

# Pressure Injury Evolution: Mobile Wound Analyzer Review

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## Abstract

This article describes the combination of computerized photography and an innovative software application. The app created by Healthpath called MOWA is a Mobile Wound Analyzer. This smart device app provides a photo for consistent, quantifiable, comparable markers. Increased accessibility to smart devices and phones with cameras creates a readily available tool that can assist with pressure ulcer analysis while creating a visual evolution that can be remotely monitored.

**Keywords:** Pressure injury; Pressure ulcer; Wound healing; Documentation; Computer photographic analysis

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## Introduction

As the baby boomer and the geriatric population increases, pressure injuries are an increased concern. Thirty percent of patients in long-term care settings experience a pressure injury [1]. Monitoring the progression and evolution of a pressure injury can cause logistical difficulties reducing positive patient outcomes. Pressure injuries are a financial burden on the healthcare system and can be difficult to monitor [2]. A combination of poor quality care, lack of interventions and prevention increases the risk for pressure ulcers. As the at-risk geriatric population grows, a new innovative approach to pressure sore management such as a Mobile Wound Analyzer can assist with wound analysis and appropriate treatment courses [3].

## Literature Review

This is a technical note describing the utilization of Health path's MOWA software for wound analysis. The Mobile Wound Analyzer software application can be utilized across many common smart device platforms. An iPhone, iPad and iPod touch with an operating iOS of 6.1 or later can utilize version 1.7 of MOWA. Android products such as tablets or smartphones performing on the operating system 2.1 and up, can utilize version 1.6. Both operating systems offer translation into five languages including, English, Spanish, Italian, French and Portuguese. This device is recognized by the World Health Organization [3]. We downloaded the software onto a smart device from the app store, then selected it to open, we selected the menu and utilized the onboard device camera to take a photo. We obtained a photo of the pressure ulcer with the gallery button, then edited to identify a file name and

selected OK. Analysis begins by drawing the contour of the lesion, this is an essential part of the analysis. It allows the software to recognize specific parts of the image. It is obtained by freehand drawing the edges of the wound, the number of pixels within the contour (perimeter) generates the wound size. After recognizing the pressure ulcer wound edges, we pressed the forward button. An algorithm then calculated three tissue colors, black, yellow and red. Black represents necrotic tissue, yellow represents fibrinous tissue and red represents granulation tissue. Identified blue areas represent unrecognizable tissue, this could be caused by a corruption in the image, light effects, or flash reflections, etc. After the wound edge analysis was completed, we selected the identifying characteristics of the pressure ulcer such as if the lesion has depth, drainage, bleeding or infection. There are two avenues to calculate the ulcer size, manually without the provided blue marker or with the automated blue marker. To complete this manually without the blue marker, we physically measured the wound size in centimeters then created a rectangular box around the wound correlating to the size. To create the matching size, we pressed the plus or minus to increase or decrease the coordinating rectangle around the wound. We then opted to use the automated calculation, a blue dot can be printed with a diameter of 25 mm and placed in the photo as it is taken. The app offers an emailed version of the blue marker for easy printing,

found under User Info, then by selecting More and providing an email. If this blue marker is found in the image, an automatic calculation will provide the dimensions of the wound edges. After calibration is completed, we pressed the results button to review the final data and suggested therapeutic treatment advice per the International Guidelines. Users are responsible for consulting with their Physician to confirm the suggested treatment plan. The report is saved as a PDF document for easy reference, patients can share their results through many different platforms such as Bluetooth and email. MOWA files are archived within the smart device [3]. This application provides ease of access with simple navigation.

## Discussion

We found this application to be user-friendly, seamless and provide results in under 10 minutes. The simplicity of the software flow is designed for anyone to use, medical training is not necessary. The analysis record can be shared with healthcare professionals in a quick and simple format. The archived documentation creates a visual representation of the effectiveness of the treatment course. This software application is a noninvasive tool for physicians to create treatment care plans. Benefits include the ability to monitor wound changes remotely, an established analytical record of wound measurements, the ability to monitor for infection and an analysis of healthy tissue vs necrotic tissue ratios. We found the analysis can be shared with other investigators and put into the patients Electronic Health Record or EHR for future review and comparison.

## Conclusion

The growing elderly demographic represents 70% of the population with pressure injuries [4]. Long Term Acute Care Settings have the highest facility acquired or FA incident population rate at 22%, followed by medical intensive care units at 12% [1]. Populations that are vulnerable to decubitus pressure sores include, 27% of those with spinal cord injuries [5], 20% of those with trauma-related injuries [6], 22% of the elderly with hip fractures [7], 22% of cancer patients [8] and 1.9% of those diagnosed with rheumatoid arthritis [9]. The largest diagnosis related risk for pressure ulcers would be those with diabetes at 46% of the population [10]. This demographic faces an increased risk for complications such as lower limb amputations. Pediatric patients are also at risk for pressure sores including 18% of children with traumatic injuries [11], 12% of those with chronic Spina Bifida [12] and 33% of pediatrics with a mental retardation handicap [13]. Pressure sores are most likely to occur over bony prominences such as the back of the head, elbows, heels, sacral area and trochanter [1]. Patients experiencing neurological complications such as Parkinson's Disease experience an increased incident rate of pressure ulcers at 2.2%, Alzheimer's 3.7%, depression 22%, and those with a cerebral vascular accident or a stroke experience an increased risk of 13.1%, over the general population [9]. Patients with spinal complications such as spinal cord tumors, spinal cord arterial venous malformation, intra-cerebral hematoma following arterial hypertension, and cerebral aneurysm faces an increased risk for pressure ulcers when not provided proper care. Patients diagnosed with Parkinson's Disease face an increased risk of

pressure ulcers due to them lack mobility in conjunction with increased exposure to pressure, shear, moisture, and friction. Moisture-associated skin damage or MASD related to urinary or fecal incontinence becomes incontinence-associated dermatitis or IAD. MASD or IAD increases the possibility of creating substantial ischemic skin damage in as little as two days [14]. A diagnosis of Amyotrophic Lateral Sclerosis, ALS or Lou Gehrig's disease increases the risk of pressure ulcers over the general population by 17.9%. Patients with Multiple Sclerosis or MS face an increased incident rate at 30.5%. Practitioners must consider compounding neurological considerations such as the inability to maintaining adequate nutrition, difficulty communicating, cognitive trouble, perceptual problems, sensory impairment, restricted mobility, incontinence, reactive depression and apathy, as well as increased risks associated with high medication doses such as steroids [15]. Pressure ulcers are a financial burden on the federal healthcare system, private health insurance sector as well as for patients. On average, a stage IV hospital-acquired pressure ulcer treatment and related costs can run as high as \$129,248, during one admission. A community acquired stage IV pressure sores on average costs \$124,327 over the course of four admissions [4]. This application in conjunction with prevention and accountability has the potential for costs saving to the healthcare community. According to Dahlstrom et al., in 2011 improving identification and documentation of pressure ulcers at an urban academic hospital, despite the implementation of Electronic Health Records pressure sore wound documentation is not comprehensive and lacks consistency [16]. This software application documents the progression of the wound with an archived copy for reference. Dahlstrom forged a two-year quality improvement campaign to research documentation as well as how to improve the identification of pressure ulcers in the hospital setting, per the University of Chicago and associate hospital [16]. The office of the National Coordinator for Health Information Technology reports that of the 354,395 providers using an electronic health record system, Epic Systems Corporation and Allscripts remain the most utilized out of the 22 independent Health IT programs available [17]. As the healthcare industry moves throughout the Meaningful Use stages of Electronic Health Record Incentives and Certification process, the community is still navigating how to share data across platforms and increase interoperability. MOWA creates easy analysis and consistent comparable markers regardless of the Electronic Health Record software bring utilized. These comparable markers can help to assist clinicians to identify advanced therapeutics that may be more effective in treatment as well as provide statistical analysis for risk stratification reporting outcomes for the Centers for Medicare and Medical Services or CMS [18]. Age coupled with co-morbidities creates an increased risk for the elderly to experience a pressure injury. As this at-risk population continues to grow, utilizing innovative wound care analysis coupled with computerized photography creates an avenue to document the progression of pressure injuries and increases communication with care providers ultimately improving healing time. Additional resources are needed to identify, prevent, and treat pressure injuries. Emerging technologies such as infrared spectroscopy tissue oxygen saturation assessments [19], indocyanine green fluorescence imaging (ICG-FI) [20], infrared thermal imagery analysis [21], three-dimensional ultrasound pressure injury

evaluation [22] in conjunction with accountability and quality care interventions such as frequent weight shifts, proper skin cleaning and turning routines will decrease the amount of unnecessary patient pain and suffering.

## Limitations

A limitation not noted includes any personal visual limitations that could impede one's ability to decipher any information relayed from the software. Health path identifies limitations of the MOWA software to include, wound bed tissue analysis is based on the quality of the photo and pixel size, the influence of the wound bed depth cannot be calculated, and the calculations of the wound analysis is dependent on the operator's measurement of the width and the wound edge drawing. Images can corrupt based on illumination, flash reflection, resolution and jpg codec. The software provides generic product names for treatments. The software can only analyze stage 2 and greater ulcers and cannot analyze the surrounding tissue. The dimension that can be analyzed is limited from 2 mm to 300 mm [3].

Technological advancements in computerized photography in conjunction with wound healing physic-pathology, mathematical algorithms, as well as increased accessibility to smart devices create an opportunity for healthcare innovation. In our experience, the Mobile Wound Analyzer application is a convenient, readily available tool that can assist with pressure injury analysis while creating a visual evolution for comparison that can be remotely monitored while paving the way for increased positive patient outcomes.

## Disclosure

The authors report no conflict of interest concerning the materials or methods used in this study or the findings specified in the paper. The article is original and has not been previously published. It is not under consideration for publication elsewhere. The authors received no monetary compensation based on the information provided.

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