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بسم اللّه الرحمن الرحيم

مركز الشبكات وتكنولوجيا المعلومات

قسم التوثيق الإلكتروني

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قسم

نقسم باللّه العظيم أن المادة التي تم توثيقها وتسجيلها

علي هذه الأقراص المدمجة قد أعدت دون أية تغيرات

Feasibility of Using Mobile Smartphone Camera as an Imaging Device for Screening of the Cervix in a Low-resource Setting: Diagnostic test accuracy study

Thesis

Submitted for Partial Fulfillment of Master's Degree in Obstetrics and Gynaecology

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Dedication

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List of Abbreviations

Abb.	Full term
AGC	Atypical glandular cells
ASIR	Age standardized incidence rate
ASUMH	Ain Shams University Maternity Hospital
CC	Cervical cancer
CD	Compact disc
CDP	Cervical digital photography
CIN	Cervical intraepithelial neoplasia
CIS	Carcinoma in situ
DART	Digital camera assessment of the reproductive tract
ECDU	Early cancer detection unit
HCC	Hepatocellular carcinoma
HD	High definition
HGSIL	High grade squamous intraepithelial lesion
HPV	Human papilloma virus
HR-HPV	High-risk human papilloma virus
IUCD	Intrauterine contraceptive device
LBC	Liquid based cytology
LGSIL	Low grade squamous intraepithelial lesion
LLETZ	Large loop excision of the transformation zone
MHC	Major histocompatibility complex
MHS	Multimodal hyperspectroscopy
NHS	National Health Service
Pap smear	Papanicolaou smear
SD	Standard deviation
SES	Social economic state

List of Abbreviations Cont...

Abb.	Full term
SFR	Single fiber reflectance spectroscopy
TSG	Tumor suppressor gene
VIA	Visual inspection with acetic acid
VILI	Visual inspection with Lugol's iodine
WHO	World Health Organization

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PROTOCOL OF A THESIS FOR PARTIAL FULFILLMENT OF MASTER'S DEGREE IN OBSTETRICS AND GYNAECOLOGY

Feasibility of Using Mobile Smartphone Camera as an Imaging Device for Screening of the Cervix in a Low-resource Setting: Diagnostic test accuracy study

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1. What is already known on this subject? AND What does this study add?

Cervical cancer is a leading cause of cancer death for women all across the developing world, where much of the infrastructure required for effective cervical cancer screening is unavailable because of limited resources. **(Millien et al., 2015)**

Given inherent challenges in analysis and documentation when characterizing cervical tissue with the naked eye, an optical solution is needed. To address this challenge, a smartphone was modified and transformed into a method that can be used as an effective method for cervical screening. **(Garçon Manite et al., 2015)**

New technologies and artificial intelligence-based software are now making cervical cancer screening and detection easier and cheaper. **(Melanie Senior et al., 2019)**

The introduction of smart-mobile phone in the field of cervical screening almost started at 2014 when the winners of Vodafone's Wireless Innovation Project Competition have taken the first steps, offering medical screening and business operations management tools to anyone with wireless capabilities by inventing what they called **Mobile OCT** which was an early-stage start-up that has developed tools to turn a digital camera (including a smartphone) into an accurate cervical cancer detection device. **(Ariel Schwartz et al., 2014)**

Since then, a lot of trials to modify the smartphone are carried out by adding new hardware and software updates to the smartphone to be more effective as a screening method for the cervix. **(Momany et all., 2017)**

The idea that the conventional colposcope is very expensive, difficult to be transported and not always available at many hospitals especially in the developing countries like Egypt has increased the need for the presence of another effective method for screening the cervix but with a lower cost, easily to be transported and at the same time can be available at each hospital or clinic.

Most of the studies done before were using the smartphone after applying new updates either hardware or software or both to it which make it expensive and physicians need to buy that updates in order to use their smartphones as a screening method **but in this study** we are going

to use a low cost smartphone(LE7000 - $300) with its original camera without applying any modification to it so it will be with lower cost and every physician can use the one he has in his pocket.

2. INTRODUCTION/ BACKGROUND:

Cancer is now the leading cause of death worldwide. Cervical cancer is the third most frequent cancer after breast and colorectal cancer. It is the second most frequent cancer among women and ranks fourth in mortality. The following statistics can give us an idea of the impact it has in the lives of women. For example: 529,800 new cases are detected each year with 275,100 annual deaths caused by cervical cancer. Poverty determines health in the development of this disease, as poor populations lack access to health care**. (Millien et al., 2015)**

Having access to transportable and less expensive methods for screening plays a vital role in the public health approach to this problem. **(Meredith Casella Jean Baptiste et al., 2015)**

Most cervical cancer cases are detected in late stage in developing countries primarily due to lack of regular screening programs. According to World Health Organization (WHO), the risk of cervical cancer reduces by 25 to 30% even if screening is done once-in-a lifetime on women in their thirties or forties. **(World Health Organization and International Telecommunication Union, 2017)**

Cervical screening is the process of detecting and removing abnormal tissue or cells in the cervix before cervical cancer develops. By aiming to detect and treat cervical neoplasia early on, cervical screening aims at secondary prevention of cervical cancer. **(National Screening Unit.,2014)**

There are several screening tests in practice to identify pre-cancerous lesions. Cytology-based Pap-test, visual inspection with acetic acid (VIA), with or without Lugol's iodine (VILI), liquid-based cytology and the human papilloma virus (HPV)-DNA test are the prominent methods being practiced across the world. In the high-income countries, Pap-test and HPV-DNA based screening programs are highly effective. However, health systems in developing countries are not well-equipped to effectively promote Pap-test based screening for all women. Therefore, VIA has been advocated as a screening technique. **(Rashmi Bagga et al., 2016)**

A meta-analysis to assess various screening tests in over 58,000 women in India and Africa found VIA and VILI to be reasonably accurate. Each woman underwent VIA and one or more other screening tests; the reference standard was colposcopy with histopathology or a negative colposcopy. The results of visual tests and colposcopy showed a very high correlation. The limitation of this meta-analysis was that because of this correlation and possible overdiagnosis of CIN2+ by pathologists, the sensitivity and specificity of VIA and VILI were overestimated. **(Niranjan Khandelwal et al., 2016)**

Currently, mobile phones are commonly available, inexpensive, and have good quality cameras. Using a smartphone device, with an application to capture images during VIA, may be a low-cost scalable screening technique. It is expected to be more objective (with reproducible results) than VIA performed and interpreted only by a health care worker. **(Huchko et al., 2019)**

Mobile technologies have increased exponentially in the last few years; in 2009, mobile telephones could be found in more than 90% of homes and were widely distributed across all socioeconomic levels. While inequalities remain in this area, they are much less profound than with other technologies; its distribution varies between 97% in high SES and 82.8% in low SES. Because of this technological explosion, mobile health (mHealth), or "medical and public health practice supported by mobile devices", has great potential in many health areas such as promotion and prevention. Overall interest in mobile health is widespread. The World Health Organization's (WHO) report on mHealth in 2011 states that mobile health strategies exist in at least 75% of the countries that belong to the WHO in each region. According to the European Commission in its program "Digital Agenda for Europe", mHealth has the potential to reduce inequalities regarding the delivery of health services, to empower patients to control their own health, and to improve the cost-effectiveness of health care delivery. **(Javiera Martinez-Gutierrez et al., 2017)**

3. Hypothesis:

Smart-mobile phone camera can be used as a screening method for cervix and cervical cancers.