**Title:** Mobile Integrated Health to Reduce Post-Discharge Acute Care Visits: A Pilot Study

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This is the author's manuscript of the article published in final edited form as:
Siddle, J., Pang, P. S., Weaver, C., Weinstein, E., O'Donnell, D., Arkins, T. P., & Miramonti, C. (2017). Mobile integrated health to reduce post-discharge acute care visits: A pilot study. The American Journal of Emergency Medicine. https://doi.org/10.1016/j.ajem.2017.12.064

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**Declaration of Interests:**

Jennica Siddle has nothing to report

Peter S. Pang receives support from Indianapolis EMS as Chief Science Officer

Christopher Weavers has nothing to report

Elizabeth Weinstein receives support from Indianapolis EMS as a Medical Director

Daniel O'Donnel receives support from Indianapolis EMS as a Medical Director

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**Abstract:**

*Background:* Mobile Integrated Health (MIH) leverages specially trained paramedics outside of emergency response to bridge gaps in local health care delivery.

*Study Objective:* To evaluate the efficacy of a MIH led transitional care strategy to reduce acute care utilization.

*Methods:* This was a retrospective cohort analysis of a quality improvement pilot of patient patients from an urban, single county EMS, MIH transitional care initiative. We utilized a paramedic/social worker (or social care coordinator) dyad to provide in home assessments, medication review, care coordination, and improve access to care. The primary outcome compared acute care utilization (ED visits, observation stays, inpatient visits) 90 days before MIH intervention to 90 days after.

*Results:* Of the 203 patients seen by MIH teams, inpatient utilization decreased significantly from 140 hospitalizations pre-MIH to 26 post-MIH (83% reduction, p=0.00). ED and observation stays, however, increased numerically, but neither was significant. (ED 18 to 19 stays, p=0.98; observation stays 95 to 106, p=0.30) Primary care visits increased 15%(p=0.11).

*Conclusion:* In this pilot before/after study, MIH significantly reduces acute care hospitalizations.

**Background**:

Mobile Integrated Health (MIH) leverages specially trained paramedics outside of emergency response to bridge gaps in local health care delivery.[1-3] A unifying theme of MIH is the provision of out-of-hospital acute or chronic services for patients at home. These services typically target ED high utilizers, specific disease conditions known for high rates of health care utilization, and readmission avoidance for specific conditions such as acute myocardial infarction (AMI), congestive heart failure (CHF), and pneumonia (PNA).[4] These MIH programs may be designed as acute visits and interventions occurring around the time of EMS calls or as longitudinal interventions and care coordination to prevent acute visits. While several programs have existed since the 1990's, efficacy data is severely limited.[1,4] Arguably, the spread of MIH programs outpaces the published data to support such growth.[1,4] This does not mean MIH programs are ineffective, however. The MedStar program in Dallas is one such example of success, demonstrating decreased acute care utilization, with a specific focus on heart failure patients.[5] Nevertheless, a recent review highlighted the limited peer-reviewed data on the efficacy, safety, or cost-effectiveness of MIH programs.[1]

As a quality improvement initiative, we aimed to test whether a MIH program within a large, urban, metropolitan area reduces acute care utilization. Thus, we report the initial findings from our MIH transitional care program.

**Methods**:

*Study Setting*

This is a before/after cohort study of a pilot, quality improvement transitional care program within Indianapolis EMS (a large urban, single county, EMS system).

*Study Population:*

The MIH team, together with Eskenazi Health (a county health system), targeted Chronic Obstructive Pulmonary Disease (COPD), Pneumonia (PNA), Myocardial Infarction (MI) and Heart Failure (HF) patients prior to hospital discharge. As financial penalties are associated with excessive readmissions for these patients, case management actively seek these patients upon hospitalization, based on preliminary diagnosis and record review. After review of the daily hospital census, a list is then generated, which is then disseminated to all care transition teams, including MIH. There were no exclusions. However, patients who did not speak English or had ready access to someone who could translate were excluded after an initial visit. Patients were then approached by the MIH team, consisting of a paramedic/social worker dyad (or social care coordinator). While the operational process was to approach all patients, this was a convenience sample. All patients were first asked if they would be interested in participating. As this was a pilot quality improvement program, we did not track those who screened and refused or who were otherwise eligible but not asked.

*MIH Team:*

The MIH team works as dyads comprised of a paramedic and social care coordinator. There is one licensed social health worker who oversees the social care coordinators but also goes on runs to patient homes. Training consisted of a minimum of 2 week shadowing for both paramedics and social care coordinators, with several months of ongoing training in an apprenticeship model. For paramedics, a minimum of 4-5 years field experience was required. In addition, specific projects led to further training. For example, projects in pediatric asthma and heart failure led to in-depth clinical training and shadowing in offices to augment or build skills and knowledge. MIH teams operate M-Friday from 8am to 5pm. In regards to scope of practice, MIH teams do not provide acute care, (i.e. nebulizer treatment,

IV therapies, etc). This decision was primarily driven by existing scope of practice guidelines and regulations.

*Data Source*

Each patient and subsequent acute care utilization or primary care follow-up was identified through the electronic health record from a single institution.

*Intervention*

If patients agreed, the intervention consisted of: 1) Post-discharge visit (usually within 48 hours) and structured assessment 2) Additional visits and telephone follow up as determined by the MIH team. Initial assessments included: A) brief exam, vitals, and assessment for home safety B) financial assessment (with follow up financial counseling) and insurance status, C) follow up and access to primary care D) medication reconciliation and E) education for their medical problems.

*Analysis and Outcomes*

The 'Before' period started 90 days prior to MIH visit and 'After' as follow up through 90 days. Outcomes of interest: reduce ED visits and hospitalizations, hospital length of stay, and increase primary care visits to better serve their chronic management needs. If patients visited another hospital or primary care physician outside the single institution, this was not captured. When classifying ED, Observation, or Inpatient visits, the final hospital status was used. For example, a patient who came to the ED, went to an observation unit, then subsequently hospitalized was counted as Inpatient. For statistical analyses, the Shapiro Wilk test was used to test for normality. Wilcoxon sign rank test or paired t-tests were used as appropriate to compare before and after CP intervention outcomes, with statistical significance set at $p<.05$. This retrospective review was IRB approved.

**Results**: From January 2015 to March 2016, a total of 203 patients were seen by the MIH team. Of these, 49% were female, average age of 58.6 years (SD 10.5), and 51% Black, 46% White, 1 Asian, 5 Unknown (Missing data: 18 patients age and sex, 19 patients race). Outcomes comparing before/after MIH intervention are shown in **Table 1**. Most notable was the decrease in hospitalizations, which also drove decreases in median length of hospital stay.

**Discussion**

In this cohort of 203 patients drawn from a large, urban metropolitan area, our MIH transitional care initiative led to: 1) numerical increase in primary care office visits, but also numerical increases in 2) emergency department visits and 3) observation stays. In addition, there were significantly less inpatient hospitalizations and critical care stays. The exact reason for this increase in observation stays, though not significant, is unknown. As we did not compare MIH to another transitional care program, the additional benefit of MIH is unknown.

MIH as a novel form of healthcare delivery appeals for several reasons: 1) Leverages a highly trained, existing workforce; 2) Infrastructure exists to delivery care to the home, though it usually requires supplementation and re-orientation, it does not need to be created from scratch; 3) Solutions are local. EMS programs are already deeply embedded in their communities. While needs assessments are still recommended, EMS programs generally already know about the unmet needs of the communities they serve; and 4) MIH programs supplement, not displace other transitional care programs, services, or disease management programs. In one sense, MIH helps solve the 'last-mile' problem; we know what to do, but how to reach patients, bridging the 'last mile' to their homes, remains a daunting barrier.

Instead, traditional healthcare tells patients to go to doctor offices or hospitals. However, many patients face significant challenges accessing care; visiting the ER is often the easiest path. MIH may be one potential solution to facilitate access to care. Although limited by the study design and relatively small sample size, our pilot data suggest MIH is effective to decrease hospital admission.

Several other broad questions regarding MIH programs remain: 1) Lack of generalizability, as MIH programs often develop from local grass roots efforts targeted to specific communities. The National Association of Emergency Medical Technicians has collated tool-kits and programs to begin standardizing data elements and aid new MIH programs.[6] Such repositories will be essential to grow the knowledge base of MIH. Ultimately however, more data is needed; 2) Scope of practice. Our pilot study does not include acute treatments provided to avoid transportation to the hospital. This differs from other community paramedic programs.[1] Varying laws and regulations across the country affect such approaches; 3) Payment for MIH remains a major hurdle. Presently, transport to a receiving hospital is the dominant form of payment for EMS systems. The sustainability of MIH beyond demonstration projects will either require payment reform or ongoing partnerships with hospital and health care systems. Initial investment and ongoing costs will hopefully be offset by demonstrable improvements in quality of care at lower cost.

**Limitations:** The before/after design and lack of comparator limits firm conclusions from this pilot study. One potential explanation of our findings is regression-to-the-mean, where higher utilizers prior to intervention simply regressed to lower utilization after a MIH visit. The lack of comparator data is also a major limitation. However, the paucity of data regarding MIH combined with the growing number of MIH programs highlights the need for even preliminary data to inform future work. Two other limitations: 1) We did not have specific data on whether any patients visited by the MIH team were

found to require immediate hospital transport; 2) We were unable to ascertain whether patients sought follow up at other institutions.

**Conclusions**: In this before and after pilot study, MIH intervention was associated with reduced hospitalizations. MIH participants had a numerical, but non-significant increase in outpatient primary care visits, as well as ED and observation stays. This pilot study supports the potential value of the MIH care delivery model.

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| Table <1> | Number of Patients | BEFORE MIH<br>90 day Utilization | AFTER MIH<br>90 day Utilization | Relative % Change | p-value |
|---|---|---|---|---|---|
| **Primary Care Visits** | 168 | 297 | 340 | +14.5% | 0.11 |
| **ED Visits** | 27 | 18 | 19 | +5.6% | 0.98 |
| **Observation stay** | 107 | 95 | 106 | +11.6% | 0.30 |
| **Hospitalizations** | 125 | 140 | 26 | -81.4% | 0.00 |
| | | | | | |
| **Length of Stay** (median(IQR))<br>[total days] | 125 | 3 (2-4)<br>[451] | 0 (0-0)<br>[115] | -74.5% | 0.00 |
| **ICU Length of Stay**<br>(median (IQR))<br>[total days] | 33 | 3 (2-4)<br>[110] | 0 (0-0)<br>[19] | -82.7% | 0.00 |