

**Beyond the Hospital Walls:
The Expanding Role of Advanced Practice Providers in
Prehospital Acute Care**

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ABSTRACT

Background: Emergency Medical Services (EMS) and Hospital Emergency Departments (EDs) across the country are experiencing an influx of patients presenting with low acuity calls and “frequent flyers” which is contributing to ED overcrowding, high hospital census, and depletion of prehospital resources. Mobile Integrated Health-Community Paramedicine (MIH-CP) programs, traditionally staffed with specially trained EMS paramedics, have recently gained attention due to innovative ways to deliver care outside of the hospital, in turn increasing access to care. Now, some areas of the country have started to utilize advanced practice providers (APP), including Physician Associates (PA) and Nurse Practitioners (NP). However, the effectiveness of APPs serving on these specialized teams has yet to be compared to the traditional standard of care.

Objectives: To evaluate the efficacy of prehospital APPs (PA and NP) compared to the standard level of prehospital care in terms of visits to the ED or hospital transports via ambulance.

Design: Systematic multi-study literature review

Methods: The National Library of Medicine PubMed, Embase, and Scopus were searched using the terms “Advanced Practice Provider” or “Physician Assistant” or “Advanced Practice Nurse” and “Mobile Integrative Health” or “Community Paramedicine” for articles not already included in the previous meta-analysis. Results were then reduced using various inclusion and exclusion criteria for the studies included. All articles were included that reported APPs with ED visits/transports and incorporated MIH-CP-like interventions and outcomes.

Results: The original meta-analysis reviewed 12 traditional MIH-CP programs and found a pooled risk ratio of 0.56 (95% CI 0.42-0.74) for ED visits, which was found to be a consistent 44% reduction in those visits. Study #1 found that PAs referred fewer patients to the general practitioner or ED compared to general ambulance registered nurses (50% vs. 73%, respectively, $X^2 = 35.5$, $P < 0.0001$). Study #2 found that it was 24 times more likely that a patient’s complaint could be mitigated on scene compared to that of a normal ACLS/BLS response ($OR = 24.19$, $p < 0.001$). Study #3 found that of the 792 total patients, 400 (50.5%) were treated and released from the scene or directed to an alternative destination other than the ED. Study #4 found patients had a 65% lower rate of total 30-day readmission compared with patients whose needs were not fully addressed ($IRR = 0.35$, 95% CI 0.18-0.68, $P = 0.002$).

Conclusion: The studies reviewed show that advanced practice providers working in prehospital programs such as MIH-CP and other mobile integrative health programs demonstrate the ability to reduce both unnecessary ED visits and hospital admissions while still maintaining safe practices. Evidence from the studies shows that APPs in the field can accurately and effectively treat patients on scene without the need for transport to the hospital, facilitate alternative transportation destinations, and help coordinate care based on social determinants of health without the need for the patient to be seen or admitted to the hospital. Despite these positive outcomes, limited evidence is available on this topic, leading to a need for further research through the use of randomized controlled studies to better focus on the role of APPs in the prehospital setting.

INTRODUCTION

In 2022 alone, the CDC estimates providers saw more than 155.4 million individual visits to emergency rooms (ERs) across the United States, which equates to about 47 out of every 100 citizens being seen in the ER at least once throughout the year. Of those visits, over 69% of those patients spent greater than 2 hours in the ER before eventually being discharged or admitted to the hospital. Despite the large number of ER visits, only about 17.8 million patients were eventually admitted to the hospital, while the other 110 million + people were discharged with outpatient follow-up.¹ This means that over 76% of those patients initially presenting to the ER via one way or another were not admitted to the hospital. Healthcare in the United States has only gotten busier since 2022, and it does not show any signs of slowing down. The American College of Emergency Physicians reports that 90% of emergency rooms across the country report they are often overcrowded with patients which requires them to operate either at or above capacity, thus resulting in delays in both time to treatment and admission times for those waiting for an inpatient bed.²

One explanation for the large influx of yearly visitors to the ED is the high amount of the US population that has chronic medical conditions. According to a 2025 CDC publication, in 2023, 76.4% of US adults had at least one chronic medical condition, with 51.4% of the population reporting 2 or more chronic medical conditions.³ This number only continues to rise from year to year. In 2010, the number of people with chronic medical conditions was thought to be approximately 141 million people but is expected to exceed 171 million people by the year 2030.⁴ With this increasing number of possible patients to the ER comes the question of not only how to take care of large influxes of patients but also how EMS agencies are supposed to keep up with the load. EMS systems are also seeing an increase in the number of calls for service,

very similar to that of ERs across the country. This increase in call volumes and ER wait times is one way to see just how busy our healthcare system really is in the United States.

A proposed solution has begun to gain attention over the last couple of years, prompting a special topic in emergency medicine article in the Journal of the American Academy of Physician Assistants, “*Using PAs in Prehospital Environments to Reduce ED and EMS Overuse*”.⁵ The focus of the article hits on why PAs would be an excellent addition to the team and provide a better solution to the increasing patient load. Katherine Thompson, PA-C, states, “This [PA] training includes the ability to identify, manage, and intervene in complex medical problems and the overlying psychosocial factors that contribute.”⁵ PA school is preparing future providers to treat and manage patients with both acute and chronic conditions. The question becomes why we cannot use PAs or other advanced practice providers outside of their normal daily roles to decrease the utilization of both the EDs and EMS agencies alike. That is the question that many have started to ask across the country, while others have started to research, plan, and implement programs for advanced practice providers to work outside the doors of the hospital or ED. Thompson shares her vision for prehospital PAs by saying she believes they can be both remote ED employees and also case managers for our patients with chronic medical conditions.⁵

Departments and hospitals across the country have started to look into new ways to utilize both EMS resources and, more recently, the use of APPs to try and cut down on both EMS transport calls and ED visits. Mobile Integrated Health-Community Paramedicine (MIH-CP) programs have started to gain attention by using emergency medical service (EMS) providers trained at an expanded scope to increase access to healthcare and cut down on hospital and ED admissions.⁶ In a 2014 survey by the NAEMT found that there were over 120 MIH-CP programs in 33 states across the US.⁷ That number has since grown, but this is still a fairly new program

overall. The same study found that these programs were staffed with NPs only 9% of the time and PAs only 3%, meaning this is a very new field for APPs, but one where there is a lot of room for growth moving forward.⁷

Initial research in this area has shown optimistic support that MIH-CP programs can be successful for both limiting ED visits and hospitalizations, but has been confined to looking at MIH-CP programs as a whole and not specifically the role of NP and PA partitioners on the team.⁸ The aim of this analysis is, for adult patients receiving prehospital care, does the evaluation and management by advanced practice providers (PAs or NPs) compared to standard EMS care reduce unnecessary emergency department visits and hospital transports? Based on the current research and training of APPs it can be hypothesized that the use of these providers outside of the hospital could lead to decreased visits to the ED and subsequent hospitalizations for some of those 141 million people with a chronic illness or condition.⁴ If this hypothesis turns out to be true, it could lead to the formation of new protocols and jobs for APPs and better access to healthcare for those in the community who may need it the most.

METHODS

In order to find articles studying the use of APPs within MIH-CP programs, a search with the assistance of the Galter Health Sciences Library at the Feinberg School of Medicine was preformed using PubMed, Embase, and Scopus databases in January of 2026. The search terms “Advanced Practice Nursing” OR “Physician Assistants” OR “advanced-practice-provider AND “mobile integrated healthcare” OR “mobile integrated health care” OR “MIH-CP” OR “community paramedicine” were used, yielding 15 results. Exclusion criteria for this search were studies that did not include the mention of an APP on the team, studies previously used in the most recent meta-analysis, and studies that did not mention an MIH-CP-like program in the methods of the study. Studies were included if they (1) examined APPs (NPs or PAs) in prehospital or community paramedicine settings, or evaluated MIH-CP programs with relevance to APP practice; (2) measured outcomes related to ED visits, hospital transports, readmissions, and safety; (3) involved adult patient populations; and (4) were published in English-language, peer-reviewed journals. Four studies were found to meet all criteria and comprised a mix of cross-sectional document review, mixed-methods investigation, observational cohort studies, and statistical analysis.

RESULTS

Study #1: Bloemhoff, A., et al. (2016)⁹

This study by Bloemhoff, A. et al. is a cross-sectional document study that was conducted in the Netherlands, comparing physician assistants (PAs) to ambulance nurses (similar to EMS in the United States) in solo emergency care responses across two Dutch EMS regions. The study examined documentation from emergency responses in the Gelderland-Zuid region, where PAs and ambulance nurses independently respond to low-urgency calls, similar to MIH-CP programs in the United States. The study aimed to compare assessment, treatment, referral patterns, and short-term follow-up outcomes between PAs and EMS RNs functioning as solo emergency care providers.

Study Design and Results: This is a cross-sectional document review that took place from October 2010 to March 2014, which analyzed medical records from solo emergency care responses. The study compared PA-led responses to ambulance nurse-led responses for low-urgency emergency calls. Calls were classified as A1 (arrival < 15 minutes) and A2 (arrival < 30 minutes) priority in the Dutch EMS system. Two PA's and 23 RNs were followed during the study. Researchers extracted data on clinical assessment processes, treatments provided, transport decisions, and documentation completeness. Data was extracted via the EMS electronic patient records (EPR). There was a total of 991 patient encounters, with 493 patients being treated by the PAs and 498 being treated by the EMS nurse. 19 calls were excluded due to not meeting the A1 or A2 categories. In terms of demographics, both groups' patients were similar, with a mean age of 52 years for the PA group and 48 years for the RN group. Approximately half of each cohort was male (PA 53% and RN 51%). The study found that PAs completed their treatment of the patient on the scene, rather than having to transport the patient to the ED,

significantly more than the EMS nurse. The PAs referred 245 of their patients to another health care professional/ED (50%), while the EMS nurses referred 351 of their patients (73%). This result was found to be statistically significant ($X^2 = 52.9$, $df = 1$, $p < 0.0001$). It was also found that PAs consulted more health care providers for their patients in order to keep them from being transported more often than the EMS nurses ($X^2 = 35.5$, $df = 1$, $p < 0.0001$). In addition, the study found that the PA performed additional procedures outside of the EMS scope of practice without the need for transport to the hospital, including suturing (3%), administration of medications outside protocol (10%), and provision of medical advice (48%). These findings suggest that PAs can function effectively in prehospital emergency response roles when compared to traditional ambulance nurses, supporting the integration of PAs into EMS systems and the feasibility of such programs.

Study Conduct: The discriminatory accuracy of this study is limited by its cross-sectional design and reliance on retrospective document review. Although the study does include a large sample size of 991, the study population only had 2 PAs and 23 EMS RNs, and the sample size was determined via feasibility rather than a formal power calculation. Due to the retrospective nature of the study, the intention-to-treat principle is not applicable. While statistically significant differences were demonstrated in referral and consultation patterns, the study did not directly assess clinical outcomes such as adverse events, delayed diagnoses, or subsequent ED visits outside the EMS system.

Study Validity & Limitations: There are a few limitations to this study design, with the biggest being the retrospective design using EMS charting that was not originally produced for research purposes, and without having a control and treatment group. Also, due to using medical charting for the study, some variability could come with documentation instead of actual medical

decision-making that is being studied. Another limitation of the study is that only 2 PAs were used during the duration of the study, which represents a small proportion of the nation's PA population. As above, the patients were a fairly large sample size of 991 patients, but they were chosen based on feasibility alone instead of a formal power calculation, which could cause some limitations to the interpretation of the data, although selection bias does seem to be low due to a centralized dispatch that allowed for provider proximity instead of call type. Another potential limitation of this study is the lack of information regarding the location where the research was conducted. The authors do not formally describe the geographic setting, which may limit the generalizability of the results if the demographics of the study population differ from those in other regions and the United States. Finally, the study was limited in its research of safety outcomes, adverse effects, and subsequent effects. ED evaluation after the provider had left the scene.

Study Conclusions: The study authors concluded that both PAs and EMS RNs can both provide very comparable emergency care in the prehospital setting, including having similar intervention rates and outcomes from short-term follow-up. They do, however, note that PAs were thinking in a different way, which was more medically oriented, which led to an increased number of cases where additional providers were consulted, and a significantly smaller number of patients were referred to the ED for further care. This data is slightly limited due to the absence of long-term clinical outcomes of the patients to look for safety and effectiveness that can be correlated with the reduced referral rates of the PAs. Although the results of this study suggest that PAs can function safely as solo emergency providers and reduce referral rates to the ED, we should be aware of the observational nature of the study and the limited additional outcomes reported when drawing final conclusions.

Study #2: Tyano, E., et al. (2021)¹⁰

This study by Tyano, E. et al. is a statistical prospective observational study which reviewed 2,759 low acuity EMS calls within the Grady Health System (Atlanta & Fulton County, GA) between September 1, 2019, and March 31, 2020. They set out to analyze the health system's response to calls while comparing MIH providers to a traditional EMS (ACLS/BLS) provider for four predefined low-acuity emergency medical dispatch (EMD) codes. Of the total responses, 454 (16.5%) were responded to by Mobile Integrated Health (MIH) units and 2,305 (83.5%) by traditional EMS units. Tyano and the other authors hypothesized that MIH responses would have a greater number of on-scene mitigation compared to the traditional EMS responses.

Study Design and Results: This was a prospective cohort analysis that used EMS documentation for its data source. The primary outcome of the study was the call outcome, which was set into two categories: either "Mitigated on scene" or "Transported."¹⁰ These were defined as a patient who was assessed on scene and remained on scene after the call was over, compared to a patient assessed on scene who was transported to any other destination after the call, respectively. The study then looked at various information about the call itself, including but not limited to time of call, sex, age of patient, ethnicity, blood pressures (both systolic and diastolic), and EMD call type. There were four EMD codes that were included in this study, which were described as the top four most common call types in this area. They included, 1) "Sick person other pain," 2) "back pain," 3) "falls," and 4) "diabetic alert behaving normally."¹⁰ These call types were randomly determined by the dispatcher prior to assigning resources to the call, with the most common type of call for both groups being "sick person other pain." The two groups' patients were very similar in age (MIH median age = 51 vs EMS median age 56, $p=0.04$), sex (MIH 48.9% female vs EMS 50.5% female, $p=0.53$), and ethnicity ($p=0.341$). There

were some statistically significant physiologic differences between the two groups. The MIH patients had lower rates of abnormal blood pressure compared to EMS patients ($p < 0.001$), along with statistically significant glucose abnormalities between groups ($p = 0.029$). When looking at the results of the study prior to calculating the significance, you could see there was a substantial difference in the dispositions for the two groups. For the MIH group, 66.1% of the calls were mitigated on scene, while 33.9% of the calls needed transport to the hospital. When looking at the EMS group, 11.4% of calls were mitigated on scene, while 88.6% of them required transport to the hospital. The difference between the two groups was about 55 percentage points, which shows a noticeable difference between the two groups. The study then used a multivariable logistic regression (MLR) to adjust for variables such as age of the patients, sex, ethnicity, blood pressures, EMD code, and found that the MIH response teams were about 24 times more likely to have a call mitigated on scene compared to traditional EMS response (OR = 24.19, $p < 0.001$). When the results were broken down by EMD category, there were some differences between the unit type and the EMD code, which were found to be statistically significant, showing that there was some difference between the overall compared to the specific complaint type ($\chi^2 = 36.706$, $df = 3$, $p < 0.001$). For “sick person other pain” OR = 27.09 ($p < 0.001$), “diabetic alert behaving normally” OR = 15.34 ($p < 0.001$), “falls” OR = 4.19 ($p = 0.03$), and “back pain” OR = 196.10 ($p < 0.001$).

Study Conduct: The sample size of this study was large, with 2,759 patients being treated by the two groups, which is good for the power of the study. Due to the prospective design of the study and its use of a multimodal regression, there seems to be better internal validity when compared to retrospective studies. Also, due to the study adjusting for clinically relevant covariables makes the idea that the provider role influences the disposition a much stronger argument overall. It is

important to understand that this study is observational in nature, and by effect does not have full randomization, which remains a possible confounding variable. A note on this study is that it did not necessarily look at the downstream effect of ED reduction but inferred based on the on-scene mitigation of its calls. In addition, it did not look at longer-term effects such as subsequent visits or hospitalizations, or any adverse effects, which means we are unable to calculate a number needed to treat for this study.

Study Validity & Limitations: In addition to the lack of longitudinal design of the study with adverse effects, there are a couple of other limitations of this study that should be addressed. First, as discussed above is this study was done without full randomization due to using, sometimes, the closest unit to an emergency call, which can raise the possibility of some sort of selection bias playing a role. Another limitation is that they only used ESO, which was the EMS documentation software and not Epic, which the APPs were using. This could have led to researchers missing out on information due to the documentation in Epic being more in-depth compared to ESO. Another limitation would be that they did not use all vital signs in the regression model due to limited abnormal results in respiratory rate or temperature, which could have led to some changes in the regression model. A final limitation that should be addressed is that there was no aspect of the study that took repeat callers into account. Due to a caller possibly calling more than one time in the research period, there could be some confounding due to previously being treated by one provider or the other and their change of mitigation on scene.

Study Conclusions: Overall, Tyano, E., et al. conclude that the MIH model used by the Grady Health System does significantly increase the mitigation of low acuity calls compared to the traditional EMS response. Further reporting that this model could imply it could lead to unnecessary ED visits and hospital admissions due to many patients not being transported to the

scene. Although this data does seem to strongly show that MIH programs can increase the rates of mitigation on scene, thus decreasing transportation rates to the ED, it does not fully address safety or long-term clinical outcomes. Due to this, more research should be performed to look at those aspects of MIH programs.

Study #3: Sanko, S., et al. (2019)¹¹

This study is a retrospective observational study that looks to evaluate a pilot program at the Los Angeles Fire Department (LAFD) known as the Advanced Provider Response Unit (APRU), which places a NP in the field to provide treatment without the need for transport, mitigation on scene, alternative destinations, or additional social services to the patients. This study looked at operational metrics, transportation rates, and the financial outcomes of the program during the first 18 months of the program. The primary outcome of this study was to see if the use of the NP response vehicle could safely lead to a reduction in the number of transports to the ED.

Study Design and Results: This is a retrospective review using electronic health records as well as surveys from the patients who were treated between January 2016 and June 2017. The APRU is a non-transport vehicle that was staffed by a NP and a Fire Fighter/Paramedic driver and dispatched to low acuity 911 calls by the LAFD dispatch communications center. This unit was staffed in the busiest area of the city with the highest average call volume, especially low acuity calls. This unit was available for calls Monday – Thursday from 6AM to 4PM, excluding any holidays. To evaluate for safety during the trial period, all patients were asked for a phone number to follow up after the visit but were ultimately only able to survey 51 (21%) of the

patients seen. Of the 51 surveyed, only 1 required visiting the ED within 3 days of the call. During the period of this study, this unit responded to a total of 1,038 incidents but only made patient contact with 812 of those patients, all of which were included in this study. 413 of the patients were male (50.9%) and had an average age of 42.9 years old. Of the 812 patients seen, 792 of those patients were low-acuity 911 calls, while 20 of the patients were follow-up visits scheduled with patients who had been high utilizers of EMS in the Los Angeles area. The types of calls responded to by this unit ranged from minor medical complaints to medication refills and wound care. They report that of the 792 patients who came from the 911 calls, 400 of those patients (50.5%) were treated on scene and released without transportation to the ED. They reported that the other 392 (49.5%) patients were transported to the ED from the scene. They also reported that they responded to 79 patients having a mental health complaint, and 76 of the 79 (96.2%) of those patients were able to be medically cleared from the scene and transported to a primary mental health institution, and not an emergency room. Due to the mitigation on scene by the APRU, 458 ambulances were cleared from the subsequent calls and allowed to return to service.

Study Conduct: This study utilizes a retrospective lens that uses operational data without any randomization or an accurate control group to compare against. The statistical testing was very limited due to the observational data they received and is more qualitative in design than it is quantitative. An intention-to-treat analysis is not applicable in this study due to the evaluation design associated with the retrospective study. The sample size of 812 is substantial for this study, but the lack of statistical analysis and the presented data limit the strength of this study overall.

Study Validity & Limitations: Overall, this study has multiple limitations that should be addressed while looking at the conclusions it makes. First, there is the observational retrospective design of the paper without a chance for adequate randomization. It also does not discuss the observational control, similar to the other studies, where the APRU could be compared to a traditional ambulance with an EMT/Paramedic. This study was also performed in a single geographic area, which is possible to skew the data. Another limitation is that the study was only able to contact 21% of the patients after the fact to inquire about safety outcome tracking, which limits the reliability of the minimal risk to the program, hospital readmissions, or ED visits, and leaves a large number of patients who possibly could have had adverse effects and required ED visits or hospitalizations. A large implication that should be discussed is that the LAFD & City of Los Angeles were the entities both paying for the pilot program as well as commissioning this research to be performed, which could cause a conflict of interest with this data. Lastly, the data is solely descriptive and does not offer a p-value to put this data into context, so extreme caution should be taken when addressing the significance of this study on its own.

Study Conclusions: Sanko, S. et al. concluded that the APRU model of care can safely reduce ED transports for low acuity 911 calls and also relieve the EMS resources so they can focus on other calls in the city. They also conclude that the use of this model can result in increased transports to other destinations, such as mental health facilities, at a higher rate than traditional EMS responses. Despite the limitations and limited power of the study, it does show early evidence indicating an increase in patient calls mitigated on scene rather than needing to be transported to the ED, along with increased rates of alternative transport. Despite these results, due to the lack of randomized control factors and longitudinal data, this topic should be studied

more in depth and with a more strict and controlled design to be able to draw solid conclusions from this study.

Study #4: Miller, G., et al. (2023)¹²

This study was a retrospective cohort study that looked at the community's mobile integrated health/community paramedicine program that was implemented in a low-income urban area in Baltimore, Maryland. For this study, they identified the patients they believed would be at high risk for future readmission or ED visits and had them be visited by the MIH-CP team and compared those results to a control group who received a normal/traditional level of care outside of the hospital. The primary outcome for this study was a 30-day hospital readmission and ED visits. Various secondary outcomes were also studied, including social needs related to their health and linkage to community resources.

Study Design and Results: This retrospective observational cohort pilot study looked at patients who were enrolled in the 30-day MIH-CP program from May 14th, of 2018, to July 23rd, of 2021. The MIH team consists of a multidisciplinary team including physicians, nurse practitioners, and paramedics. This took place in 6 zip codes on the west side of Baltimore, Maryland. These patients were identified as being high risk and enrolled in the program due to the following criteria. The patients were 1) recently in observation or inpatient status, 2) on family med or internal med service while admitted, 3) older than 18 years old, and 4) lived in one of the 6 zip codes of the study. The study did not include pregnant patients or those noted to be homeless, and each of the patients was enrolled in the program prior to discharge from their stay in the hospital. They picked the 30-day mark to measure readmissions and ED visits due to the current

definition set by the Office of Medicaid and Medicare Services for hospital compensation being 30 days after discharge. The patients could be enrolled in the study multiple times, each starting a new study record. Overall, there were 1,003 total records entered into the study from 867 different participants. 61% of the subjects were female, and the average age of the participants was 62 years old. The MIH-CP team worked to address not only the medical needs of the patients but also the social needs as well. Some of these social needs were able to be assisted with during the 30 days, like getting a primary care appointment, but others, like help with housing, were not always able to be addressed during the 30 days of the study, so are reported as partially addressed. When looking at readmissions and unplanned admissions (ED visits), they used a Poisson regression model that considered many confounding variables, like age, gender, the Charleston Comorbidity index, and the HOSPITAL Score. The results of their study were split into two categories: the 30-day total inpatient readmission and 30-day unplanned inpatient readmission (ED visits). For the 30-day total inpatient readmission, the readmission rate per participant in the study was 0.194. When using the Charleston Comorbidity Index (Figure 1), each point was associated with about an 8% higher change of readmission (IRR = 1.08, 95% CI 1.03-1.13, $p = .001$). When the HOSPITAL Score (Figure 2) was used, each point was associated with a 30% higher risk of readmission (IRR = 1.30, 95% CI 1.22-1.38, $p < 0.001$). They went on to show that if the MIH-CP team was able to address the medication-related needs of the patients, there was a 65% reduction in the rate of readmissions (IRR = 0.35, 95% CI 0.18-0.68, $p = 0.002$). Finally, they showed that patients who did not have the MIH-CP address their needs had a 90% readmission rate when compared to the patients whose needs were fully addressed by the MIH-CP team (IRR = 1.9, 95% CI 1.04-3.45, $p = 0.037$). When looking at the unplanned inpatient readmissions (ED visits), they showed that the mean 30-day readmission was 0.134.

They found that the Charleston Comorbidity Index was not significantly associated with unplanned readmissions, but the HOSPITAL Score that showed each 1-point increase was linked to about 47% higher unplanned readmission rates (IRR = 1.47, 95% CI 1.36-1.58, p < 0.001).

Figure 1: Charleston Comorbidity Index¹³

Comorbidity	Score
Prior myocardial infarction	1
Congestive heart failure	1
Peripheral vascular disease	1
Cerebrovascular disease	1
Dementia	1
Chronic pulmonary disease	1
Rheumatologic disease	1
Peptic ulcer disease	1
Mild liver disease	1
Diabetes	1
Cerebrovascular (hemiplegia) event	2
Moderate-to-severe renal disease	2
Diabetes with chronic complications	2
Cancer without metastases	2
Leukemia	2
Lymphoma	2
Moderate or severe liver disease	3
Metastatic solid tumor	6
Acquired immuno-deficiency syndrome (AIDS)	6

Figure 2: HOSPITAL Score¹⁴

Characteristics	Value	Points
Low H emoglobin level at discharge (<12 g/dL)	Yes	1
Discharge from an O ncology service	Yes	2
Low S odium level at discharge (<135 mmol/L)	Yes	1
P rocedure during hospital stay	Yes	1
I ndex admission T ype: urgent or emergent	Yes	1
N o. hospital A dmissions in prior year	≤1	0
	2–5	2
	≥5	5
I ndex hospitalization L ength of stay ≥ 5 d	Yes	2

The HOSPITAL score has 13 total points as scored above.
 Bold indicates the letters associated with the HOSPITAL acronym from each characteristic.

Study Conduct: The study has a fairly large pool of participants and used a Poisson regression modeling system to adjust for readmission risk factors, which increases the power of the study. They did allow participants to be entered into the study sometimes more than once, with each new enrollment used as a new record, which could cause some effect on the data that they were unable to adjust for possibly decreasing the power overall. It also did not offer a specific control group to compare the results to, so it limits the power due to not having a good baseline to compare to.

Study Validity & Limitations: This study, although it has some statistically significant data within it, does have some limitations that should be addressed. First, as discussed above, this is an observational study without any comparison, so it is hard to make causal conclusions about the results, even with them being statistically significant. Secondly, this study followed the patients for a 30-day period, which is very short and even something the authors mention as a need for further research. Next, again as stated above, they allowed over 100 participants to be counted more than once, which could skew results by introducing potential bias into the results. This study, like many of the other ones, also only occurred in one small section of a city, which could limit the generalizability. Additionally, a portion of this study's timeline occurred during the COVID-19 pandemic, which brought with it changes in hospitalization patterns, unlike other times in the study, which could skew some of the results. Despite these limitations, this study does have a good basis for validity common in observational studies and should be used to guide future research on this topic.

Study Conclusions: Miller, G. et al. concluded that this MIH-CP program was successful at addressing some needs of patients after discharge from the hospital, reducing the admissions to the hospital in the future, mainly by addressing medication problems and helping with

coordination of care. But they go on to show that these same items do not necessarily reduce unplanned readmissions to the hospital, like going to the ED. They go on to say that there are actions that the teams can do in the short term that lead to lower rates of admissions, but many of their patients have complex social needs that one single visit will not fully address, and these teams would need continued support over longer periods to address and evaluate the absolute reduction in patient readmission and unplanned readmissions. Due to the short duration of this study, more research needs to be done on the long-term effects of these specialized teams. Overall, this research is a good start, but further randomized controlled studies should be done based on the results of this study to further prove the significance of the outcomes presented.

Table 1: Summary table of study characteristics and primary efficacy and safety outcomes

Study/Design	Total Patients	Active	Comparison	Timeline	Efficacy Outcome	Safety Outcome
Bloemhoff et al., 2016 (Cross-Sectional)	991 Patients	Physician Assistant (Solo Response)	Ambulance Nurse	26 Months – Region 1 14 Months – Region 2	Similar diagnostic ability, Fewer referrals to the ER	No increase in adverse effects reported
Tyano et al., 2021 (Retrospective Analysis)	2,759 911 Calls	APP MIH Program	Standard EMS Care	6 Months	Reduced low acuity ED transports	None Reported
Miller et al., 2023 (Cohort Study)	1,003 Patients	MIH-CP Program	Standard EMS Care	38 Months	Reduced readmissions	No increase in hospitalizations
Sanko et al., 2020 (Observational)	812 Patients	APP Response Unit (PA/NP)	Standard EMS Care	18 Months	Reduced transports and ED utilization	None Reported

Table 2: Summary table of validity assessment

Study	Study Design	Meaningful Clinical Endpoint	Blinding	Meaningful Comparison	Adequate Patient Timeline	Patient Accounting	Intention To Treat Analysis	Power Adequate	Safety	Grade
Bloemhoff et al., 2016	Cross-Sectional	Y	N/A	A	A	A	N/A	M	A	MQ
Tyano et al., 2021	Retrospective Analysis	Y	N/A	A	A	A	N/A	A	A	MQ
Miller et al., 2023	Cohort Study	Y	N/A	A	A	A	N/A	M	A	MQ
Sanko et al., 2020	Observational	Y	N/A	M	A	A	N/A	M	A	LQ

A=Adequate M=Marginal I=Inadequate

For Grade H = High Quality. MQ= Moderate Quality. LQ= Low Quality. IQ= Inadequate Quality.

Table 3: Summary table of study results

Study	Design	Sample Size	Primary Outcome	Key Results	Statistical Significance	Major Limitations
Bloemhoff et al., 2016	Cross-Sectional Observational system evaluation	991 Patients	ED transport & referral rates	<p>PAs referred less patients to the ED compared to RNs (EMS)</p> <p>PAs consulted more often other specialties than RNs (EMS)</p>	<p>P < 0.0001</p> <p>P < 0.0001</p>	No randomized or concurrent control; Observational; PA representation vs. EMS RN representation; System-level confounding
Tyano et al., 2021	Retrospective Analysis	2,759 Calls	Mitigation on scene rate	The odds that a patient was mitigated on scene and not transported to the hospital was 24x higher for MIH response than traditional EMS	P < 0.001	Not fully randomized design; Retrospective vs. Prospective; Differences in reporting software; Repeat callers
Miller et al., 2023	Retrospective (Cohort) observational	1,003 Records	30-day readmission rate	<p>Charleston Comorbidity Index → 8% Increase per point</p> <p>HOSPITAL Score → 30% Increase per point</p>	<p>P = 0.001</p> <p>P < 0.001</p>	Observational; No control group; Short 30-day follow-up; 100 repeated patients; COVID-19 Pandemic timing
Sanko et al., 2020	Retrospective Observational	812 Patients	ED transport rate	50.5 % treated on scene vs. 49.5 % transported to the ED	Descriptive Comparison Only (No p value reported)	Observational design w/o randomization; Single geographic area of research; Lacking follow-up safety data; Sponsorship of study

DISCUSSION

Study Endpoints

All four of these studies all reviewed the use of APPs as part of MIC-CP-based care teams outside of the hospital, looking at how the use of these teams can cut down on EMS transports to the hospital, ED visits, and hospital admissions as a whole. Throughout all four, there is a consistent theme that by utilizing APPs outside of the hospital doors, we can reduce the strain that is placed on our EDs, EMS, and hospital systems by reducing ED visits, hospital admissions, and proactively addressing social and community needs of our patients before they need the hospital. In Bloemhoff et al., they found that these advanced clinicians could see lower acuity patients outside of the hospital and mitigate a large majority on scene without the need for transport to the ED for admission while also finding that PAs could consult other services more from the scene for consults which also decreased much of the need for transport to the hospital, suggesting properly trained advanced clinicians could reduce ED transports by seeing patients in the field. Similarly, Tyano et al. found that the APP MHI team was able to mitigate patients' complaints on scene 24 times more than a traditional EMS response, thus also reducing transports to the hospital. Sanko et al. had similar results showing that over 50.5% were treated on scene without the need for transport to the hospital. Although looking at a slightly different aspect of the prehospital care, Miller et al. found that by having APP MIH teams address specific social constraints outside of the hospital, they were able to decrease the patient population that was readmitted to the hospital for their chronic condition or had to be taken emergently to the ED. Together, all four of these studies show findings suggesting that the presence of an advanced clinician on scene, such as an APP, was able to not only provide diagnostic evaluation and treatment but also address social factors that traditionally are preformed within the hospital

setting. Thus, supporting the concept that APPs in the field can lead to increased system efficiencies by reducing unnecessary hospital utilization.

When looking at all four of these studies, we can start to draw the conclusion that prehospital APP care models could provide improved health care in many communities by expanding access to care and reducing unnecessary ED transports and hospital admissions. Despite the encouraging nature of this research, it is important to understand that the conclusions drawn from this data are very limited by the predominantly observational nature of these studies and the lack of randomized control groups for comparison, which can lead to possible bias and the possible introduction of many compounding variables. These studies overall have many limitations that need to be addressed before this data could be used to fully guide future clinical decision making, including the lack of long-term outcomes and safety data. It should be acknowledged that these studies all took place in small, geographically different areas of the United States and the Netherlands, each bringing with it differences in training, scope of practice, and local EMS protocols, making it difficult to use this data as a generalization across all health care systems in the US. Finally, many of these studies do not discuss the direct role of the APP when the MIH program is a team, which can add some extra compounding variables that should be better addressed in future studies. Despite these limitations, this data is encouraging that future research on this topic will provide better direction for this evolving subset of healthcare.

Next Steps & Future Direction

Although this current literature does provide favorable data for the use of APP staffed MIH-CP programs, the data presented is limited, drawing into question whether the conclusions made are valid for replication in the varying hospital systems across the US. Despite the limited data available, this research should be a steppingstone to future research on this topic to further

prove that APPs do have a crucial role in prehospital emergency and chronic care. In the future, research should use these results to formulate randomized controlled trials along with larger, more comprehensive prospective studies to evaluate the safety and long-term benefits of these programs compared to the traditional model currently in use in many places across the country. Many of these studies looked at APP-led MIH-CP programs but did not evaluate them against the current EMS practice already in use in those communities. By putting these APP-led teams up against the current practice, we can see exactly where the improvements can be made and how these programs can lead to increased care for our quickly aging population. In addition, future studies should look at outcomes past a 30-day period while also considering repeat patients and whether these programs cut down on those visits to the ED. This concept has been shown to work in various communities; MedStar, a Fort Worth ambulance service, reports that since its inception of an APP-led program in 2009, there has been a reduction of 1917 ED visits and 462 hospitalizations.¹⁵ The next step is to study whether there are similarities between programs across the country and whether these should become a universal part of every hospital system and EMS agency.

Based on this data, the future of APP-led MIH-CP programs is promising and something that will continue to grow over the coming years. In 2021, the NAEMSP created a position statement on the role of EMS PAs and EMS NPs, stating these providers with some additional training would be able to provide advanced field response, consult EMS crews, and participate in and assist with the coordination of MIH-CP programs.¹⁶ Now, in 2026, there are programs popping up across the United States putting PAs and NPs into these positions to better serve our patient populations. The hope is that as more health systems and communities put stock into these programs, better and more statistically significant research can come out showing just what

APP-led MIH-CP programs can do, not only for the patients but also the hospitals they are affiliated with.

CONCLUSION

MIH-CP programs across the United States remain a very new model for healthcare delivery, and one that current research is limited on. That amount of research is even more sparse when you start to look at the programs that utilize Physician Assistants and Nurse Practitioners as part of these prehospital teams. Although there is limited research, these alternative prehospital care teams seem to represent a growing strategy to address the ever so apparent increase in emergency department visits, EMS calls, and gaps in patient care in the outpatient setting on a day-to-day basis. Although limited in scope, these studies have demonstrated that the various MIC-CP programs can reduce the strain on ED and EMS providers by safely and effectively addressing patient complaints and needs on scene without the need for transport, thus limiting those who actually need to be transported to the hospital. These findings show that by expanding the utilization of APPs in the field, we can improve acute care of our patients and help address social barriers that keep patients returning to the ED. They show we can do this while also helping to cut down on excess resources being used in the hospital. Despite these promising results, the current evidence on these programs still remains very limited due to observational design, small sample sizes, geographic variability, and differences in program structure and outcomes. As APP-led MIC-CP programs become more popular across our healthcare systems, further prospective and randomized controlled research will be required to better understand the risks and benefits of these programs, as well as the long-term impact they have on the ever-growing needs of our patient population.

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