Executive Summary: Telemedicine and Advanced Technology Research Center (TATRC) is a component of the United States Army Medical Research and Materiel Command (USA MRMC) and serves as the Military Health System (MHS) research entity for Health Informatics Technology (HIT). With the implementation of the Army Patient Centered Medical Home model throughout the MHS since 2009, the focus is now on comprehensive/longitudinal, patient-centered, and easily accessible healthcare. This had led to many research initiatives to enhance telemedicine and expand from electronic health (eHealth) to mobile health (mHealth). Mobile HIT is an essential component to the advancement of our health care system as we strive to establish true relationships and connect providers and patients outside their scheduled appointments to positively impact their “life space.” Utilizing the Community Based Warrior Transition Unit (CBWTU) population to facilitate a focus on supporting the OTSG mild traumatic brain injury (mTBI) program, TATRC developed a HIPAA-compliant, bi-directional secure messaging system that would operate on patient’s existing mobile devices in a manner uniquely distinct from standard text messaging or email. Between May 2009 and October 2012, mobile care (“mCare”) was developed with penetration into commercial wireless space; which allowed a venue for patients to gain acceptance, interest, and sustainment towards such an initiative. As a result, this mobile intervention transmitted 300K secure messages between 1,120 patients and their care providers across five CBWTUs crossing 28 states; ultimately enhancing care coordination and communication between care teams and geographically dispersed patients.
Objective of the best practice: Consumer demands and expectations in the healthcare realm are increasing as advances in technology continue to drive the system’s transformation. Many are seeking mobile applications to meet their needs wherever they are, with or without wireless connectivity. On the other hand, healthcare delivery organizations are also seeking innovative means to reach out to patients beyond actual encounters. It was this response that triggered TATRCs mCare research project towards enhancing the MHS capabilities by enhancing patient-provider communications. The present day mCare completed two distinct phases of development between May 2009 and October 2012 to solidify the structure of this solution that went from concept to operations in less than six months. Between May 2009 and April 2011, the first phase focused on the feasibility of the bi-directional, HIPAA-compliant, user-friendly mobile intervention that ran on multiple platforms (both smart phones as well as feature phones). This also included the agreements and relationships with the commercial carriers to ensure there were no additional surcharges being placed on the patients who utilized this solution. The research phase from April 2011 to October 2012 focused on mCare’s positive impact on case management and patient well-being by providing access to the appropriate level of care at the right time in the most convenient means. This focused on: 1) Ascertain mobile secure messaging frequency/delivery timing, 2) Benchmarking end user response times, 3) Quantifying system reliability and quality of service, and 4) Assessing perceived value of the mobile intervention by patient and care team via structured focus group interviews.

Background: CBWTUs provide regional organizational structure and support for ill and recovering wounded military members going through rehabilitation in their hometowns across the country. This WTU population requires extensive case management and also tends to have a high prevalence of mTBI. Therefore, by focusing on developing a mobile health intervention for geographically separated wounded warriors receiving care in an outpatient environment (both with and without mTBI diagnosis), this project came to fruition with almost $7.5M in funding through OTSG, MRMC, and TATRC. Due to the practicability of meeting the needs of mTBI patients, the application’s design was structured around simple, 1-click or drop-down responses to limit the amount of required free text entry. The mCare solution is a four step process as follows: 1) Care team enters and schedules the delivery of a message 2) Message is sent to a patient’s mobile phone, 3) Patient responds 4) Care team reviews the responses and reports online. Responses are collected and trended for the care team’s visibility to enhance “meatier” encounters, while “red flag” responses alerted the Service Member’s leadership team for intervention as necessary. Commercial challenges that were met included the continual refresh of wireless devices, changes in wireless carrier certifications and policies, and the coordination of mobile version updates.

In the initial pilot effort, Service Members received several different types of mobile messages to include administrative announcements (timesheet reminders, career fairs in their area, change in POC, etc), appointment reminders, health and wellness tips addressing sleep, nutrition, exercise, alcohol consumption, goals, and family relationships from validated sources such as afterdeployment.org. Additionally, there are static information cards that contain their care team contact information as well as a card to view their Army WTU Comprehensive Training Plan (ACTP) goals. In the subsequent research study patients were also required to answer daily well being questionnaires that assessed mood, sleep, ACTP goal progress, energy, general wellbeing,
weight and anger to compliment interactions with their care team. Negative responses to questionnaires triggered email alerts to the care team for follow up.

**Literature Review:** With the costs of required infrastructure and need for sustainment, considering the US healthcare expenditures are already consuming approximately 18% of the GDP, our society is fervently seeking means to enhance treatment by capitalizing on the enhanced, secure, real-time, bi-directional communication capabilities mobile phones can now provide. Nearly 80% of the US adult population, or 239 million users, were identified as mobile phone users as of June 2007. With increased technological capabilities and infrastructure in this realm, there is the potential to reach the “one phone per person” ratio that is already the case in certain countries such as Finland. (NIH, August 2008). For this reason, there is the increasing potential for mobile phones to enhance the delivery of healthcare if properly integrated and managed across the plethora of mobile platforms.

According to a 2011 World Health Organization (WHO) publication on the results of a global mHealth survey, commercial wireless signals cover over 85% of the world’s population, which exceeds the capabilities of the electrical grid. While there are nearly 5 Billion mobile subscriptions worldwide, the USA data reflects approximately 95% of the population that fall into this category (94.83 per 100). In reviewing published literature on the effectiveness of mHealth initiatives, it was determined through this study that many related studies are occurring in silos throughout the globe; with none of the presented cases tapping the secure, mobile application market. The residual concern with these technological implementations occurring in pockets is the lack of interoperability with the numerous eHealth stand-alone systems already in place.

**Implementation Methods:** The multidisciplinary mCare team researched many Commercial-Off-The-Shelf (COTS) products and selected Diversinet® as their means to establish precedence above all competing solutions due to its fully functional mobile application platform, mobile secure messaging, and mobile application program. Upon development of the extensive and tedious protocol, mCare tackled the challenges of both the Authority to Operate (ATO) and Defense Business Certification (DBC) processes required by the AMEDD/DoD in order to begin and sustain their initial 23-month feasibility study. During this time, TATRC sought volunteers from the CBWTUs throughout five sites which included Virginia (14%), Alabama (12%), Florida (28%), Illinois (22%), and Massachusetts (24%). Once the system was deemed to be fully developed and ready for clinical implementation, the required IRB process was completed to allow TATRC to proceed with their two-armed, prospective, randomized, clinical outcomes study. This study utilized the same CBWTU population (with the exception of Massachusetts) and protocol to facilitate and enhance dialogue between patients and their respective care teams.

**Results:** As mentioned previously, the primary objective for mCare was to develop a user friendly, mobile means to reach out to enrolled patients throughout the day in order to facilitate patient-provider engagement and accountability over their own health. During the initial phase, 617 volunteers (officers and enlisted between the ages of 18-61) took advantage of the mCare solution. The breakdown of the 150,742 secure outbound mobile messages was 10% Announcements, 47% Health and Wellness Tips, and 43% Appointment Reminders. It was also during this time that mCare received the 2010 Army Greatest Inventions Award. By analyzing
the feasibility data, it was determined that the project successfully gained acceptance by both care providers and patients. Survey results were: 1) 85% of the healthcare team stated they would refer patients; 2) 84% of patients stated it improved communication with their unit; and 3) over 90% of the patients stated it not only improved their CBWTU experience, but also provided valuable and relevant information, and facilitated their ability to attend their appointments through the reminders. Additionally, through monitoring utilization behavior, it was identified that while there was utilization recorded throughout the day, the majority of correspondence occurred between 09:00 and 12:00 with a peak around 10:00. Of the volunteers, 58% utilized mCare for over six months, and it was surprising to realize that less than 50% of the users were of the millennial generation (under 34 y/o), with 57% ranging from 35-65 y/o (33% GenX, 21% from 47-56, and 3% from 56-65 y/o).

Conclusion: The mCare project has overcome many obstacles to break down the barriers throughout their journey into unchartered territory with a secure mobile health communication platform to promote patient-centric engagement. In its pursuit of facilitating healthcare capabilities in the life space, the successful results in the target population had met the four established best practice criteria (outcomes-based, adaptable/replicable, sustainable, and innovative). Remote patient management facilitates efficient use of our declining numbers of professional staff through extended coverage. This best practice has also been proven to facilitate the MHS focus on obtaining tangible improvements as it pertains to the quadruple aim strategy through enhanced Experience of Care and patient trust, increased focus on Population/ Holistic Health, a decrease in Per Capita Cost using proactive team care (e.g., decrease no shows), and Readiness promotion and awareness.

As of 08 October 2012, data collection for the 18-month research phase in mobile care (“mCare”) was complete. There were initially 182 volunteers who participated in the randomized, controlled research study, which grew by 321 additional users as of January 2012. While the team is awaiting the biostatistical analysis from this research leg, mCare Solutions is in the process of migrating its current system to USAMITC for AMEDD use. There is currently 9K remaining licenses intended to be utilized for system-wide CBWTU implementation as they also ramp up towards the next phase of their research in transitioning mCare to Mobile Healthcare Environment (MHE). Upon IRB approval of the MHE concept, based off the Concept of Operations (CONOPS) signed on May 2012 for commencement in Spring 2013, the intent is to enhance the mCare solution benefits and capabilities using existing infrastructure and integrating it with the overall eHealth system. Biomonitoring technologies (such as the adhesive or implant prototypes) provide the potential to record vital signs through secure mobile devices, to mobile information servers, and into Electronic Medical/Health Records throughout the day. However, as with the introduction of any new technology solution, the key to obtaining a positive return on investment is to instill a culture of change and shared accountability with a focus on strategic integration/synchronization to include SOP and message development.

References