men and women on different levels of academic hierarchy. Women are more frequently represented on lower positions in the hierarchy, while men have the majority on decision making positions. The situation is almost the same across disciplines and sectors. In 2010, on average throughout the EU-27, 15.5% of institutions in the Higher Education Sector were headed by women, and only 10% of universities had a female rector.[1]

We can confirm this distribution by numbers from the universities in the Czech Republic: among 25 rectors of public universities, only 2 are women. Of the 62 directors of research institutes of the Academy of Sciences, 12 are female. A similar situation exists in other sectors.[4] Women represent 56% percent of all university educated graduates in the Czech Republic and about 43% of PhD graduates. However, in jobs the ratio changes, in particular in higher positions. When we observe the numbers in research and development, females constitute only 26%.[4] They are concentrated in specific scientific areas and in lower positions in the hierarchy. Definitely one of the reasons for this is care for children and family. If a woman does not find support in her family, it is usually difficult to continue the career, in particular in areas where for example, frequent and whole-day presence in laboratories is required. These facts show that without systematic work and support from the side of the institutions it is almost impossible to reach more satisfactory results. These observations were also confirmed by the study performed by Servou and Visser.[10]

Hewlett et al. focused their study on numbers in business and reasons why women quit engineering jobs.[5] On the lower rungs of corporate career ladders, fully 41% of highly qualified scientists, engineers, and technologists are women. But the dropout rates were huge, and over time 52% of these talented women quit their jobs. What were the reasons? The authors identified 5 serious aspects. First and foremost, the hostility of the workplace culture drives women out. Second, is the dispiriting sense of isolation that comes when a woman is the only female on her team or at her rank. Third, there is a strong disconnect between women´s preferred work rhythms and the risky "diving catch" and "fire-fighting" behaviour that is recognized and rewarded in these male-dominated fields. Fourth, "extreme jobs", with their long workweeks and punishing travel schedules, are particularly prevalent in science, engineering, and technology companies. Fifth, many women surveyed bemoaned the "mystery" around career advancement.

Although the statistics do not follow jobs in telemedicine and eHealth separately, we can derive the ratio from the numbers in STEM and medicine jobs, where engineering and information technology are in the majority. That means that in the technical positions men dominate while on the other hand women dominate in care positions.

Authorship – ratio of women and men

Several studies on the role of gender in scholarly authorship have recently been published.[6,7,8] The statistics on authorship and proportion between women and men are correlated with the numbers of

women and men working in scientific disciplines (STEM vs. humanities and life sciences). Men publish more papers on average than women, although the gap differs between fields and subfields. Women publish significantly fewer papers in areas in which research is expensive, possibly as a result of policies and procedures relating to funding allocations.[6]

Lariviere et al. present a global and cross-disciplinary bibliometric analysis of:

- The relationship between gender and research output (authorship)
- The extent of collaboration (co-authorship)
- Scientific impact of all articles published between 2008 – 2012 and indexed in the Thomson Reuters Web of Science databases (citations).

They analysed 5,483,841 research papers and review articles with 27,329,915 authorships.[6] Their findings are interesting but unfortunately not very surprising. All articles with women in dominant author positions receive fewer citations than those with men in the same positions. Men dominate scientific production in nearly every country. Globally, women account for fewer than 30% of fractionalised authorships. Women are similarly underrepresented when it comes to first authorship. For every article with a female first author, there are nearly two (1.93) articles first-authored by men. South American and Eastern European countries demonstrate greater gender parity.[6]

Specialties dominated by women include nursing; midwifery; speech, language and hearing; education; social work; and librarianship. Male-dominated disciplines include military sciences, engineering, robotics, aeronautics and astronautics, high-energy physics, mathematics, computer science, philosophy and economics. Although disciplines from the social sciences show a larger proportion of female authors, the humanities are still heavily dominated by men. Another key limitation is that authorship of papers is only one of many indicators of research activity. Moreover, the analysis was only of journal articles and books and conference papers were not considered.

West et al. performed another study using a different source of documents for analysis. They focused on the authorship order, given that first and sometimes last author publications are at least as important as raw publication counts for hiring, promotion, and tenure, particularly in scientific fields.

The study used the JSTOR corpus, comprising more than 8.3 million documents from 1545 to 2011, including 4.2 million research articles. Overall, 21.9 % of authors were female irrespective of their position in the list of authors. The ratio is very different in various disciplines; mathematics 10.6%, law 24.2%, cognitive science 32.1% and education 46.4% (data were taken from 1990 till 2011).[7]

Studies of authorship in the medical literature reveal that women have been historically underrepresented in the prestige positions of first and last author, although the ratio of women and men is almost balanced.[7] As already mentioned, telemedicine brings certain technical issues to medicine, thus the number of men as authors is higher than women. There are differences connected with the content of papers. Papers focused on aspects of care have more women as authors. Technical articles have more (or only) men as authors. Since telemedicine and eHealth are still relatively young disciplines it is too early to make any conclusion about the temporal development of balance between female and male authorship. It will definitely be closely correlated with ratio of women in STEM jobs, since in medicine the numbers are almost balanced.

Vela et al. analysed publications in software engineering in terms of gender. This was an empirical study of female participation in 12 leading software engineering journals over a two year period The main goal of the study was to analyse the participation rate of women as authors and whether women are underrepresented on editorial boards and as editors-in-chief by taking as the reference population the number of authors of the journals selected to discover whether there is a glass ceiling for women in this area of computer science.[8] The absolute numbers considered in the study were 3,546 authors of 1,266 papers from 61 different countries, and 363 members of editorial boards from 30 different countries.

Women appear as the first author in 17.4% of all the papers considered. The US was the most productive country with 954 authors which corresponds to 27% of all authors. Female authors from the US comprise 17.9% of US authors which is close to world average. The female author ratio from several European countries varies from highs of Finland 34.4%, Spain 33.9%, and France 23.4% to less than 10% from Ireland, Austria, Belgium, Netherlands, Germany and Greece. Not all EU countries were included in the analysis due to missing data. The

imbalance in editorial boards is more marked. Of the 12 journals, males dominate as Editors-in-Chief (90.5%), Associate Editors (76.1%), and Editorial Board Members (82.1%).[8]

Hunt et al. performed an analysis of patent authorship. The gender gap in patenting rates is much more pronounced than the gender gap in many other endeavours: American women patent at only 8% of the male rate. The highest shares were for Spain and France (12.3% and 10.2% respectively), while the lowest shares were for Austria and Germany (3.2% and 4.7% respectively). The authors analysed the reasons and found the following gaps in field of study, degree, number of commercialised patents, and in job positions. All of them have as a cause the underrepresentation of women in electrical and mechanical engineering which are the disciplines with the highest number of patents.[9]

Conclusions

The striking disparity between the numbers of men and women in science, technology, engineering, and mathematics has often been considered as evidence of biologically driven gender differences in abilities and interests. The classical formulation of this idea is that men "naturally" excel in mathematically demanding disciplines, whereas women "naturally" excel in fields using language skills. Recent gains in girls´ mathematical achievements demonstrate the importance of culture and learning environments in the cultivation of abilities and interests. However there are many stereotypes found in children´s books, school manuals, gendered attitudes of teachers, gendered advice, and guidance on courses to be followed. A concerted effort by parents, teachers, policy makers and opinion leaders is needed if boys and girls are to be able to realise their full potential and contribute to the economic growth and wellbeing of their societies. Finally we should mention that there are also areas where men are underrepresented. We presented the percentage of teachers at all levels of education from which it follows that in particular at primary and secondary schools the male element is missing. There were few studies performed that analysed the reasons. Similar underrepresentation of men is in health care, social care and humanities. If we want to study the gendered pattern of study and job choice, it is necessary to consider both sexes equally.

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References

1. European Commission She Figures 2012. *Gender in research and innovation*. European Commission. Luxembourg: Publication Office of the European Union, 2013.
2. OECD (2015). *The abc of gender equality in education: aptitude, behaviour, confidence.* PISA, OECD Publishing, 2015
3. Hill C, Corbett C, Rose, AS. *Why so few? Women in science, technology, engineering, and mathematics.* Report. American Association of University Women. 2010
4. Lhotská L, Radisavljevič Djordjevič V. IT and engineering education: how to make it more attractive for women. *Global Telemedicine and eHealth Updates: Knowledge Resources.* 2014;(7):622-625.
5. Hewlett SA, Luce, CB, Servon LJ. Stopping the exodus of women in science. *Harv Bus Rev* 2008;86(6):22-24.
6. Lariviere V, Ni C, Gingras Y, Cronin B, Sugimoto CR. Bibliometrics: Global gender disparities in science. *Nature* 2013;504: 211-213.
7. West JD, Jacquet J, King MM, Correll SJ, Bergstrom CT. The role of gender in scholarly authorship. *PLoS ONE* 2013;8(7):e66212.
8. Vela B, Cáceres P, Cavero JM. Participation of women in software engineering publications. *Scientometrics* 2012;93(3):661-679.
9. Hunt J, Garant J-P, Herman H, Munroe DJ. Why are women underrepresented amongst patentees? *Res Policy* 2013;42(4):831-843.
10. Servon LJ, Visser MA. Progress hindered: the retention and advancement of women in science, engineering and technology careers. *Hum Resour Manage J* 2011;21(3):272-284.

WOMEN AS BENEFICIARIES OF TELEMEDICINE AND EHEALTH SERVICES IN PERU: ACCESS AND USE OF ICT FOR HEALTH AMONG FEMALE HEALTHCARE WORKERS IN THE AREA OF ePREVENTION

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Abstract

Improving access to information and communication technologies (ICT) and the affordability of these services are prerequisites for their efficient and sustainable use in healthcare and eHealth. This article reports a survey of 239 Peruvian female health related personnel in the Andean region, to assess the role ICT play in facilitating access to health information among healthcare workers (HCWs) in the region for the prevention of infectious diseases. The survey questionnaire enquired about the HCWs' access to ICT (pre and postpaid mobile cellular telephones, residential Internet, and telecentres), their use of ICT for healthcare contact and health information retrieval, and their communication and training preferences. The only statistics calculated were frequency of responses. Ninety per cent of the participants reported having access to at least one modality and 78% reported having access to two of the three services, highlighting the increasing importance of these technologies as platforms for urban and rural HCWs to exchange health information. Female HCWs in Peru reported taking advantage of these technologies to contact their healthcare centres (67%) and to obtain health information (65%); yet, 30% mentioned having difficulty in contacting such centres. Key topics of interest for health information and training included prevention and promotion (60%) and infectious diseases (24%), especially tuberculosis, dengue and HIV/AIDS. Only 2% of respondents expressed interest in receiving training on eHealth and telemedicine.

Keywords: Telecommunications; eHealth; health personnel; women; Latin America.

Introduction

The Peruvian healthcare system is characterized by its fragmentation and inequity. Historically, the marginalization of large sections of the population has limited their access to healthcare services. This situation is particularly pronounced in rural areas of the country, where healthcare facilities lacked qualified professional staff until the 1990s.[1] The poverty, informal employment and poor living conditions of rural populations, where 60 different ethno-linguistic indigenous groups live, have widened the healthcare access gap between urban and rural settings.[1,2]

Despite advances in infrastructural and primary care coverage in the last decades, inequities in the distribution of public subsidies and differences in healthcare costs still marginalise the most disadvantaged population groups. About 36% of the population is currently insured under the Peruvian public insurance system, and private health providers only serve a small percentage of the population.[3] The epidemiological mosaic of the country aggravates the impact of healthcare access gaps. In Peru, communicable diseases, such as malaria, dengue and yellow fever, coexist with an increasing number of people with non-communicable diseases and those affected by HIV/AIDS.

Improving the access to information and communication technologies (ICT) and the affordability of these services are prerequisites for their efficient and sustainable use in healthcare, including eHealth for ePrevention and health promotion practices. Peru, like the rest of the Americas, has seen a rapid rise in the penetration of wireless services, particularly mobile cellular telephony.[4,5] In 2013, 98.1% of the population and 77% of the homes with women heading the household

had a mobile cellular subscription. [6,7] In rural areas, however, the subscription rate drops to 50.6% of the households.[7] The International Telecommunication Union (ITU) notes, however, that the number of unique mobile telephone users might differ from that of active post- and prepaid subscriptions, as a single user may have multiple subscriber identification module (SIM) cards or share the use of a single subscription and SIM card among several members of a household. By owning several SIM cards, mobile cellular users in developing countries - where the prepaid modality is more commonly used - seek to avoid paying high termination fees charged for calling people using a different service provider.[8]

Growth in fixed telephone subscriptions (11.3 subscriptions per 100 inhabitants) has stagnated in Peru, due to deployment costs and increased substitution by mobile telephony. In contrast, access to the Internet is expanding, with 39.2% of the population using the service and 22.1% of households being connected to it.[6] Thanks to increased broadband deployment and a slow reduction in service rates, the percentage of the population above 6 years old who access the Internet using public telecentres, known as 'public cabins' in Peru, has decreased steadily, from 23.5% in 2007 to 16.9% in 2013.[9] Nevertheless, in rural areas, the use of telecentres for Internet access has increased slightly during the same time period, from 7.0 to 8.6% of the population. Among women, Internet use has reached 36%, with large disparities in access between those living in urban and rural areas of the country (44.2% and 8.9% respectively).[10] Similarly, among households headed by women, there are significant differences in Internet access in urban (26%) and rural (0.7%) areas.[11] Penetration of mobile broadband among the population is still limited, with only 2.9% subscriptions per 100 inhabitants by 2013.[6]

To assess the role that ICT play in facilitating access to health information for prevention and rapid response among healthcare workers (HCWs), the Institute of Tropical Medicine Alexander von Humboldt at the Universidad Peruana Cayetano Heredia (IMT AVH UPCH) conducted a survey among health related personnel in the Andean region, under the sponsorship of the Millennia2025 Foundation. In the context of this special themed issue on Women and eHealth, this article analyses the survey data on the use of ICT for health (eHealth) among the 239 Peruvian women who participated in the survey, as a sample of HCWs in the region.

Methods

Recruitment and Participants

The selection of survey participants was not random. In January 2014, the *ePrevention in Latin America and the Caribbean Project* of the IMT AVH UPCH surveyed 404 HCWs and health related personnel from the Andean region - Bolivia, Colombia, Ecuador, Peru, and Venezuela - and 15 other countries, attending an ePrevention session held in the Province of Cajamarca, Peru. Peru had the largest representation among the survey participants, with 314 respondents (78%), of whom 239 (76%) were women. This article discusses the responses of the Peruvian women who participated in the survey. This subgroup was composed mostly of women from urban areas (93%) of Peru, with only 10 participants (4%) residing exclusively in rural settings. The participants' age ranged from 20 to more than 60 years old, with a median age of 45 years (Table 1).

Table 1. Profile of survey respondents.

Characteristic	Distribution	n (%)
Residence	Urban	222 (92.9)
	Rural	10 (4.2)
	Rural and urban	4 (1.7)
	Not disclosed	3 (1.3)
Age group	20-29	14 (5.9)
	30-39	68 (28.5)
	40-49	72 (30.1)
	50-59	68 (28.5)
	60+	10 (4.2)
	Not disclosed	7 (2.9)

The professional background of the Peruvian women was also diverse: 67% were healthcare providers working in nursing, general medicine, obstetrics, health promotion, and technical medical professions; the remaining 32% worked in health-related areas ranging from psychology, biology, and social work to education, engineering and informatics, with 1% not disclosing their profession.

Questionnaire

The questionnaire (Appendix 1) consisted of nine closed and two open-ended questions covering three areas of interest: 1) *Access to ICT*, which focused on the ownership of mobile cellular telephones (pre-

and/or postpaid), subscription to residential Internet service, as well as usage of public cabins (telecentres) to access the Internet; 2) *ICT use for healthcare contact and information retrieval*, which enquired about the use of mobile or Internet services to contact a healthcare centre, the ease with which this contact took place, the use of ICT to receive health information, as well as the participants' opinion on whether radio and television programmes provided health information. Finally, the questions on 3) *Communication and training preferences* asked participants about their interest in receiving health information - either through the Internet or mobile phones - in their local language, and included two open-ended questions on the type of health information they obtained from their healthcare centres and the health topics they would be interested in receiving training for in the future through distance education.

Respondents were asked to indicate if they agreed or disagreed with each statement. Internal reliability was not assessed because the purpose of the survey was simply to gather information from these HCWs about their level of access to ICT, and their use of ICT and traditional media to obtain health information.

Analysis

As a descriptive study, the only statistics calculated were frequency of responses. The small number of survey participants from rural areas (10) did not allow for the use of inferential statistics. For the open-ended questions, percentages were calculated based on those who provided a response. The content of open-ended questions was analysed qualitatively to identify trends in the health areas of greatest interest to the participants.

Results

ICT access

The survey enquired about access to mobile cellular telephony - in its prepaid and postpaid modalities - and to Internet service, both at the household and through telecentres. Table 2 shows the results by type of service and location. Residential Internet had the highest number of subscribers (84%), followed by postpaid (50%) and prepaid mobile cellular service (37%). Only 25% of the Peruvian women surveyed used telecentres.

The increasing importance of the Internet as a communication and information retrieval medium among the women sampled is reiterated when the data are disaggregated by location; 80% of the rural women and 84% of those living in urban settings reported subscribing to residential Internet service, compared to 40% and 51%, respectively, of those subscribed to postpaid mobile telephony.

Prepaid mobile telephony and telecentres were the only services for which rural women reported a higher level of access/usage compared to their urban counterparts: 40% of rural and 36.5% of urban women owned a prepaid telephone, while 30% of rural and 24.3% of urban women used telecentres to access the Internet. The "pay-as-you-go" modality, characteristic of telecentres and prepaid mobiles, usually provides rural residents more affordable service options, freeing them also from dealing with long-term contracts and monthly bills. Of the ten rural women participating in the survey, four owned prepaid phones, four subscribed to postpaid service, and more importantly, two did not have access to this service. In total, 13 survey participants (5.4%) indicated not having access

Table 2. Profile of respondents' access to ICT services. Data are shown as the total number of respondents (n) and the percentage of respondents from that group (%) who have access to a service.

Service	ICT SUBSCRIBERS / USERS				
	All n (%)	Urban n (%)	Rural n (%)	Both n (%)	Unknown n (%)
Prepaid cell phone	89 (37.2)	81 (36.5)	4 (40)	2 (50)	2 (66.7)
Postpaid cell phone	120 (50.2)	114 (51.4)	4 (40)	1 (25)	1 (33.3)
Both pre- & postpaid	17 (7.1)	16 (7.2)	0 (0)	1 (25)	0 (0)
Telecentres	60 (25.1)	54 (24.3)	3 (30)	1 (25)	2 (66.7)
Residential Internet	201 (84.1)	187 (84.2)	8 (80)	4 (100)	2 (66.7)

to mobile cellular telephony, 4.8% of women in urban areas and 20% of women in rural areas.

The distribution of users according to the number and type of ICT services to which they had access is shown in Table 3. Of the 239 Peruvian women surveyed, 13% had access to residential Internet, telecentres and mobile cellular telephony (in one or both modalities); the majority (67%) reported using one or both of the mobile cellular telephony modalities and residential Internet, followed by 10% who had access to one or both of the cellular modalities and used telecentres. Only one respondent (0.4%) lacked access to both mobile telephony and Internet services in any modality. The most popular mix of services was postpaid mobile phone and residential Internet service (38%), followed by those who preferred the prepaid modality and residential Internet service (24%). Of the 20 respondents with access to only one service, 90% were urban women.

Table 3. ICT access by type and number of services (pre = prepaid mobile cellular telephony, post = postpaid mobile cellular telephony, tele = telecentre, Int = residential Internet).

Service	n (%)
Pre, post or both, tele and Int	31 (13.0)
Post and Int	90 (37.7)
Pre and residential Int	58 (24.3)
Pre and post and Int	12 (5.0)
Pre and tele	11 (4.6)
Post and tele	11 (4.6)
Tele and Int	3 (1.3)
Pre and post and tele	2 (0.8)
Only pre	2 (0.8)
Only post	9 (3.8)
Only tele	2 (0.8)
Only Int	7 (2.9)
Lacked access to all services	1 (0.4)

Use of ICT for healthcare contact and information retrieval
An objective of this survey was to better understand how healthcare workers are taking advantage of their access to ICT for health (eHealth), either by facilitating their contact with healthcare centres and/or by easing their retrieval of health information.

Although in this section the focus is on the use of mobile phones and the Internet for health, an additional question brings attention to the role played by traditional media (radio and television) as providers of health information. For these questions, results are also given in relation to the professional background and age group of the respondents to identify the potential impact that the level of education and/or familiarity with ICT may have on the HCWs' use of these technologies for health.

ICT use (mobile phone or Internet) for contacting a healthcare centre
Of the 239 participants, 160 (67%) reported having used their mobile phone or the Internet to contact their healthcare centre, 66% of urban women and 70% of those in rural areas. The specific technology used to contact the healthcare centre was not requested as part of the survey. Of the health professionals, 75% of the 100 nurses, 72% of the 32 gynaecologists, and 71% of the 17 general doctors were more likely to use ICT to contact a health centre compared to only 50% of the health promotion workers who did so (Table 4). In terms of age, participants between 30 and 49 years of age reported the highest number of ICT use to contact a health centre, with 63% reporting doing so.

One third of the 239 survey respondents have faced difficulties when contacting their healthcare centre, with urban and rural residents facing equal levels of difficulty (30.2% and 30.0%, respectively). All health promotion workers and 71% of social workers reported having difficulty, while between 25 – 30% of doctors and nurses had difficulties. Technicians had the least difficulty (11%).

Age did not seem to make a difference in terms of the difficulties faced in contacting a healthcare centre; at least 20% of the respondents in each age group reported facing difficulties (Table 5).

Use of ICT (mobile phone or Internet) to receive health information
Of the 239 survey participants, 155 (65%) reported having received health information through their mobile phone or the Internet; 65% of women who live in urban areas and 60% of those in rural areas.

With the exception of those in academia (18%), all the other professional subgroups surveyed had at least 50% of their staff members using some form of ICT to receive health information (Table 4). Health promoters topped the list with 100% of the participants, followed

Table 4. Use of ICT for health, by profession. Data are shown as the total number of respondents (n) and the percentage of respondents from that group (%) who had used ICT for health.

Profession	n (%) N=239	Used ICT to contact their health centre n (%) N=160	Faced difficulties in contacting health centre n (%) N=73	Received health information via ICT n (%) N=155
Nursing /Technical nursing	100 (41.8)	75 (75.0)	28 (28.0)	65 (65.0)
OB-GYN	32 (13.4)	23 (71.9)	8 (25.0)	26 (81.3)
General doctor	17 (7.1)	12 (70.6)	5 (29.4)	12 (70.6)
Psychology	12 (5.0)	5 (41.7)	4 (33.3)	6 (50.0)
Education	11 (4.6)	3 (27.3)	5 (45.5)	2 (18.2)
Technician (medical, lab, etc.)	9 (3.8)	6 (66.7)	1 (11.1)	6 (66.7)
Biology	7 (2.9)	4 (57.1)	1 (14.3)	5 (71.4)
Social work	7 (2.9)	4 (57.1)	5 (71.4)	4 (57.1)
Other natural sciences	6 (2.5)	4 (57.1)	2 (28.6)	4 (57.1)
Engineering, IT	3 (1.3)	2 (66.7)	2 (66.7)	2 (66.7)
Health promotion	2 (0.8)	1 (50.0)	2 (100)	2 (100)
Other	30 (12.6)	19 (63.3)	9 (30.0)	18 (60.0)
Not disclosed	3 (1.3)	2 (66.7)	1 (33.3)	3 (100)

by the gynaecologists (81%). Once again, age did not seem to be a differentiating factor among the respondents, since at least half of those within each age subgroup used ICT to receive health information (Table 5).

Table 5. Use of ICT for health, by age group. Data are shown as the total number of respondents (n) and the percentage of respondents from that age group (%) who had faced difficulties in contacting health centres (N=73) or who had received health information via ICT (N=155).

Age group	Difficulty contacting health centre n (%)	Received health information via ICT n (%)
20-29	4 (28.6)	8 (57.1)
30-39	18 (26.5)	44 (64.7)
40-49	23 (31.9)	46 (63.9)
50-59	24 (35.3)	45 (66.2)
60+	2 (20.0)	6 (60.0)
Not known	2 (28.6)	6 (85.7)

Provision of health information through radio and television
Over two thirds (71%) of the 239 survey participants considered traditional media to be a source for health information. While 72% of the HCWs in urban areas agreed with this statement, only four of the ten rural HCWs did so, but the survey did not include any additional question to help explain this difference in opinion. From 40% (technicians) to 100% (social workers) of the respondents within the different professional subgroups agreed with this idea. Similarly, in terms of age group, the level of agreement with the role of traditional media reached at least 64%.

Interest in receiving health information in their local language
The respondents' interest in receiving health information in their local language was almost unanimous (95%), regardless of location (96% urban / 90% rural), professional background (86% to 100%), or age difference (90% to 100% agreement).

Health information retrieved: Quality and topic preferences

This section analyses the responses to the two open-ended questions on the type of information participants usually obtain from their healthcare centres and the health topics they would be interested in getting distance education on.

Type of health information obtained from healthcare centres

Of the 239 survey participants, 193 (81%) answered this open-ended question. Nine percent of those respondents indicated that they did not obtain any type of information from their healthcare centres, while another 9% focused on the quality of health information provided rather than replying about the type of information retrieved. This latter group failed to find value in the health information received because it was perceived as dated, scarce, or too general.

A total of 158 respondents provided details on the type of health information they received from healthcare centres, including training and additional resources, such as brochures and statistics. These replies were categorised under eight topic areas, ranging from health prevention and promotion to health strategies, capacity building, and statistics. The distribution of the participants' responses by category is shown in Table 6.

Table 6. Type of information respondents (n=158) obtain from their health centres (CD=communicable diseases, NCD=non-communicable diseases.

Type of information	n=	%
Prevention and promotion	95	60.1
CDs (HIV/AIDS, TB, etc.)	38	24.1
Capacity building & training	31	19.6
Other	30	19.0
Administrative and legal	23	14.6
Epidemic bulletins & statistics	16	10.1
Brochures on diverse topics	16	10.1
NCDs	14	8.9

As expected, prevention and promotion - the topic of the session from which the survey respondents were selected - was the most recurrent theme on which they obtained information, resources and/or training (60%),

followed by communicable diseases (CDs), especially information on tuberculosis (TB), dengue and HIV/AIDS (24%). This interest motivated the HCWs to keep abreast of research and scientific developments (20%).

Topics of interest for future distance education courses

All 239 participants replied to this question. Their replies were classified under 12 topical areas to better reflect the breadth of topics HCWs considered important for capacity building, which ranged from community health to non-communicable diseases, and from maternal, neonatal and children's health to emergency care and alternative medicine. Communicable diseases topped the list, with 39% of responses. The mere opportunity of building capacity on health topics was considered valuable by a quarter of respondents, as shown under the category of "Other/any topic" (Table 7). Under the topics of primary care and maternal and children's health (21%, respectively), respondents expressed particular concern about health issues relating to adolescents. This subtopic crossed several of the categories included in Table 7, such as prevention of communicable diseases (HIV) and promotion activities, family medicine (family planning), maternal newborn and child health (youth pregnancy, for example), and nutrition (child obesity).

Finally, it should be noted that interest in receiving training on eHealth or sub-components such as mHealth or telemedicine was still incipient, with only 2% of positive replies.

Discussion

This survey provides evidence of the interest of female healthcare professionals in Peru for use of ICT to obtain health information and build their capacity to better address the health issues affecting the population. In terms of access, high subscription rates to Internet and mobile cellular telephone services among the respondents underscore the usefulness of these two technologies. They function as platforms that can be used by HCWs in urban and rural settings to exchange health information, implement ePrevention strategies, and for distance education.

It is encouraging that 90% of the respondents reported having access to Internet services and mobile

Table 7. Health topics of interest for future distance education courses (CD = communicable diseases, NCD = non-communicable diseases, MNCH = maternal newborn and child health), N=239.

Health education topic	n=	%
CDs research, monitoring, diagnosis, treatment / epidemiology	93	38.9
Other / any topic	60	25.1
Primary care/ family & community health	51	21.3
MNCH	50	20.9
Prevention & Promotion	47	19.7
NCDs (diabetes, obesity, heart & kidney diseases, cancer, mental health, etc.	47	19.7
Health services management / Administration / HR management/ healthcare quality	39	16.3
Public health	37	15.5
Emergency care / disaster response	22	9.2
Nutrition	16	6.7
Alternative medicine / occupational health	7	2.9
eHealth / mHealth / telemedicine	4	1.7

cellular technology, in one or both of their respective modalities. Yet, the nearly 10% of survey respondents who have access to only mobile telephony or Internet services, highlights the continuity of access barriers. The cost of owning equipment and the affordability of service subscriptions, although not directly addressed in the survey, remain key barriers to access among rural HCWs. This is illustrated by their higher rates of subscription to prepaid mobile telephony and their higher usage of public Internet services through telecentres, compared to their urban counterparts. As the penetration of broadband services increases in Peru, particularly of wireless broadband service - a technology identified as especially useful as a platform for eHealth services - it is important for the government to consider the provision of subsidies or incentives to ensure the affordability of such services among rural HCWs and reduce existing access gaps.

In terms of ICT usage, the survey results clearly indicate that female HCWs in Peru are taking advantage of these technologies to contact their healthcare centres (67%) and to obtain health information (65%). But the results also emphasise the difficulties that at least 30% of those surveyed faced in contacting such centres. Regretfully, the questionnaire did not enquire about the specific nature of such difficulties - technical problems with the use of ICT, lack of personnel at the health centre, or some other factor - thus impeding the identification of potential areas for improvement.

Results for the question on the usefulness of traditional media as a source of health information (71% agreement) and the respondents' interest in receiving health information in their local language (95%) were not surprising. This relates to the wide penetration of traditional media in Peru and the large number of indigenous groups in the country.

Similarly, the respondents' interest in receiving information and training on the areas of communicable diseases and prevention and promotion reflects health priority areas for the country, as well as particular interests of the group from which the sample was drawn. In general, respondents were enthusiastic about building capacity on a spectrum of areas within the continuum of care, giving emphasis to health problems affecting youth. Taking into consideration the valuable resources that telemedicine and e- and mHealth applications could provide in helping these HCWs address priority health areas, it is surprising that such a small percentage of participants (2%) included eHealth and telemedicine as areas of interest for future training. This finding underscores the need to raise awareness among HCWs about the potential benefits of ICT.

Finally, further research is needed on the impact that reduced access to ICT services might have on the ability of rural HCWs to obtain health information and implement ePrevention practices.

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References

1. Bardález del Águila C. La Salud en el Perú. Proyecto Observatorio de la Salud. Lima, Consorcio de Investigación Económica y Social, 2003, pp. 4, 6. Available at: http://www.bvsde.paho.org/bvsacd/cd67/saludenelperu.pdf accessed 25 March 2015.

2. Instituto Nacional de Estadística e Informática (INEI). Censos Nacionales 2007: XI de Población y VI de Vivienda – Resumen Ejecutivo – Resultados Definitivos de las Comunidades Indígenas. Lima, Republica del Perú, 2009, p. 7. Available at: http://www.inei.gob.pe/media/MenuRecursivo/publicaciones_digitales/Est/Lib0789/Libro.pdf accessed 25 March 2015.

3. Instituto Nacional de Estadística e Informática (INEI). Censo Nacional de Población y Vivienda 2007, Tabla 3.1 Población Total, Censada y Omitida, Según Censos Realizados, 1940, 1961, 1972, 1981, 1993, 2005 y 2007, available at: http://www.inei.gob.pe/media/MenuRecursivo/Cap03001.xls, and Tabla 6.99 Población Asegurada en el Seguro Social de Salud-Essalud, según Tipo de Asegurado, 2005-2013, available at: http://www.inei.gob.pe/media/MenuRecursivo/indices_tematicos/orden-3_24.xls accessed 26 March 2015.

4. International Telecommunication Union (ITU). *The World in 2014 – ICT Facts and Figures*. Geneva, Switzerland: ITU, 2014;2 - 6.

5. International Telecommunication Union (ITU). (2015). *World Telecommunication/ICT Indicators Database. Time series by country*. Available at: http://www.itu.int/en/ITU-D/Statistics/Pages/stat/default.aspx accessed 24 February 2015.

6. International Telecommunication Union (ITU). (2015). ICTEye Country profile. Peru profile (Latest data available: 2013). Available at: http://www.itu.int/net4/itu-d/icteye/CountryProfile.aspx accessed 24 February 2015.

7. Instituto Nacional de Estadística e Informática del Perú (INEI). (2015). Encuesta Nacional de Hogares. Cuadro 7.11. Perú: Hogares que tienen al menos un miembro con celular, según sexo de jefe de hogar y ámbito geográfico. Available at: http://www.inei.gob.pe/estadisticas/indice-tematico/brechas-de-genero-7913/ accessed 22 February 2015.

8. International Telecommunication Union (ITU). Mobile subscriptions near the 7 billion mark. Does almost everyone have a phone? ITU News; 2013, (2). Available at: https://itunews.itu.int/en/3741-Mobile-subscriptions-near-the-78209billion-markbrDoes-almost-everyone-have-a-phone.note.aspx accessed 26 March 2015.

9. Instituto Nacional de Estadística e Informática del Perú (INEI). (2015). Encuesta Nacional de Hogares. Población que Accede a Internet: Población de 6 y más Años de Edad que Hace Uso de Internet en Cabina Pública, Según Área de Residencia y Departamento, 2007-2013. Available at: http://www.inei.gob.pe/media/MenuRecursivo/indices_tematicos/orden-15.xls accessed 26 March 2015.

10. Instituto Nacional de Estadística e Informática del Perú (INEI). (2015). Encuesta Nacional de Hogares. Cuadro 7.1. Perú: Mujeres y hombres que usan Internet, según ámbito geográfico. Available at: http://www.inei.gob.pe/estadisticas/indice-tematico/brechas-de-genero-7913/ accessed 22 February 2015.

11. Instituto Nacional de Estadística e Informática del Perú (INEI). (2015). Encuesta Nacional de Hogares. Cuadro 7.13. Perú: Hogares que tienen Internet, según sexo de jefe de hogar y ámbito geográfico. Available at:

http://www.inei.gob.pe/estadisticas/indice-tematico/brechas-de-genero-7913/ accessed 22 February 2015.

Appendix A

Survey Questionnaire

1. Do you own a prepaid mobile cellular phone? Yes / No
2. Do you own a postpaid mobile cellular phone? Yes / No
3. Do you use the Internet at home? Yes / No
4. Do you use public cabins i.e. telecentres to access Internet services? Yes / No
5. Do you use your mobile phone or the Internet to communicate with your health centre? Yes / No
6. Do you receive health information in your mobile phone or via the Internet? Yes / No
7. Would you like to receive health information in your own language (local language) through your mobile or the Internet? Yes / No
8. Do radio and TV programmes provide information on health related topics? Yes / No
9. Do you face any difficulties contacting your health centre? Yes / No
10. What type of information do you receive from your health centre?
11. What type of health related courses would you be interested in taking using distance education?
12. Demographic data:
    - Gender
    - Do you live in an urban area? Yes / No
    - Do you live in a rural area? Yes / No
    - Do you live outside the country (Peru)? Yes / No
        - If yes, provide the country of origin
    - Age
    - Profession

MYDIABBY: TELEMEDICINE FOLLOW-UP OF GESTATIONAL DIABETES FOR DEPRIVED WOMEN AS A CONTRIBUTION TO THE PREVENTION OF EPIDEMIC TYPE 2 DIABETES

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Abstract

Gestational diabetes mellitus (GDM) is a condition in which pregnant women without known diabetes exhibit high blood glucose. When untreated, babies are at risk of being large for gestational age (above 4,000g) which may lead to delivery complications. The efficacy of treatment is assessed by self-monitoring of blood glucose. GDM is growing in prevalence, and limited medical resources exacerbate the situation. GDM affects 10% of pregnancies, but up to 20% in deprived populations, the homeless, migrants, and underdeveloped countries. In Paris, a University hospital used a telehealth intervention to successfully control 95% of patients in a suburb area, where the deprived population nears 100%. Many women succeeded in exchanging a computerised logbook with the medical team via the Internet. "MyDiabby" is an improved tool, which includes colour coding to help understand glucose concentrations, and an algorithm to help their interpretation. Tailored for novices, the application is appropriate for many populations. Telehealth is valuable for the management of GDM. It is reliable for: clinical, biological, and therapeutic situations; time and money saving; appreciated by patients and clinicians; and improves quality of care. It also improves equity of access, regardless of geographical and socio-economic situations, and contributes to prevention of the worldwide Type 2 diabetes epidemic. This program is the first step of an educational process to help prevent diabetes which is expected to increase seven fold in this population. within the next 10 years.

Keywords: gestational diabetes; telemedicine; myDiabby; type 2 diabetes; prevention; mHealth.

Introduction

Just imagine you are a healthy woman, so happy to be pregnant. You may be slightly overweight but you feel well, with no particular adverse symptoms. Suddenly, your blue sky disappears, the gynaecologist or midwife has monitored your blood glucose and diagnosed gestational diabetes mellitus (GDM). You are asked to make an appointment as soon as possible with a diabetologist. Diabetes, what is that? You have heard things: your grandmother was diabetic; needing insulin injections several times a day; baby malformations; amputations, … you feel lost and the Internet is your first resource to answer your questions. The gynaecologist gave you a number of reference websites, including the website of myDiabby. Briefly, this is what you are going to discover:

GDM is a condition in which women without previously known diabetes exhibit high blood glucose levels, mainly during their third trimester. The condition is related to the inability of the pancreas to produce the increased production of endogenous insulin required during pregnancy. GDM generally has no symptoms and it is most commonly diagnosed by the systematic screening you just had: inappropriately high levels of glucose in blood samples. GDM affects 10% of pregnancies. Depending on the population studied, it can reach 20%, typically in deprived populations. Babies born to mothers with untreated GDM are at increased risk of problems such as being large for gestational age, which may lead to delivery complications. GDM is a treatable condition and women who have adequate control of glucose levels can effectively decrease these risks. A food plan is often the first recommended action for management of GDM, as well as moderate physical activity. The goal is to manage and maintain the blood glucose level at around

0.90 g/l before meals, and about 1.20 g/l after meals. This requires self-monitoring of blood glucose concentrations and correct interpretation. In 40 to 60% of cases, insulin may be necessary until delivery. Women with GDM are at increased risk of developing Type 2 Diabetes Mellitus after pregnancy: the risk can be lessened by a healthy lifestyle: weight control, balanced diet and regular exercise.[1]

Method

There are three challenges to addressing of GDM: 1) the large increase in the number of patients, 2) limited (or incorrect) knowledge of the disease and how to manage it, 3) the short time, around 3 months, to identify and control all the aspects of the situation.[2]

To address some of these challenges, a previous telehealth program, based on email exchanges between patients and medical staff, was successfully implemented for 4,000 patients from 2006 in a university hospital of Paris. Optimal glycaemic control, obtained in 95% of women, led to a normal delivery term (on average 39 weeks) where only 5% of large babies were noted. Patient satisfaction was very high, reducing stress at home, and requiring appointments with a diabetologist only if needed.[2]

The program was extended to a suburb, Saint-Denis, where almost all people are considered deprived. This location has the highest level of destitution in France, with poverty, unemployment, homelessness, foreign and unofficial migrants, unwanted pregnancy and single mothers. Because of many risk factors, including obesity, the prevalence of GDM is 18%. The vast majority cannot write French and have limited comprehension of the language. The goal of the study was to establish the percentage of women who could successfully use a computerised log book and exchange information with the medical team via the Internet. This was 30%, as opposed to 95% in the university hospital study. It was believed that this already fair result could be improved upon by using a better tool, tailored for deprived people, and a better communication approach to the pregnant women, making the application available and applicable for a very disadvantaged population. Most tutorials are videos avoiding the problem of understanding of French writing.

myDiabby

Using the Internet-based experience from the Paris suburb, a new program - myDiabby, has been established this year.[2,3] It is a simple and very friendly online mobile platform, and is the first tool specifically dedicated to the handling of GDM in a multicultural environment. The messages are easy to understand and to use. myDiabby gathers in one place all the necessary tools to quickly find all the answers for GDM. It includes an electronic log book to record the necessary daily self-monitoring of blood glucose conceentration. The system shows the data with a colour code (red, orange, green) to help the women understand if they are doing well and includes an algorithm to help interpretation.[3] On top of this data management system, there is a set of video clips to explain how to manage the disease. This learning experience, on nutrition, sugar intake, and weight control during pregnancy, is important for the future of these women. This approach is the first step of an educational process intended to contribute to the prevention of a 7-fold increase in Type 2 Diabetes Mellitus in this population over the next 10 years if nothing is done.

Discussion

Telemedicine is particularly good for the management of GDM due to the reproducibility of the clinical, biological and therapeutic situation of the patients. This approach, time and money saving, appreciated by patients and the medical team is a model of improvement in quality of care. It provides equity of access, independent of geographical and socio-economic situations and a link to contribute to the prevention of the worldwide epidemic type 2 diabetes.[4]

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References

1. Janin C, Ducloux R, Fontanié M, Altman J-J. Consultation diabétologique du postpartum après diabète gestationnel : un exemple d'amélioration des pratiques *MmM* 2014;8:169-175.
2. Altman JJ, Altman PC. MyDiabby, la solution de télésuivi du Diabète Gestationnel. Quand le parcours de soins devient mobile. La mobilité au service de la continuité des soins dans le suivi du diabète gestationnel. SFT Antel, 2014.
3. Altman PC, Calvet H, Sarda B, Altman J-J My-Diabby : De la prise en charge télémédicale du Diabète Gestationnel à la prévention du diabète de type 2. Savoir évaluer un besoin de télémédecine chez les femmes atteintes d'un diabète gestationnel SFT Antel, 2014 et site de l'Antel, www.congres-antel.com et European Research in Telemedecine, 2014;3: 190-191.
4. Be4Life. Available at: http://mydiabby.fr/ accessed 23 March 2015.