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# MEDJEM

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The Mediterranean Journal of  
Emergency Medicine & Acute Care

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# MedJEM

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# *Meet the MedJEM Board*



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# ***MEDJEM***

## ***The Mediterranean Journal of Emergency Medicine & Acute Care (MedJEM): Why?***

Amin Kazzi, MD, MAAEM, FAAEM  
 Editor-in-Chief, MedJEM

Certainly, we cannot launch a new open access journal such as MedJEM without justifying why we are doing so and what will be different about it.

First, we believe the specialty of emergency medicine (EM) as well as emergency, urgent and acute care around the Mediterranean basin have reached over the last three decades a level of development, complexity and needs that require the establishment of a regional internationally-driven medical journal. The publication of such a journal constitutes a major milestone in the development of any specialty in general - and of EM and emergency medical services in particular.<sup>1</sup>

### **What will be different about MedJEM?**

The Mediterranean Academy of Emergency Medicine (MAEM), the regional international chapter of the American Academy of Emergency Medicine (AAEM), will be the entity publishing this periodic peer-reviewed, open-access academic journal. It will do so in collaboration with a number of regional and international professional societies, academic organizations and institutions that are committed to excellence and exchange in the provision of emergency medicine and acute care education, research and practice (Table 1).

MedJEM aims to serve the patient, the medical provider, the specialty of emergency medicine (EM) as well as all fields of acute care.

Accordingly, MedJEM will encourage and promote publications submitted by specialists, educators and scholars from all academic backgrounds and specialties as long as they pertain to acute care and any related topics or fields. We shall ensure that no less than half of our reviewers and editorial board have a non-EM specialist background since such a scholarly multidisciplinary and interdisciplinary forum will undoubtedly enrich the exchange, the value and the impact of our journal.

**Table 1** Sponsoring organizations.

The Mediterranean Academy of Emergency Medicine (Founder)	<i>MAEM</i>
The American Academy of Emergency Medicine	<i>AAEM</i>
The American University of Beirut	<i>AUB</i>
The Global Research on Acute Conditions Team	<i>GREAT</i>
The Lebanese Academy of Emergency Medicine	<i>LAEM</i>
The Lebanese Society for Emergency Medicine	<i>LSEM</i>
The Middle East & North Africa Clinical Toxicology Association	<i>MENATOX</i>
The University of California, Irvine	<i>UCI</i>
The Western Journal of Emergency Medicine	<i>WestJEM</i>

MedJEM will embrace the multidisciplinary nature of emergency medical care. MedJEM is committed to core values that we plan to publish as our Mission and Vision statements in our December 2020 issue. One adopted value is that excellence in emergency and acute care requires comprehensive multidisciplinary collaboration.

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1. Arnold JL. International emergency medicine and the recent development of emergency medicine worldwide. *Annals of Emergency Medicine*. 1999;33(1):97-103.

For that reason, MedJEM will certainly encourage interdisciplinary acute care collaboration between specialists, academicians and scholars. It will provide a platform for other professionals who collaborate with EM to publish. These include physicians from all other specialties including but not limited to the fields that are closely tied to EM (e.g., Medical Toxicology, Emergency Medical Services, Sports Medicine, Hyperbaric Medicine, Preventive Medicine, Critical Care Medicine, Trauma Surgery). MedJEM will also provide an exchange, publication and educational platform for nurses, technicians, paramedics & prehospital providers, public health professionals, and allied health providers

Yes, MedJEM is different. This will be particularly evident through our international focus and commitment to advancing EM and acute care across and beyond the Mediterranean region to include any nations where the field and the specialty of EM remain in an early or middle phase of development. Accordingly, the journal opts to select publications from contributions and manuscripts that:

1. Are submitted by authors and researchers with a primary affiliation in the Mediterranean region or in any nations where EM and Acute Care are still in an early or middle phase of development.
2. Pertain to study populations & topics of primary relevance to these nations' health needs
3. Increase the quality of educational and scientific skills in the field.

Last but not least, MedJEM will empower young investigators by encouraging them to present their work at international meetings and selecting substantial work for subsequent publication in the journal.

# Impact of Internally Developed Electronic Prescription on Prescribing Errors at Discharge from the Emergency Department

Eveline Hitti<sup>1</sup>, Hani Tamim<sup>2</sup>, Rinad Bakhti<sup>1</sup>, Dina Zebian<sup>1</sup>, Afif Mufarrij<sup>1\*</sup>

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## Abstract

**Introduction:** Medication errors are common, with studies reporting at least one error per patient encounter. At hospital discharge, medication errors vary from 15%-38%. However, studies assessing the effect of an internally developed electronic (E)-prescription system at discharge from an emergency department (ED) are comparatively minimal. Additionally, commercially available electronic solutions are cost-prohibitive in many resource-limited settings. We assessed the impact of introducing an internally developed, low-cost E-prescription system, with a list of commonly prescribed medications, on prescription error rates at discharge from the ED, compared to handwritten prescriptions.

**Methods:** We conducted a pre- and post-intervention study comparing error rates in a randomly selected sample of discharge prescriptions (handwritten versus electronic) five months pre and four months post the introduction of the E-prescription. The internally developed, E-prescription system included a list of 166 commonly prescribed medications with the generic name, strength, dose, frequency and duration. We included a total of 2,883 prescriptions in this study: 1,475 in the pre-intervention phase were handwritten (HW) and 1,408 in the post-intervention phase were electronic. We calculated rates of 14 different errors and compared them between the pre- and post-intervention period.

**Results:** Overall, E-prescriptions included fewer prescription errors as compared to HW- prescriptions. Specifically, E-prescriptions reduced missing dose (11.3% to 4.3%,  $p < 0.0001$ ), missing frequency (3.5% to 2.2%,  $p = 0.04$ ), missing strength errors (32.4% to 10.2%,  $p < 0.0001$ ) and legibility (0.7% to 0.2%,  $p = 0.005$ ). E-prescriptions, however, were associated with a significant increase in duplication errors, specifically with home medication (1.7% to 3%,  $p = 0.02$ ).

**Conclusion:** A basic, internally developed E-prescription system, featuring commonly used medications, effectively reduced medication errors in a low-resource setting where the costs of sophisticated commercial electronic solutions are prohibitive.

**Keywords:** electronic prescription, emergency room, medication, medication error, prescribing error

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## INTRODUCTION

Medication errors frequently result in adverse drug events. These errors greatly impact patient safety, representing the leading cause for injuries and death.<sup>1</sup> Studies have reported at least one error per patient encounter.<sup>2</sup> An emergency department (ED) setting is believed to be particularly sensitive to medication errors due to exposure to new patients, time constraints, frequent interruptions and limited patient history.<sup>1,3</sup> Additionally, there is a higher frequency of prescriptions in this setting, with more than 75% of ED visits resulting in drug



administration or prescription dispensing.<sup>4</sup> Errors at discharge in particular are also common, varying from 15%-38%.<sup>5-8</sup> Of discharged patients from the hospital, 23% encountered at least one adverse event and 72% of the adverse events were attributed to medications errors.<sup>9</sup>

To our knowledge, a total of two studies have looked at the impact of electronic (E)-prescription error rates at discharge from the ED. Bizovzi *et al.* found that a commercial E-prescription system was three times less likely to result in errors and five times less likely to demand pharmacist clarification than hand-written (HW) prescriptions within the ED.<sup>10</sup> A similar effect was reported at discharge in a pediatrics ED with a commercially-based system.<sup>11</sup> This study examined the effect of introducing a low-cost, internally developed E-prescription system with a list of commonly prescribed medications to the ED at a tertiary care center in Lebanon, on prescription errors compared to HW-prescriptions.

## METHODS

### Study Setting

This study was conducted at the ED of the American University of Beirut Medical Center, the largest tertiary care center in Lebanon, with around 49,000 patient visits per year. The ED is staffed by attendings around the clock along with residents from multiple different services for adult patients (internal medicine, family medicine, surgery and obstetrics residents) and pediatric patients (family medicine and pediatrics residents). The majority of our patients are covered by private third-party payers (67%), while the remaining pay out of pocket. The ED uses an internally developed dashboard system that allows for patient tracking, electronic diagnostics ordering and review of prior visits and diagnostics results. All ED medication ordering throughout the ED stay is done through hand-written orders (HW), including at discharge.

### Study Design

We conducted a pre- and post-intervention study with a random sample of patients selected from the pre- and post- intervention period. The pre-intervention phase, which included the HW-prescription at discharge, ran from November 1, 2010- June 30, 2011, while the post-intervention phase, which included the E-prescriptions, ran from November 1, 2011-June 30, 2012. These periods

were selected to allow for a wash-out period, specifically one month pre-introduction of the E-prescription and two months post-introduction, during which piloting and implementation was occurring. Approval for this study was granted by our institutional review board.

#### *Population Health Research Capsule*

What do we already know about this issue? *Commercially available electronic prescription systems decrease prescription errors at ED discharge however they are cost-prohibitive in resource limited settings.*

What was the research question? *Assess the impact of introducing an internally developed, low-cost electronic prescription system on prescription error rates at ED discharge.*

What was the major finding of the study? *An electronic prescription system featuring commonly used ED medications reduced prescription errors at ED discharge.*

How does this improve population health? *Reducing prescription errors at discharge from the ED, by applying a basic electronic prescription system, can prevent adverse drug events and improve quality of care.*

### Sample selection

Patients eligible in this study were of all ages, genders, and diagnoses, with at least one prescription at discharge, either HW or electronic. We excluded patients whose charts were not scanned into the electronic medical record or if the discharge prescription was missing. We randomly selected charts for the pre-intervention month, by selecting every 10<sup>th</sup> admission medical record number, checking for the presence of a discharge prescription. If so, the patient was included in the study. This process was repeated until the target number of patients was reached. We also used this method for the post- intervention group.



## Power calculation

Although the HW-prescribing error rate in the literature ranges between 15-46%,<sup>12,13</sup> for the sample size calculation of the current study, we considered a rate of 50%, since it yields the highest sample size (most conservative). Accordingly, we estimated that a sample size of 770 patients in each group was needed to detect a 7% reduction in error rates post-intervention, with an 80% power and an alpha level of 5%, assuming one discharge prescription per patient.

## Intervention

An electronic discharge process was internally developed by a team that included an emergency-physician champion working with the hospital information technology (IT) team and director of pharmacy. The electronic discharge module was introduced on August 1, 2011. The new system included forced fields for diagnoses, an optional section for follow-up care, optional patient education handouts and a prescription section that included 166 commonly prescribed medications with the generic name of the medication, strength, dose, frequency, route, and duration. The list was developed based on historical data of commonly prescribed medications from the ED, in addition to faculty input. When deciding on common medication categories where multiple options exist, we included the ones on hospital formulary, e.g., esomeprazole rather than pantoprazole. For pediatrics, the list included the medication, strength and recommended dosing only on a mg/kg basis, where the final dose required manual calculation. Hospital pharmacy reviewed the final list for accuracy and availability of medications in the local market. The system did not include allergy- or medication-reconciliation functions. Physicians could also free text additional medications without forced fields. The time to complete and print the E-prescription was around 30 seconds. The total cost of development and implementation including IT personnel time, ED medical director time and pharmacist time was approximately \$4,300 U.S. in our setting.

## Data collection

The methods followed in this study adhere to the criteria suggested by Worster *et al.* for retrospective chart review.<sup>14</sup> We used a data collection sheet to

facilitate extracting the information and to de-identify the phase of the study. Two research assistants who were trained prior to data collection and monitored throughout transcribed both the HW- and E-prescriptions into a Microsoft Excel database. We reviewed medical charts retrospectively to collect patient-specific demographic and medical data including age, gender, emergency severity index (ESI), discharge diagnosis, allergies, home and discharge medications (number and all prescription-related information on medication name, dose, strength, frequency, route, and duration) and number of handovers as reflected by attending shift changes during the patient's stay.

Moreover, we used an administrative database to collect workload and scheduling metrics that might affect error rates. These included ED visit volume per day, weekday/weekend shift, shift type (morning shift, which ran from 8am-4pm; evening shift, 4pm to midnight; and night shift, midnight to 8am).

## Definitions and identification of errors

The definition of errors in each prescription was according to the error list provided in Table 1. Duplication with discharge medication was considered an error when two medications of the same family were included in the discharge prescription, for example, ibuprofen and naproxen. We considered duplication with home medications an error when at least one of the discharge medications was of the same family as one of the home medications and there were no instructions to hold or stop the home medication. Drugs were reviewed for interactions with all the medications listed in the discharge prescription list and the home medication list. We used Lexicomp® drug interaction software to check for all interactions and risk ratings as per the software, where risk A involved no known interaction, risk B required no action, risk C required monitoring therapy, risk D required consideration of therapy modification and risk X required avoidance of combination.<sup>15</sup> All risk D and X interactions were considered an error. We included drug allergy error if the patient was discharged on a medication that was listed as an allergy in the patient record, or was of the same family of the allergy medication. Lexicomp software was also used to review all medication dosing, frequency, and duration recommendations.

A prescription was considered to have an error in these categories if there was deviation from the Lexicomp recommendation. Incorrect strength was considered an error if the strength of the medication was not one available in the local market per the Lebanese Ministry of Public Health formulary list.<sup>16</sup> A medication was considered illegible if the research assistant was unable to read it. The two research assistants who extracted the data completed the error scoring. Moreover, to verify the scoring, a clinical pharmacist, who was blinded to the purpose

illegibility and missing duration, dose, frequency, or strength.

### Other outcomes

Errors that were not directly targeted by the intervention but were felt to potentially impact patient safety were considered other outcomes. These included the following: duplication with discharge medication, duplication with home medications, interactions of discharge medication with another discharge medication, interaction of discharge medications with home medications and drug/allergy interaction.

**Table 1** Types of errors in prescriptions for discharge medication, and corresponding risk level.

Description	Risk level classification
High-risk errors	
Duplication with discharge medication	High
Duplication with home medication	High
Drug/drug interaction (D/H)	High (type D and X)
Drug/drug interaction (D/D)	High (type D and X)
Drug/allergy interaction	High
Incorrect dose	High
Incorrect frequency	High
Incorrect strength of drug	High
Low-risk errors	
Incorrect route	Low
Missing duration	Low
Missing dose	Low
Missing frequency	Low
Missing strength of drug	Low
Illegibility	Illegible

*Drug/drug interaction (D/H): interaction of discharge medications with home medications. Drug/drug interaction (D/D): interactions of discharge medication with another discharge medication. Type D required consideration of therapy modification and type X required avoidance of combination.*

and phase of the study, reviewed the de-identified data and scored them independently. Finally, any discrepancy between the scoring of the research assistants (RAs) and the pharmacist was resolved by discussion with the principal investigator (PI) of the study, as well as the director of clinical pharmacy at our institution.

## Outcomes and classification of errors

### Primary outcomes

We classified errors directly impacted by the intervention as primary outcomes. These included incorrect route, dose, or frequency, or strength,

### Classifications

A priori, we categorized those under 14 years of age as pediatric, and those above as adults. This classification was based on a previous study, where the age group corresponds to a typical weight of 50kg or less and is likely to need weight-based prescription dosing.<sup>10</sup> The error types were classified into three groups: incorrect errors (incorrect route, dose, frequency, and strength), missing information errors (missing duration, dose, frequency, and strength) or illegible errors. Error types were also grouped as high or low risk. We considered errors high risk if they had the potential to cause significant harm and were not part of routine pharmacist verification practice. All missing-information errors were considered low risk as pharmacy verification would be required to fill the prescription. High-risk errors included duplication with discharge medication, drug/drug interaction with home medications, drug/drug interaction with discharge medications, drug/allergy interaction, incorrect dose, incorrect frequency, incorrect strength, and duplication with home or discharge medication. Low-risk errors included incorrect route, missing duration, missing dose, missing frequency, and missing strength.

### Statistical Analysis

We used the Statistical Package for Social Sciences (SPSS)® for the data management and analyses. The distribution of the medication errors and the predictors (sociodemographic characteristics, ED scheduling, ED workload and patient medical status) are presented as means  $\pm$  standard deviations (SD) and frequencies and percentages for the continuous and categorical variables, respectively. We used

**Table 2.** Association between the demographic variables and the use of handwritten (HW) or electronic (E) prescription.

Total sample		Pre-intervention HW	Post-intervention E	p value
		number (%)	number (%)	
		N=1475	N=1408	
<b>Patient characteristics</b>				
Age (years)	(Mean, ±SD)	31.4 (±20.9)	31.3 (±20.0)	0.81
Male gender		746 (50.6%)	715 (50.8%)	0.91
ESI	(Mean, ±SD)	3.3 (±0.6)	3.3 (±0.7)	0.10
Pediatric patients	Pediatric	320 (21.7%)	268 (19.0%)	0.08
Number of home medications/patient	(Mean, ±SD)	1.3 (±1.7)	1.1 (±1.6)	0.002
Number of discharge medications/patient	(Mean, ±SD)	2.4 (±1.0)	2.3 (±1.0)	0.001
<b>ED workload</b>				
Shift				0.001
Morning		528 (35.8%)	485 (34.4%)	
Evening		575 (39.0%)	485 (34.4%)	
Night		372 (25.2%)	438 (31.1%)	
Handovers per visit	(Mean, ±SD)	1.1 (±0.3)	1.2 (±0.4)	0.33
ED volume per day	(Mean, ±SD)	134.1 (±13.4)	132.4 (±16.4)	0.002

HW, handwritten prescriptions; E, electronic prescriptions; ESI, Emergency Severity Index; SD, standard deviation.

**Table 3.** Association between the type of errors and the use of handwritten (HW) or electronic (E) prescriptions.

Total sample	Pre-intervention HW	Post-intervention E	Crude OR (95% CI)	p value
	number (%)	number (%)		
		N=1475	N=1408	
All type errors	999 (67.7%)	641 (45.5%)	0.40 (0.34 – 0.46)	<0.0001
Duplication with discharge	5 (0.3%)	4 (0.3%)	0.84 (0.22 – 3.13)	1.00
Drug/drug interaction (D/H)	107 (7.3%)	96 (6.8%)	0.94 (0.70 – 1.25)	0.65
Drug/drug interaction (D/D)	51 (3.5%)	55 (3.9%)	1.14 (0.77 – 1.67)	0.52
Drug/allergy interaction	0 (0.0%)	2 (0.1%)	-	0.24
Incorrect drug	2 (0.1%)	1 (0.1%)	0.52 (0.05 – 5.78)	1.00
Incorrect dose	40 (2.7%)	26 (1.8%)	0.68 (0.41 – 1.11)	0.12
Incorrect frequency	51 (3.5%)	57 (4.0%)	1.18 (0.80 – 1.73)	0.40
Illegibility	11 (0.7%)	1 (0.1%)	0.10 (0.01 – 0.73)	0.005
Missing duration	398 (27.0%)	410 (29.1%)	1.11 (0.95 – 1.31)	0.20
Missing dose	166 (11.3%)	61 (4.3%)	0.36 (0.26 – 0.48)	<0.0001
Missing frequency	51 (3.5%)	31 (2.2%)	0.63 (0.40 – 0.99)	0.04
Missing strength	478 (32.4%)	144 (10.2%)	0.24 (0.19 – 0.29)	<0.0001
Incorrect strength	22 (1.5%)	51 (3.6%)	2.48 (1.50 – 4.12)	<0.0001
Duplication with home medication	25 (1.7%)	42 (3.0%)	1.78 (1.08 – 2.94)	0.02

HW, handwritten prescriptions; E, electronic prescriptions Drug/drug interaction (D/H): interaction of discharge medications with home medications. Drug/drug interaction (D/D): interactions of discharge medication with another discharge medication.

Pearson's chi-squared and one-way Student's t-test to assess the significance of the association between the predictor factors (continuous and categorical) and the medication error.

We performed a multivariate analysis using logistic regression to find the best model that fit the data and explained the association between medication error and all predictor variables, which included the following: type of prescription, age, gender, ESI, number of home medications, number of discharge medications, shift type, ED volume per day and handovers per visit. We conducted a backward selection procedure by fitting medication error with all risk factors found to be significant at the bivariate level, in addition to those considered clinically meaningful. Furthermore, the magnitude of association between the predictor variables and medication errors was determined by calculating the adjusted odds ratios (aOR) and their corresponding 95% confidence intervals (CI). Missing data were not modified, and statistical significance was established at the p-value of 0.05.

## RESULTS

We included a total of 2,883 prescriptions in the study, of which 1,475 (51.2%) were in the pre-

intervention period (HW), and 1,408 (48.8%) in the post-intervention (E). Table 2 presents the results of the comparison of the demographic characteristics and the ED workload data between the pre- and post-intervention periods. Overall, characteristics of both patient populations were similar, although there was a slight decrease in the number of home medications and discharge medications per patient in the post-intervention period (1.3 prescription per patient compared to 1.1,  $p=0.002$ ). As for the workload characteristics, the ED workload per day, though not clinically significant, was lower in the post-intervention period (132.4 vs 134.1,  $p=0.002$ ) with more patients presenting during the night shift (31.1% vs 25.2%,  $p=0.001$ ).

Overall, E-prescriptions were significantly associated with a reduced error rate (67.7% vs 45.5%,  $p<0.0001$ ) (OR=0.40, 95% CI [0.34–0.46]) (Table 3). More specifically, E-prescriptions were associated with a significant reduction of “missing dose” errors (11.3% vs. 4.3%, OR=0.36, 95% CI [0.26–0.48],  $p <0.0001$ ), “missing frequency” errors (3.5% vs. 2.2%, OR=0.63, 95% CI [0.40–0.99],  $p=0.04$ ), and “missing strength” errors (32.4% vs 10.2%, OR=0.24, 95% CI [0.1–0.29],  $p <0.0001$ ). “Legibility” also significantly improved with E-prescriptions (0.7% vs 0.1%, OR=0.10,

**Table 4.** Association between the types of prescribing errors by broad categories and the use of electronic or handwritten prescription.

Total sample	Pre-intervention HW number (%)	Post-intervention E number (%)	p value
	N=1475	N=1408	
Drug interaction errors	128 (8.7%)	140 (9.9%)	0.24
Incorrect information errors	103 (7.0%)	126 (8.9%)	0.05
Illegible errors	11 (0.7%)	1 (0.1%)	0.005
Missing information errors	870 (59.0%)	500 (35.5%)	<0.0001
Drug allergy errors	0 (0.0%)	2 (0.1%)	0.24

*HW, handwritten prescriptions, E, electronic prescriptions*

**Table 5.** Comparison between handwritten and electronic prescriptions according to the risk level.

Total sample	Pre-intervention HW number (%)	Post-intervention E number (%)	p value
	N=1475	N=1408	
All errors	985 (66.8%)	626 (44.5%)	<0.0001
Low-risk errors	871 (59.1%)	500 (35.5%)	<0.0001
High-risk errors	221 (15.0%)	256 (18.2%)	0.02
Illegible errors	11 (0.7%)	1 (0.1%)	0.005

*HW, handwritten prescriptions, E, electronic prescriptions*



**Table 6.** Multivariate analysis for the predictors of all types of medication errors vs no errors (hierarchical method imposing the type of prescription).

Predictors	Adjusted OR (95%CI)	P value
Type of prescription (handwritten/electronic)	0.40 (0.35 – 0.47)	<0.0001
Age	1.01 (1.01 – 1.02)	<0.0001
Pediatrics	1.38 (1.06 – 1.78)	0.02
Number of home medications per patient	1.18 (1.11 – 1.25)	<0.0001

*Variables entered in the model include the following: type of prescription, total visits, ED volume, age, gender, (Emergency Severity In- dex), pediatric (as compared to adult) patients, number of home medications per patient, number of discharge medications per patient, shift evening, shift night.*

95% CI [0.01–0.73],  $p=0.005$ ). On the other hand, E-prescriptions were associated with a significant increase of “incorrect strength” errors (1.5% vs. 3.6%, OR=2.48, 95% CI [1.50– 4.12],  $p <0.0001$ ) and “duplication with home medication” (1.7% vs. 3.0%, OR=1.78, 95% CI [1.08–2.94],  $p = 0.02$ ).

When classified into broad categories of prescription error types, “missing information” (which includes missing duration, route, dose, strength, name, and frequency) was the most common type of error to occur overall (47.5%) and was significantly less common in E-prescriptions as compared to the HW-prescriptions (35.5% vs 59.0%, respectively,  $p <0.0001$ ) (Table 4). On the other hand, “incorrect information” (which includes incorrect route, dose, and frequency) errors were more common in prescriptions, with borderline statistical significance (8.9% vs 7.0%,  $p=0.05$ ).

Table 5 presents the comparison between the HW- and E-prescriptions by risk level of errors. Low-risk prescribing errors were the most common type of errors in both groups, yet it was found to be less in the E-prescriptions as compared to the HW (35.5% vs. 59.1%,  $p <0.0001$ ). Similarly, the illegible errors were less in the E-prescription (0.1% vs 0.7%,  $p= 0.005$ ). On the other hand, high-risk errors were more common in the E-prescriptions as compared to the HW ones (18.2% vs 15.0%,  $p = 0.02$ ).

The results of the multivariate logistic regression analysis for the predictors of all types of medication errors are presented in Table 6. After adjusting for potentially confounding factors, it was found that E-prescriptions were a strong predictor of fewer errors (adjusted OR = 0.40, 95% CI [0.35 – 0.47],  $p<0.0001$ ).

## DISCUSSION

This pre- / post-intervention study demonstrates

that the implementation of a low-cost, internally developed E-prescription system, featuring a list of commonly used medications, with no decisional support features, can effectively reduce the number of medication errors. While multiple studies have demonstrated the impact of sophisticated E-prescription system on reducing prescribing errors at discharge, the expense of such systems may be prohibitive in low-resource settings.

The types of errors significantly reduced with E-prescriptions in our study were the following: missing dose, missing frequency, missing strength, and illegibility errors. In terms of broad categories of errors, low-risk errors, illegible errors and missing-information errors emerged as significantly reduced by E-prescription. By contrast, incorrect information errors were more common in E-prescriptions. This was mainly due to an incorrect strength of one commonly used medication that was included in the final list and perpetuated in all the E-prescriptions.

Our study revealed no improvement in the other outcomes. In fact, duplication with home medications increased upon E-prescription use while no such effect was noted for drug-interaction errors and drug-allergy errors. This was likely because the design of the internally developed system in our study did not specifically target high-risk errors or include drug-allergy checking, medication reconciliation, and drug-drug interaction features. Since no controls for these errors were introduced, the difference in corresponding error rates between pre- and post-intervention was expectedly not large. Overall, this is in line with previous studies in which computerized systems were not as effective with high-risk medication errors.<sup>17,18</sup> Such high-risk errors would require developing more sophisticated programs that include fields for entering home medications and allergies, which could then be cross- checked with the discharge medications for

interactions/ contraindications.

In addition, although the current system includes a list of commonly prescribed medications, a free-text option remained available to providers. This may have reduced the impact on missing-information errors. Implementing a program that makes some elements mandatory would be an easy, low-cost modification that would further mitigate this type of error.

Features of commercially available E-prescription systems range from basic medication lists to robust decision-making support with medication reconciliation processes. While decision support capability to address high-risk errors is an important component of commercially available E-prescription systems, such complex systems can cost up to \$29,000 per physician for the first year and \$4,000 annually thereafter.<sup>19</sup> Even the cost of commercially available E-prescriptions systems with basic features is high, ranging between \$1,500 and \$4,000 per physician.

Such costs are likely unaffordable in low-resource settings where internally developed solutions may offer more feasible options.

## LIMITATIONS

There are a few limitations to this study. Firstly, this intervention was implemented across a single institution, which may limit generalizability. Given the pre-/post study design, some physician- and patient-related characteristics may have varied and introduced a bias into the results. Additionally, the outcome and consequences of medication errors and their severity, including adverse drug events, were not measured and assessed. Moreover, although discrepancy between abstractors was resolved through a systematic process with the PI, nevertheless, inter-observer reliability was not tested.

## CONCLUSION

An E-prescription system that includes a common list of ED medications considerably decreased the frequency of the majority of prescription errors. To date, no studies have investigated the impact of a low-cost electronic, internally developed system in an ED where resources are limited and acquiring comprehensive and commercial E-solutions is cost-prohibitive. The developed system is comparatively

more basic than currently available systems and uses entirely internal resources. The decrease in error rates introduced by this cost-effective system supports its implementation, particularly in developing countries with limited financial resources.

*Conflict of interest:* No author has professional or financial relationships with any companies that are relevant to this study. There are no conflicts of interest or sources of funding to declare.

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# Utility of a Bedside Pocket-Sized Ultrasound Device to Promptly Manage Abdominal Pain in the Emergency Department

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## Abstract

**Introduction:** Abdominal pain is a frequent reason for Emergency Department (ED) admission; it amounts for around 5–10% of all ED visits. Early assessment should focus on immediately distinguishing cases of acute abdomen that require urgent surgical intervention. The clinical localization of pain is crucial, suggesting an initial evaluation of the origin of the abdominal pain; however, imaging is often required for final diagnosis. Ultrasound (US) represents a rapid imaging modality that is readily available in the ED and does not involve radiation or contrast agent administration. A new generation of portable, battery-powered, low-cost, hand-carried ultrasound devices have become available recently; these devices can provide immediate diagnostic information in patients presenting with abdominal pain in ED.

The aim of the study was to demonstrate the diagnostic usefulness of a bedside pocket-sized ultrasound (BPU) device (Vscan from General Electrics) in non-traumatic patients complaining of acute abdominal pain in a tertiary care university hospital in Italy.

**Methods:** Patients with acute non-traumatic abdominal pain presenting in ED were prospectively enrolled and underwent physical examination, traditional imaging and BPU.

**Results:** A total number of 230 patients with acute non-traumatic abdominal pain were enrolled. Overall agreement between routine standard imaging and BPU turned out to be equal for computed tomography (K=0.3) and traditional ultrasound (K=0.29). Receiver operating characteristics curve (ROC) analysis for diagnostic power of the BPU in comparison with traditional US showed an area under the curve of 0.65, sensitivity and specificity of 87.2% and 42.31% respectively.

**Conclusions:** Emergency use of BPU in patients with non-traumatic abdominal pain demonstrated good diagnostic performance when compared to traditional imaging, with the potential advantage of reducing costs and delay in patient final disposition.

**Keywords:** abdominal pain, computed tomography, diagnosis, emergency department, ultrasound

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## INTRODUCTION

Abdominal pain is a frequent complaint in the emergency department (ED), and it amounts for 5–10% of all ED visits.<sup>1</sup>

It encompasses a wide differential diagnosis that includes medical, surgical and non-surgical diseases that can involve all organs within the torso, abdomen, back and pelvis. Almost 10% of patients

complaining abdominal pain in the ED have a life-threatening cause and/or require surgery.<sup>2</sup>

Immediate assessment should focus on distinguishing those cases of true acute abdomen that require urgent surgical intervention from those that do not, which can initially be managed conservatively.<sup>3-5</sup>

Patient's outcome is directly related to early accurate diagnosis for providing immediate treatment; however, the final etiology could remain unknown in about 25% of patients discharged from ED and for 35% of patients admitted to hospital.<sup>3-6</sup>

Patient history, physical examination, and laboratory testing may not identify an underlying cause of pain but could narrow the differential diagnosis.<sup>6,7</sup>

The location of pain should drive the evaluation of the patient with abdominal pain; however, imaging is often required for definitive diagnosis and treatment.<sup>1,3</sup>

Computed tomography (CT) scan provides the highest sensitivity and specificity of all imaging modalities for patients with abdominal pain.<sup>7,8</sup> In particular, in case of discriminating urgent from non-urgent conditions, the sensitivity for CT is 89% and the specificity is 77%.<sup>7</sup>

However, CT has major downsides such as the risk of contrast-induced nephropathy and exposure to ionizing radiation (a great concern in children and pregnant patients).<sup>9</sup>

Moreover, CT is expensive and may not be available at certain times and locations, which leads to delay in diagnosis and may compromise management and outcome.<sup>7,8</sup>

On the other hand, ultrasound (US) is a rapid and safe modality, which is widely available, and does not involve radiation exposure and contrast media administration.<sup>7,8</sup>

When compared with computed tomography, the sensitivity and specificity of ultrasound are lower. However, US has clearly demonstrated it is effective in identifying an accurate diagnosis in 53–83% of patients when coupled with good clinical assessment.<sup>7,10</sup>

Additionally, performing US study and/or CT scan in the radiology department could be time-consuming and/or not always possible, especially in patients with hemodynamic instability and cannot leave the ED.<sup>11-13</sup>

In the last few years, a new generation of portable, battery-powered, inexpensive, hand-carried ultrasound devices has become available; these devices can provide immediate diagnostic information not assessable by physical examination alone and may be useful in diagnosis of some fatal pathologies especially in overcrowded shifts.<sup>11,13</sup>

The aim of the present study was to demonstrate the diagnostic usefulness of Vscan (Vscan™, c, USA) in non-traumatic patients complaining from acute abdominal pain in our ED by comparing results of Vscan exams have been compared with standard radiological methods such as US, CT and plain films.

## MATERIAL AND METHODS

### Study design

We conducted this prospective observational study in a 400-bed tertiary care university hospital located in a large metropolitan city in Italy with fifty thousand ED visits per year. The study was conformed to the Helsinki declaration and approved by the local ethical committee.

Written informed consent for the study was obtained from each patient.

### Study population

Patients with acute non-traumatic abdominal pain, age >18 years old and able to give a written informed consent were considered eligible for the present study (Figure 1).

We excluded patients unable to give written consent, with hemodynamic instability or any other indication for immediate care or surgery, or if they had a previously diagnosed abdominal pathology.

Patients were triaged according to the presenting symptoms.

The medical history, the physical examination and the vital parameters were recorded in the

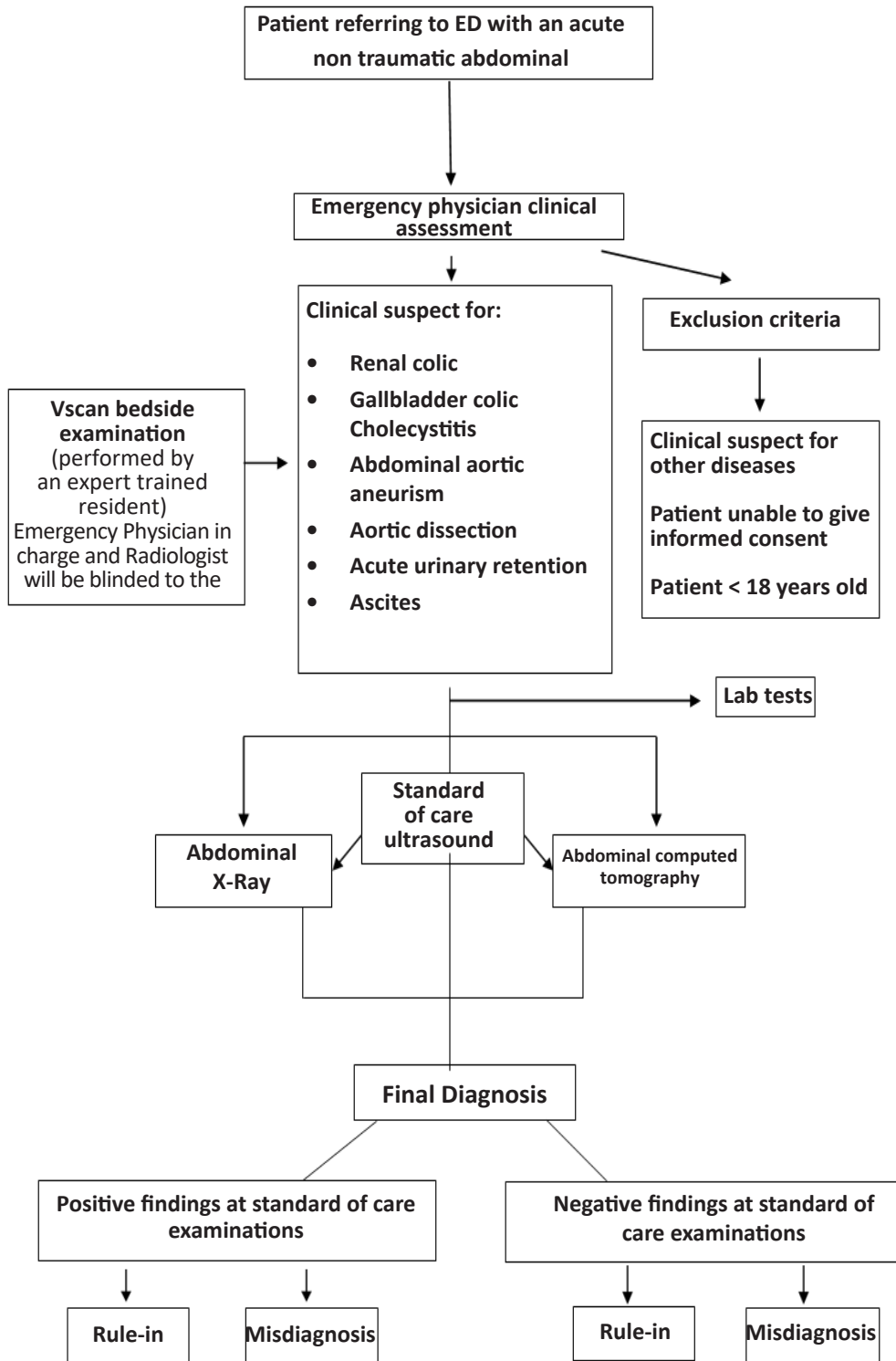


Figure 1 Study design.

computerized system. Laboratory tests and diagnostic imaging (X-rays, computed tomography, traditional ultrasound) were performed in a normal goal-directed manner.

A Vscan was performed at the bedside, in the emergency department by ED residents who had completed basic training in ultrasound. This training included two weeks of didactic and hands-on experience under the supervision of experienced faculty certified in ED ultrasonography. The trainees had to successfully perform and complete no less than 50 cases that required them to view image torso, abdomen and pelvis and view kidneys, bladder, liver, gallbladder, spleen and abdominal aorta. Immediately after the bedside US, patients underwent standard imaging provided by a specialist radiologist blinded to the Vscan results.

Different diagnosis was made on the basis of clinical findings as well as diagnostic and laboratory studies. The actual patient management and disposition were never based on the bedside US results alone.

Patients' diagnoses were encoded in four codes:

- Code 1: for kidney diseases (renal colic, acute urinary retention)
- Code 2: for gallbladder diseases (biliary colic, cholecystitis)
- Code 3: for abdominal aorta diseases and ascites (abdominal aortic aneurysm, aortic dissection, ascites)
- Code 4: for other abdominal diseases.

### Data collection

Clinical data, demographic characteristics, comorbidity, length of stay, presenting symptoms and discharge diagnosis, time in the ED, time to perform each diagnostic test, laboratory tests, and time of admission to the hospital were recorded for each patient.

The duration for any "Standard imaging study" was considered as the period, in minutes, between the time of the computerized entry for the study request by the emergency physician (EP) in the centralized electronic health care system and the radiologist's official written reading for that study.

Vscan acquisition time was also measured. It was considered as the period, in minutes, between the time the probe was placed till the moment the exam was completed.

### Pocket-sized ultrasound device

Vscan (Vscan™, GE Healthcare, USA) is a new generation pocket-sized ultrasound instrument, miniaturized (unit size: 135x73x28 mm; transducer size: 120 x 33 x 26 mm; weight: 390 g; display resolution: 240 x 320 pixels), battery-operated (total scan time: one hour) with a broad bandwidth (1.7 to 3.8 MHz). Its dimensions fit into a pocket. The device has a unique sectorial probe. The device provides black and white mode to display the anatomy in real-time, uses a color-coded overlay for real-time blood flow imaging and is capable of switching from cardiologic to abdominal settings. Vscan can store digital still-frames or image loops in a memory card downloaded on computerized system, allowing distance measurements using integrated electronic calipers.

### Statistical analysis

Data points are expressed as mean  $\pm$  SD. Chi square exact test was used for the comparison of non-continuous variables expressed as proportions.  $P < 0.05$  indicates statistical significance. All  $p$  values are 2-sided.

The diagnostic performance of bedside abdominal US and of abdominal CT and standard US was assessed by calculating sensitivity, specificity, positive predictive value, negative predictive value and likelihood ratios.

The  $k$  statistic was calculated to assess inter-observer agreement of abdominal bedside US and abdominal CT and abdominal standard US.

For the statistical analyses, SPSS software (version 17.0, SPSS Inc., Chicago, IL, USA) was used.

## RESULTS

We included 230 patients (M/F= 50/50%; 51.81  $\pm$  17.82 years) with acute non-traumatic abdominal pain in the study. Patients' characteristics are shown in Table 1.



**Table 1** Patients' characteristics.

Gender (M/F)	115/115
Age (years)(mean ± SD)	51.81 ± 17.82
ED LOS (hours)(mean ± SD)	15.58 ± 18.21

M: male; F: female; SD: standard deviation; LOS: length of stay

In 76.9% of patients bedside abdominal US showed significant pathological findings, of those 55.6% had hydronephrosis and/or ureteronephrosis, 14.7% gallbladder-biliary tract diseases, 3.9% free fluid in abdomen, 3.04% abdominal aorta aneurism, 1.7% acute urinary retention (Table 3).

**Table 2** Comparison between Vscan and traditional imaging.

Vscan visualization (poor/good)(%)	7.4/92.6
Traditional imaging visualization (poor/good)(%)	3%/97%
Traditional imaging acquisition time (minutes) (mean ± SD)	94.8 ± 73.8
Vscan acquisition time (minutes) (mean ± SD)	4 ± 1

SD: standard deviation

In our population, pathological findings were recorded in standard imaging as follows: 76.09% with traditional ultrasound, 28.26% computed tomography, and 5.91% X-ray.

The global agreement between routine standard imaging and bedside ultrasound was higher for computed tomography (K=0.55) than for traditional ultrasound (K=0.44) (Figure 2); no concordance was found between abdominal X-ray and Vscan.

Patients were triaged as red code (1.74%), yellow code (51.30%), green code (46.96%). Traditional imaging report acquisition time was 94.8 ± 73.8 minutes while Vscan execution time was 4 ± 1 minutes (Table 2). ED final diagnosis is shown in Figure 3 and final patient's disposition is shown in Figure 4.

Vscan ROC curve analysis showed high diagnostic value for diagnosis codes 4 (all other causes) and 1 (kidney disease) in comparison to conventional radiology (Table 4).

In particular, for diagnosis code 4 (all other causes), results showed a sensitivity (CI95%) of 89.47% (66.86-98.70) and a specificity (CI95%) of 80.00% (28.36-99.49) with an AUC=0.85 for abdominal CT in comparison with Vscan; abdominal US had sensitivity (CI95%) of 91.30% (71.96-98.93) and a specificity (CI95%) of 72.22% (46.52-90.31) with an AUC=0.82.

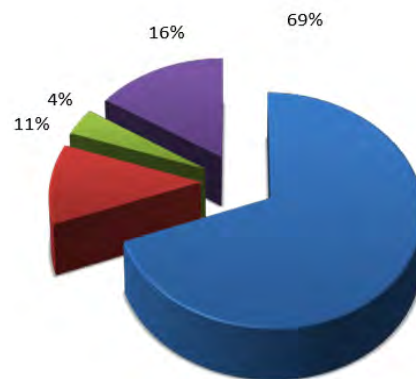
**Table 3** Vscan findings

Hydroureteronephrosis	55.6%
Gallbladder-biliary Tract Disease	14.7%
Free Fluid In Abdomen	3.9%
Abdominal Aorta Aneurism	3.04%
Acute Urinary Retention	1.07%

In code 1 patients (kidney diagnosis), abdominal CT showed a sensitivity (CI95%) of 91.18% (76.32-98.14) and a specificity (CI95%) of 50.00% (1.26-98.74) with an AUC=0.71; abdominal US showed a sensitivity (CI95%) of 86.11% (78.13-92.01) and a specificity (CI95%) of 45.83% (25.55-67.18) with an AUC=0.66.

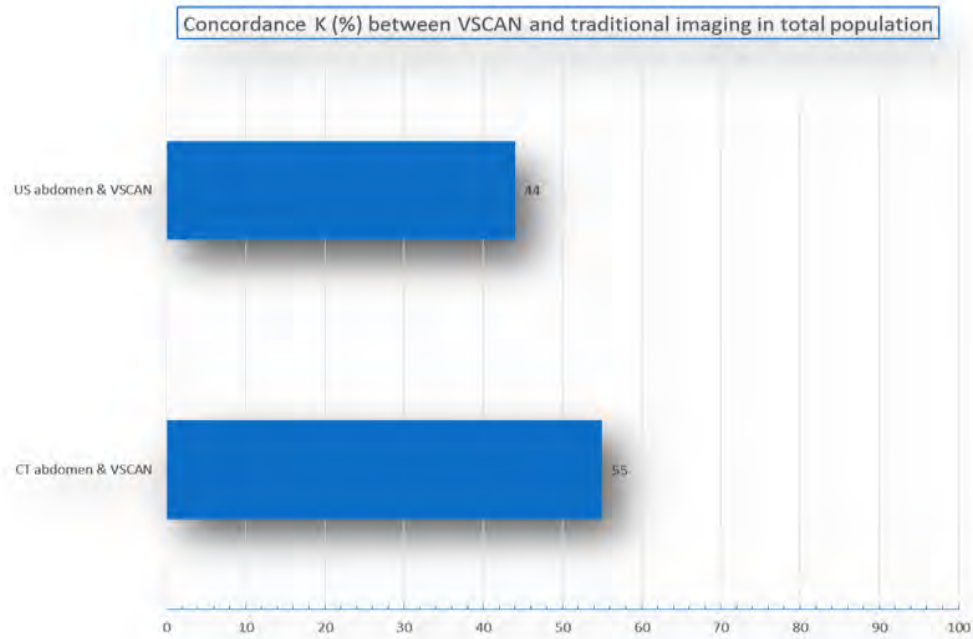
A subgroup analysis was performed dividing patients as follows: hepatic/gallbladder diseases (including diagnosis code 2 + 4), urinary disease (diagnosis code 1) and abdominal aorta disease (diagnosis code 3).

The higher concordance between bedside US and traditional imaging (K=0.64) was found in the first subgroup (diagnosis code 2 + 4).



**Figure 3** Final diagnosis. (Blue: kidney disease; red: gallbladder disease; green: abdominal aorta disease/free fluid in abdomen).





**Figure 2** Concordance between Vscan and traditional imaging.

**Table 4** Comparison between Vscan and traditional imaging.

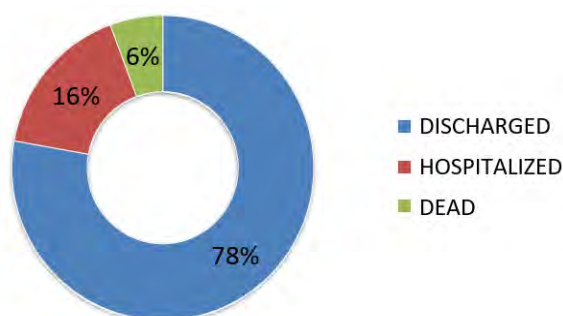
Vscan	Sensitivity	Specificity	NPV	PPV	+LR	-LR	AUC
Diagnosis 1 (standard abdominal CT)	89.47% (66.86-98.70)	80.00% (28.36-99.49)	66.67% (22.28-95.67)	94.44% (72.71-99.86)	4.47 (0.77-26.00)	0.13 (0.03-0.52)	0.85
Diagnosis 1 (standard abdominal US)	91.30% (71.96-98.93)	72.22% (46.52-90.31)	86.67% (59.54-98.34)	80.77% (60.65-93.45)	3.29 (1.54-7.00)	0.12 (0.03-0.47)	0.82
Diagnosis 4 (standard CT)	91.18% (76.32-98.14)	50.00% (1.26-98.74)	25.00% (0.63-80.59)	96.87% (83.78-99.92)	1.82 (0.45-7.32)	0.18 (0.03-1.02)	0.71
Diagnosis 4 (standard US)	86.11% (78.13-92.01)	45.83% (25.55-67.18)	42.31% (23.35-63.08)	87.74% (79.94-93.31)	1.59 (1.09-2.31)	0.30 (0.16-0.57)	0.66

Diagnosis codes: code 1: kidney disease; code 2: gallbladder disease; code 3: abdominal aorta disease and ascites; code 4: others abdominal diseases. All parameters are present at 95% confidence interval; NPV: negative predictive value; PPV: positive predictive value; +LR: positive likelihood ratio; -LR: negative likelihood ratio; AUC: area under the curve.

In the urinary disease subgroup (code 1), concordance between traditional US and Vscan ( $K=0.31$  was better than abdominal CT and Vscan ( $K=0.28$ ).

No concordance was found in the vascular disease subgroup.

Furthermore, a high statistically significant correlation between bedside ultrasound and both computed tomography ( $r=0.65$ ;  $p=0.0006$ ) and traditional ultrasound ( $r=0.65$ ;  $p=0.0001$ ) were shown in the first subgroup.



**Figure 4** Final disposition from the emergency department.

## DISCUSSION

Acute abdominal pain is a common presenting symptom in ED visits for conditions ranging from benign to life threatening.<sup>1-6</sup> Accurate early diagnosis and treatment are essential to optimize patient outcomes and prevent adverse events.<sup>4</sup> In 70% of patients, an urgent diagnosis was correctly identified based on clinical assessment and US.<sup>14</sup>

The utility and accuracy of bedside US have been established with several studies and it has been incorporated into the training of EPs, however it has not yet included in the international guideline on acute abdominal pain.<sup>11-16</sup> The present study demonstrated that bedside abdominal US with Vscan had a good diagnostic performance compared to standard CT and US for patients with abdominal non-traumatic pain due to kidney diseases and other causes of abdominal pain except to vascular and gallbladder related diseases.<sup>14-19</sup>

This result was totally unexpected at the beginning of our study. The findings are different than those

reported in other prior studies that showed excellent diagnostic performance for emergency bedside US to detect the presence of the aortic and gallbladder related diseases in symptomatic patients;<sup>11-13,15</sup> this could be related to the small sample, to the level of training and experience of the EP performing the Vscan and/or to the small number of positive findings among the examinations performed.

Moreover, we found a high concordance and correlation between Vscan and traditional imaging in a larger subgroup including hepatogastrointestinal-pancreatic diseases and gallbladder diseases (code 2 + 4). This result must be taken in consideration with standard imaging evaluation patients with abdominal non-traumatic pain.

Furthermore, we demonstrated how bedside US with Vscan could be very quickly used in an acute emergency scenario giving important information that could not be depicted with the clinical assessment alone. In our series bedside US can be performed in  $4 \pm 1$  minutes contemporary with clinical care and complementary to the physical examination. This could lead to significant timesaving for the assessment of an adequate management of patients arriving in ED with acute non-traumatic abdominal pain. In fact, our results demonstrated how an overcrowded ED can lead to a delay in the acquisition time of standard imaging reports, that in our experience was  $94.8 \pm 73.8$  minutes with a subsequent delay in patient disposition (in our study we recorded an ED length of stay of  $15.58 \pm 18.21$  hours).

In our opinion, bedside US with Vscan should be used as part of the initial evaluation of all patients presenting to ED with acute non-traumatic abdominal pain, and that its complementation with clinical assessment will provide improved diagnostic value.

The use of US with Vscan as a complement to routine clinical assessment may avoid misdiagnoses, improve patient satisfaction, and may also reduce costs associated with return visits, additional unnecessary exams or potential adverse events caused by a delayed diagnosis.

Last but not least, bedside ultrasonography may

be particularly valuable in rural and underserved regions where healthcare providers have no access or limited access to CT scans, radiologists or formal ultrasonography. This is of special relevance to developing nations where such access is invariably absent or compromised.

## LIMITATIONS

This study has some limitations. First, the analysed sample is small. Second, the majority of patients had kidney disease (69% of our sample) with a consequent underrepresentation of other relevant abdominal diseases such as gallbladder and abdominal aorta diseases that could represent an important spectrum bias in this study.

Finally, this was an observational study; therefore, EPs did not have the possibility to use the results of the Vscan examination to change their decision-making process. This prevented investigators from quantifying the effective timesaving and cost reduction in such a patient population.

## CONCLUSION

Emergency bedside US with Vscan in patients with non-traumatic abdominal pain had demonstrated good diagnostic performance, when compared to traditional radiology imaging.

Bedside US can be performed and interpreted by EPs and it could represent an important tool to reduce time in clinical decision-making, improve patient outcome and reduce time and costs to patients when compared with traditional radiological exams.<sup>20,21</sup>

*Conflict of Interest:* The author declared receiving a fund from General Electrics to conduct this study.

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Department: Emergency Medicine  
Application Deadline: December 1, 2019

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*Job Posting*

# Psoriasis and Heart Failure: Literature Review and a Case Challenge

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## Abstract

Psoriasis is a disease characterized by chronic inflammation with a global prevalence of 1-2%. It has a strong genetic component with a systemic immunological response mainly driven by T helper (Th) 1 and 17 lymphocytes. The relationship between HF and psoriasis is not well-described. In this paper we describe 2 cases of concomitant psoriasis and heart failure. Furthermore, we revisit the pathogenesis of those entities and discuss the available evidence on their association, and the proper evaluation of psoriasis in the management of heart failure in patients present with both diseases.

**Keywords:** cardiovascular disease, heart failure, immunology, inflammation, pathogenesis, psoriasis

## INTRODUCTION

Around 26 million adults worldwide are living with heart failure (HF) that is thus described as a “global pandemic”.<sup>1</sup> In Indonesia, the prevalence of HF is 0.13%.<sup>2</sup> Psoriasis is a disease characterized by chronic inflammation with a global prevalence of 1-2%. It has strong genetic component with a systemic immunological response mainly driven by T helper (Th) 1 and 17 lymphocytes.<sup>2,3</sup> The relationship between HF and psoriasis is not well-described.

By presenting two cases of psoriatic HF patients with re-hospitalizations, this manuscript aims at highlighting the potential role of psoriatic inflammation in worsening HF.

## CASE PRESENTATION

### First Case

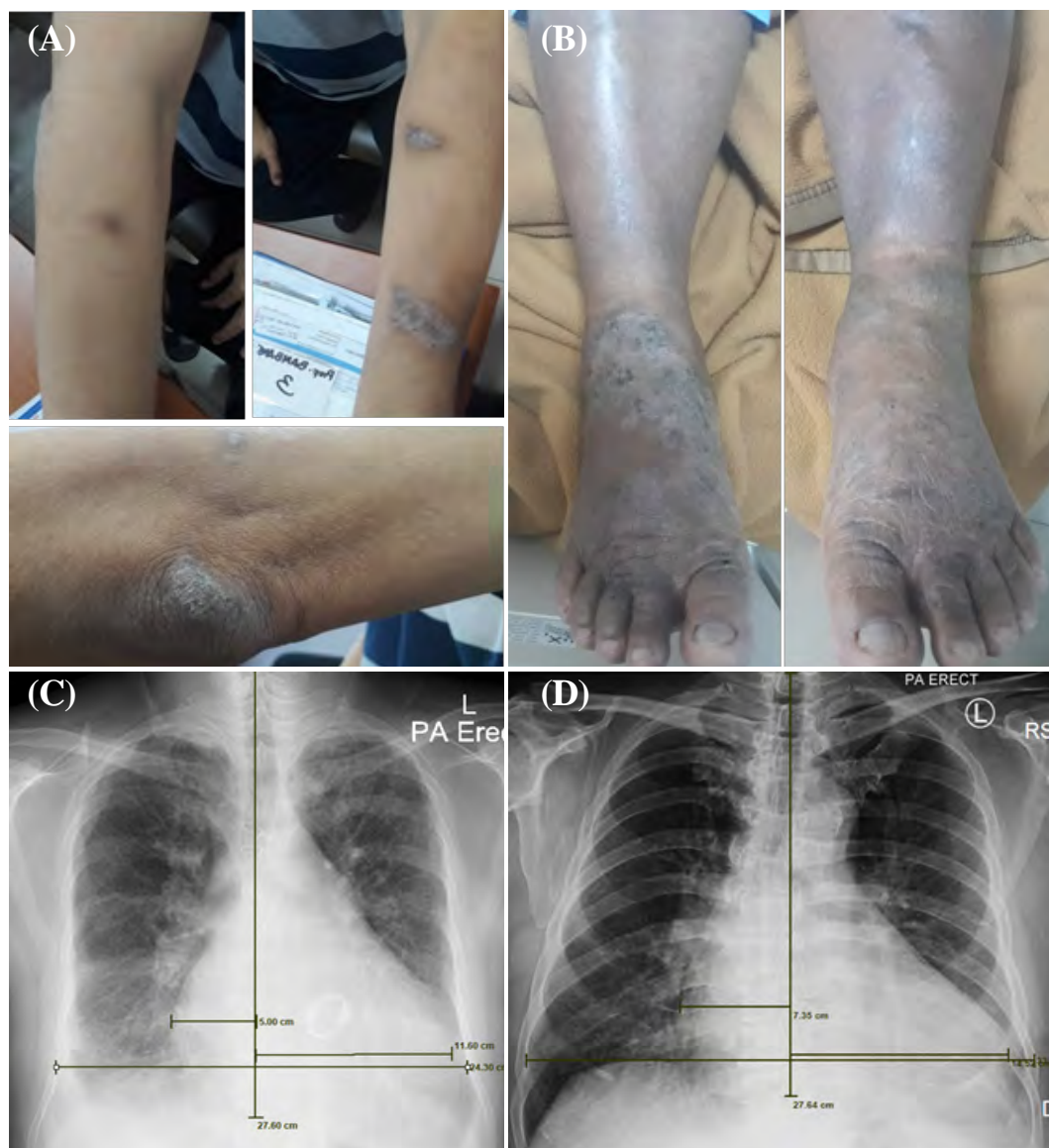
This is a case of a 61-year-old man, who regularly visits the outpatient clinic in the National Cardiac Center Harapan Kita (NCCHK) every two

months. During his last visit, he only admitted having slight limitation of physical activity without any paroxysmal nocturnal dyspnea (PND) or orthopnea. He had a history of valvular disease but did not complain of any HF symptoms until the age of 51. He then had mitral valve replacement due to mitral regurgitation in Penang. The patient also had a history of psoriasis diagnosed at the age of 49 but was not on any psoriasis treatment. There was no history of psoriasis exacerbation. The patient also denies any history of hypertension, diabetes mellitus, smoking, obesity, alcohol abuse, and drug use. Family history was negative for cardiovascular disease or cardiomyopathy. He reported four prior hospitalization in NCCHK due to decompensated HF. The first one was two months after surgery. The second one was in 2012, the third in 2014, and the last in 2016. On physical examination, the patient had normal vitals. There was no signs of left or right HF. Skin lesions consisting of scales and plaques over the extremities were noted. His joints were normal. Routine laboratory tests revealed normal renal function and normal electrolytes. Chest radiography (2016) showed an enlarged heart and bilateral pulmonary congestion. Electrocardiogram showed sinus rhythm, right bundle branch block (RBBB), and multiple PVCs. Echocardiography showed general severe hypokinesis, dilatation of

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**Figure 1** (A) skin lesions in the first patient: scales and plaques over the extremities; (B) skin lesions in the second patient: plaques over the feet; (C) chest radiograph of the first patient: enlarged heart and bilateral pulmonary congestion; (D) chest radiograph of the second patient: enlarged heart and mild congestion.

left atrium (LA) and left ventricle (LV), severely reduced global systolic function and regional wall abnormality, mild pulmonary regurgitation (PR), mild tricuspid regurgitation (TR), and a well functioning mechanical valve with trivial central leakage. Coronangiography in 2011 demonstrated normal coronary arteries.

### Second Case

This is a case of a 58-year-old man who was admitted with a 1-month history of dyspnea. One

month prior to admission, he began suffering from shortness of breath on effort, orthopnea, and paroxysmal nocturnal dyspnea. His legs and abdomen started to swell 3 days before admission. The patient had a history of HF diagnosed in 2012. He was hospitalized in NCCHK back then. After discharge, he did not seek any medical therapy. His risk factors included hypertension, smoking, and obesity. He denied any family history of cardiovascular disease or cardiomyopathy, drug use or alcohol consumption. He has had psoriatic



skin lesions for 3 months prior to admission, for which no medical treatment was sought. On physical examination, the patient had normal vitals. However, he did have signs of congestive HF. He also has scaly skin lesions and plaques on both of his feet. Routine laboratory tests revealed normal white blood count and normal renal function. Chest radiography showed an enlarged heart and bilateral congestion. Electrocardiogram showed atrial fibrillation. Echocardiography showed generalized severe hypokinesia, dilatation of LA and LV, severely reduced global systolic function, severe mitral regurgitation, and severe TR. Coroangiography in 2012 demonstrated a normal left main artery, an irregular left axis deviation, an irregular left circumflex artery, and a normal right coronary artery (i.e., an insignificant stenosis).

## DISCUSSION

Across the globe, 17-45% of patients admitted to hospital with heart failure (HF) die within 1 year of admission and the majority die within 5 years. This “global pandemic” affects 26 million adults. In many countries, population-based studies have found that 1-2% of people have HF, and similar or higher proportions have been reported in single-center studies.<sup>1</sup> Prevalence is variable across nations, ranging between 1.5-1.9% in North America, 1-2% in Europe, 1-3% in Australia, and as low as 0.13% in Indonesia. Interestingly, reported prevalence of HF in Malaysia and Singapore exceeds global prevalence.<sup>1,4</sup>

Psoriasis is a disease of chronic inflammation, with a global prevalence of 1-2%, affecting not only the skin but also many other systems.<sup>3</sup> The prevalence of psoriasis in Indonesia has not been calculated yet.<sup>5</sup> The levels of interleukin 17A (IL-17A) and TNF- $\alpha$ , both responsible for inflammation in psoriasis, are also increased in HF. This mechanism is assumed to link both diseases.

## Psoriasis

Psoriasis is a common chronic inflammatory disease with a strong genetic component characterized by a systemic immunological response, which is mainly driven by T helper (Th) 1 and 17 lymphocytes.<sup>6,7</sup> Like other chronic

inflammatory disorders, including rheumatoid arthritis, inflammatory bowel disease, and systemic lupus erythematosus, psoriasis shares inflammatory mechanisms with atherosclerosis and confers an independent risk for various cardiovascular diseases as myocardial infarction.<sup>8</sup> According to current guidelines, patients with rheumatoid arthritis and other forms of inflammatory arthritis, including psoriatic arthritis, should undergo annual evaluation of cardiovascular risk factors. There is also evidence suggesting that such a recommendation should be extended to patients with psoriasis.<sup>9</sup>

## Pathogenesis of Psoriasis and Systemic Inflammation<sup>10</sup>

Chronic inflammation of the skin and joints have many common immunopathological features, including genetic predisposition, composition of inflammatory infiltrates, vascular changes, early immune events and proangiogenic similarities. The cellular infiltrate is predominantly perivascular. B lymphocytes are abundant but the contribution of B cells to the pathogenesis is unlikely. T lymphocytes are the most abundant in both skin and joints, with the dominant types being cytotoxic T lymphocyte CTL, T helper 1 (Th1) and T helper 17 (Th17). Neuropeptides (NP) are also involved in proinflammatory pathways. Antigen is presented to naive CD4 in lymph nodes. Emerging lymphocytes migrate preferentially to skin and joints, where the above-mentioned infiltrating T lymphocytes (CD4, CD8) interact with local Antigen Presenting Cell (APC), such as Langerhans cells, myeloid-DC and plasmacytoid-DC, to produce chronic inflammatory conditions. Local re-activated T cells secrete chemokines and cytokines that amplify the inflammatory environment, resulting in the formation of psoriatic plaque, induction of degradation of cartilage and perhaps atherosclerotic plaque. Since the suppressive activity of regulatory cells is decreased in both tissue and blood, lymphocytes show high replicative power. The chronic production of proinflammatory cytokines [interferon gamma (IFN- $\gamma$ ) and tumor necrosis factor (TNF- $\alpha$ )] crucially contributes to the perpetuation of the disease. TNF- $\alpha$  is critically involved in induction of inflammatory degradation

of cartilage and bone. The osteolytic activity is the result of the activation of osteoclasts by the action of IFN- $\gamma$ .

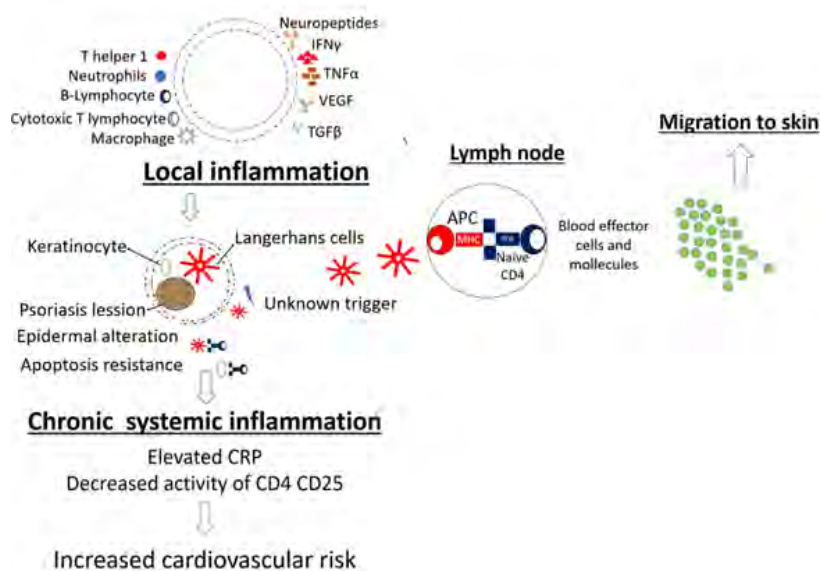
### Diagnosis of Psoriasis<sup>11</sup>

The diagnosis of psoriasis is primarily clinical. There are different clinical types of psoriasis, the most common being chronic plaque psoriasis, affecting 80% to 90% of patients with psoriasis. The hallmark of classic plaque psoriasis is well-demarcated, symmetric, and erythematous plaques with overlying silvery scales. Plaques are typically located on the scalp, trunk, buttocks, and extremities but can occur anywhere on the body. Patients might demonstrate nail involvement, which can present without concomitant plaques. Active lesions might be itchy or painful. Psoriasis can also present as an isomorphic response, where new lesions develop

on previously normal skin that has sustained trauma or injury. The severity of disease can be helpful in guiding management and is classified as mild, moderate, and severe. Less common variants of psoriasis include inverse psoriasis, pustular psoriasis, guttate psoriasis, erythrodermic psoriasis, and annular psoriasis. These variants can be differentiated from the common plaque type by morphology. Differential diagnoses include atopic dermatitis, contact dermatitis, lichen planus, secondary syphilis, mycosis fungoides, tinea corporis, and pityriasis rosea. Careful observation often yields the diagnosis. For more atypical presentations, a skin biopsy might be helpful.

### Heart Failure<sup>12</sup>

Activation of the adrenergic nervous system is an important regulator of cardiac performance during



**Figure 2** Immunopathogenesis of psoriasis and psoriatic arthritis associated events that worsen the cardiovascular risk profile.

exertion; it increases myocardial contractility and redistributes cardiac output. In acute HF, enhanced contractility resulting from adrenergic activation stimulates the depressed contractility of the failing heart and, by causing vasoconstriction, raises the blood pressure and aids in the perfusion of vital organs. However, prolonged activation of the adrenergic nervous system and of the

reninangiotensin-aldosterone system causes maladaptive remodeling of the ventricles and further myocardial injury, thereby initiating a vicious cycle in what has become known as the neurohumoral model of HF. In HF, there is elevation of C-reactive protein (CRP). The concentration of a number of pro-inflammatory cytokines, such as TNF- $\alpha$  and IL-6, have also been shown to increase in HF. In

elderly subjects without HF, abnormal elevation in three inflammatory markers (CRP, tumor necrosis factor alpha, and IL-6) was reported to be associated with a 4-fold increase in the risk of HF. The level of these biomarkers was correlated with the severity of HF; they appeared to be important predictors of the outcome.

### Inflammation in HF and Psoriasis

The association of cardiomyopathy and psoriasis requires an insight into the possible pathogenetic links of these two diseases. The pathogenesis of psoriasis is characterized by an increased antigen presentation process, increased T lymphocyte activity, and upregulation of type 1 helper T cytokines.<sup>12,13</sup> The etiology of psoriasis is unknown and is thought to be a combination of genetic, immune and environmental factors. One third of psoriatic patients has a first-degree relative with psoriasis, and the incidence in monozygotic twins is estimated to be 70% compared to dizygotic twins, where it is 25%. A number of genes related to psoriasis have been identified, but their role and function is not clear.<sup>13,14</sup>

HF is a systemic disease that has many etiologies including genetic factors and immune factors. Immune activation leads to production and release of pro-inflammatory cytokines, activation of the complement system, and production of autoantibodies. Gene expression of chemokines is upregulated in T cells of patients with HF. This activates the immune system through binding to the tumor necrosis factor superfamily and their receptors. The inflammatory cytokines IFN- $\gamma$  and IL-18 have a similar pattern in ischemic and idiopathic cardiomyopathy.<sup>13</sup> T helper 1 and T helper 2 cytokine imbalance has also been identified to play a role in HF pathogenesis.<sup>12</sup>

IL-17A is a pro-inflammatory cytokine produced mainly by Th17 lymphocytes, but also by natural killer T cells, gd T cells, cytotoxic CD8<sup>+</sup> T cells, and neutrophils.<sup>13</sup> Multiple lines of evidence from animal and human studies suggest crucial roles of IL-17A and its receptor interleukin-17 receptor A (IL-17RA) in ischemic heart disease.<sup>13</sup> Similarly, animal studies have provided evidence that IL-17A

plays an important role in dilated cardiomyopathy (DCM). Previous studies have identified Th17/Treg imbalance with upregulation of IL-17A that plays an important role in HF pathogenesis.<sup>15</sup> Recent studies have identified single nucleotide polymorphisms (SNPs) in IL-17A/IL-17RA axis that contribute to both psoriasis and HF. A recent study demonstrated associations of rs8193037 in the promoter of IL17A with the risk of congestive HF, and of rs4819554 in the promoter of IL17RA with the risk of cardiovascular mortality in patients with congestive HF.<sup>15</sup>

Circulating levels of proinflammatory cytokines such as TNF- $\alpha$ , soluble TNF receptors (sTNF-R1 and sTNF-R2), IL-6 and sCD14 have been shown to be independent predictors of mortality in patients with advanced HF.<sup>13</sup> Several published studies have investigated the association between the -308G/A (rs1800629) polymorphism in the tumor necrosis factor- $\alpha$  (TNF- $\alpha$ ) gene and the risk of dilated cardiomyopathy (DCM). However, the TNF- $\alpha$  gene polymorphism has a controversial role in the pathogenesis of DCM among different populations. There may be a moderate association between TNF- $\alpha$  rs1800629 polymorphism and DCM susceptibility in populations studied; however, TNF- $\alpha$  rs1800629 polymorphism was significantly associated with the susceptibility of DCM for Asians, which indicates that such associations may be different between ethnicities.<sup>15</sup>

### Association Between Clinical Manifestation of HF and Severity of Psoriasis<sup>9</sup>

A few observational studies have previously demonstrated an increased risk of HF in patients with psoriasis while others have found no such association.<sup>10</sup> These conflicting results may be explained, in part, by methodological issues (e.g. differences in population size and adjustments for important covariates). Moreover, previous studies are mainly based on selected populations and so the impact of the severity of psoriasis on the risk of HF has not been fully investigated. However, one study, which is by far the largest to date, add to the evidence provided in the earlier studies demonstrating an association between psoriasis and HF with an increased risk of new-

**Table 1** Case reports of psoriasis patients with heart failure.

<i>Anupam Prakash</i> <sup>14</sup>	25-year-old man with generalized erythematous lesions for 4 months	Psoriasis, DCM, Anasarca
<i>Matt Chua</i> <sup>16</sup>	38-year-old male with psoriasis and alcohol abuse	Psoriasis, septic shock/cardiogenic shock, high output HF
<i>Pietrzak A</i> <sup>17</sup>	80-year-old male with DM, HTN, and ischemic heart disease	Psoriasis, ADHF, inflammation-related cardiomyopathy, conduction abnormality, hypertension, ischaemic heart disease

onset HF with increased severity of psoriasis. The association remains strong even after adjustments for comorbidities, cardiovascular medications and socioeconomic status. These results support the proposition of independent effects of psoriasis on the risk of HF mediated through inflammatory mechanisms. It is thus possible that even asymptomatic patients with psoriasis are at high risk of HF with/without structural heart disease. In the study, the overall incidence rates of new-onset HF were 2.82, 4.22 and 4.70 per 1000 person-years for the reference population, mild psoriasis, and severe psoriasis, respectively. This concludes that severity of psoriasis led to increased risk of new-onset HF. Several case reports about HF in psoriasis patients have been published. They are listed in Table 1.

Despite being diagnosed with heart disease earlier, the first patient only complained of dyspnea at the age of 51 and had mitral valve replacement shortly. Two years before symptom exacerbation, he had psoriasis on his legs, arms, and elbow. He was also hospitalized in 2012, 2014 and 2016 due to HF exacerbation. By that time, the psoriasis was still uncontrolled.

The second patient was hospitalized due to HF 6 years ago in NCCHK. He did not seek medical treatment afterwards. He was also obese and had hypertension and dyslipidemia. One month prior to admission, he experienced dyspnea and is now treated for full-blown HF. Also, three months before admission, he experienced psoriasis for the first time and was not treated.

In both patients, untreated psoriasis led to HF exacerbation. Chronic systemic inflammation in psoriasis, if left untreated, will amplify the

inflammatory state in HF patients thus leading to the exacerbation of the HF symptoms.

Patients with psoriasis carry an excessive risk of atrial fibrillation (AF). The differences between the maximum (Pmax) and the minimum (Pmin) P-wave duration on ECG are defined as P-wave dispersion (PWD). Prolongation of PWD is an independent risk factor for the development of AF. Atrial conduction of sinus impulses was shown to be impaired in patients with psoriasis vulgaris. It was more prominent in patients with severe disease, high disease activity score and hsCRP. Physicians caring for patients with psoriasis vulgaris should screen them for AF development.<sup>11,18</sup> In the first patient, there is not any abnormality of PWD on ECG. However, the second patient had atrial fibrillation but due to unavailability of precious electrocardiography, his PWD during sinus rhythm could not be evaluated.

## CONCLUSION

Psoriasis is a risk factor for the deterioration of HF due to uncontrolled inflammation factors. It is important to evaluate the disease activity of psoriasis to control the HF.

*Conflicts of Interest:* The authors declare no conflicts of interest or sources of funding.

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# Establishing Emergency Medicine in Iran: a Post-implementation Perspective

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## INTRODUCTION

In the 1990s, a comprehensive evaluation of national emergency care (EC) system was performed by the Iranian Ministry of Health and Medical Education (I-MOHME) to identify gaps in timely and proper EC delivery. It was then concluded that a refurbished patient-centered specialty, namely emergency medicine (EM), could reduce or close these gaps.

At its implementation planning phase, there were two major and entirely different models of Emergency Medicine (EM) namely the Anglo-American and the European referred to in the literature as “Franco-German” (Arnold Paper). I-MOHME took it upon itself to implement the Anglo-American version of EC as seeing it was a better fit with the well-developed national pre-hospital Emergency Medicine Service (EMS), already in existence since 1978. The Anglo-American model was also more compatible with the educational curricula of Iranian medical students and residency trainees. In 1999, a collaboration between Iranian and American medical universities was established.<sup>1</sup> Professor James Holliman and Jeffrey Smith played an important role in the implementation of EM in Iran. In 2000, I-MOHME sent six Iranian faculty members from different specialties to George Washington University as part of a short-term faculty exchange program with the aim of learning the steps on how to start a national

EM residency training program.

It is evident that designing a new specialty program with an overlapping curriculum requires a rigid transformational change across different residency programs. More so, it would need the strong support of I-MOHME who facilitated the process.

The first EM residency training program appeared in 2001 at the “Iran University of Medical Sciences”. In 2018, the number of medical universities with approved EM residency training program reached 25.<sup>2</sup>

Iranian physicians undergraduate medical education lasts seven years: 2 years pre-medical course in basic sciences, 1 year of pathophysiology of diseases, 2.5 years of externship and 1.5 years of supervised internship period. Afterwards, these graduating Medical Doctors (MD) are essentially General Practitioners (GPs) who are required to perform 2 years of community service in low resource provinces or rural areas around the country. Towards the end of this service, graduates participate in a national residency written entrance examination; if they achieve adequate scores, they can apply for residency programs, such as EM. The EM residency curricular matters are devised uniformly across universities by I-MOHME. The residency program is a 36-month post-graduate training program.

The Iranian Society for Emergency Medicine is a non-profit national EM organization that was established in 2006 and is dedicated to improving the national EC system.

In the first few years post-implementation, the main challenges for EM specialists centered around the lack of recognition of their specialty not only by the population but also by specialists in other fields. After 2002, annual key performance improved the

**Keywords:** emergency medicine, burnout, development, Iran, health

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EC quality within Emergency Departments (EDs) with assigned EM specialists on a full-time basis, 24 hours/7 days a week. Such a realization led I-MOHME to increase the number of EM residents accepted into the national program. This posed a major threat to the quality of education delivered to EM trainees since the decision was not matched by an increase in dedicated and qualified program sites, educators or administrators that can oversee or guarantee the quality and adequacy of the training.

## DISCUSSION

Eighteen years after the initiation of the first EM training program, the recognition of EM as a distinct profession has seen higher levels understanding and tolerance. In fact, the genesis of the practice's development lies in the acknowledgment that emergency medicine entails a characteristic body of knowledge requiring specialized practitioners or physicians.<sup>3</sup> However, new challenges are facing EM physicians today. The greatest challenge is what's referred to as "burn-out." In 2013, a relevant survey was administered on EM residents and physicians by Jalili et al. (Maslach Burnout Inventory) study.<sup>4</sup> This research laid out an average burn-out score for emotional exhaustion, depersonalization and personal accomplishment and the scores came as follows: 22.94, 9.3 and 31.47; respectively. Fifty-six percent of surveyed participants had emotional exhaustion, 66% experienced depersonalization, and 78% endured problems with personal accomplishment. Inadequate and limited access to the necessary medical equipment, improper ED design and interaction with actors in other specialties were frequently reported as causes for burnout. In 2016, Vaziri et al. reported that the mean burnout score amongst Iranian EM residents for emotional exhaustion, depersonalization and personal accomplishment were about 40.25, 22.04, 30.25; respectively.<sup>5</sup>

In 2016, Farahmand et al. performed a qualitative study on EM physicians who had at least 2 years of work experience. The purpose of the study was to explore and assess their take on EM as a career path.<sup>6</sup> The study revealed that insufficient income, poor recognition of the specialty by the population, inadequate organized medicine and/or government

support, working in an insecure, overcrowded and stressful workplace with a lot of night shifts are major challenges confronting Iranian EM physicians. It was also mentioned that faculty members and consultants at medical universities are more optimistic about their careers than EM physicians who work in non-academic settings.

Nowadays, lack of continuous system support and encouragement is another challenge facing EM physicians. Sometimes the latter are confronted with unreasonable ill-prepared directives or protocols that limit their private sector practice or force them to work in poorly paid governmental or public hospitals.

On another note, a national health transformation plan (HTP) has been in place in Iran since 2014 with the aim of improving patient care.<sup>7</sup> The goal was ideally to decrease out-of-pocket (OOP) health expenditures and enhance fairness in financial contributions. In 2015, one year after developing HTP, the analyzed data revealed a reduction for OOP health expenditures about 33% on inpatient health services per person (capita). Simultaneously, household catastrophic health expenditure decreased from 2.9% to 2.1%.<sup>8</sup> Due to this national healthcare transformation plan, EDs faced a surge in the number of patients seeking medical treatment for the less emergent chief complaints. As a result, Iranian EDs became overcrowded. Understaffed EDs coupled with a relatively high ED provider workload and a significant drop in physician income became another major source of frustration.

Pursuing a career in a stressful, overcrowded and poorly paid working environment led to a decrease in the number of practicing EM residents. Today, young Iranian medical physicians prefer to continue their study in a less stressful and alternatively well-paid specialties instead of EM - a new challenge that should be promptly addressed.

## CONCLUSION

Burnout and quality of training issues are facing Iranian emergency medicine physicians and compromising Iranian Emergency Care. Solutions include securing proper EP compensation in the public sector or by authorizing the establishment of

private practice settings (e.g., Urgent Care Clinics.), starting fellowship programs as a motivation for EM physicians to increase the depth of their knowledge and their practice skills and the initiation of well-being programs. Additional solutions include collaboration with international societies, starting physician exchange programs such as visiting physician electives, sabbaticals, jointly organized workshops or research to reinvigorate the interest of talented young medical physicians in EM as a specialty.

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## Together for Emergency Medicine in the United Arab Emirates!

Saleh Fares

Founder and President, Emirates Society of Emergency Medicine

As I began writing this article, I was stunned realizing that September 2019 marks the anniversary of a ten-year journey for the specialty of emergency medicine (EM) in the United Arab Emirates (UAE). I had returned home to the UAE after 17 years' acquiring and refining knowledge and skills as well as building experience and expertise abroad. This included medical school studies in Ireland,<sup>1</sup> an Emergency Medicine (EM) Residency training in Montreal, Quebec<sup>2</sup>, a Prehospital Care fellowship in Toronto, Ontario,<sup>3</sup> a Disaster Medicine fellowship in Boston, Massachusetts<sup>4</sup>, and finally a public health graduate degree in Baltimore, Maryland<sup>5</sup>. Throughout that time spent in nations where EM was well-developed, I was persistently asking myself, "What can I learn from here to allow me to develop EM back home?". This challenging journey was certainly exciting and beneficial and exposed me to so many different "systems", to their strengths and weaknesses, to the different approaches used to address problems, needs and day-to-day operations, and reinforced my belief that there is room and a need for flexibility, variability and diversity in the EM models one could build.

This stimulated me further to try and explore what could be a suitable model for "our" emergency care system in the UAE and the region. My focus was always at the "bigger picture" and how can we put the pieces together. The systems mentioned above were in different stages of development and have gone through similar challenges to what

**Keywords:** emergency medicine, development, United Arab Emirates, health

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we are facing in the region. The complexity of the Emergency Medical Care reminds me of the philharmonic orchestra<sup>6</sup>. Although it combines numerous instruments from different families, it can produce an outstanding piece of art "*only if*" everything is synchronized. This would not have been possible without having the critical elements of success, namely the knowledge, the training and the skills, as well as the practice, its resources and its tools, and, above all, the clear command and control.

Looking at the Emergency Care in the UAE specifically, and the Middle East in general, makes you realize that there have been several genuine regional efforts to develop the specialty over the years, all driven by the needs and pressures of the public.<sup>7-21</sup> Although several initiatives have managed to build parts of the system, it was faced by frustrating disconnections from other crucial components that serve the same purpose. A typical example I frequently encountered at the time, was the emergency physicians' frustration from the suboptimal prehospital care which occurred in some cases, and on the opposite side, I also hear the paramedics' teams complaining of their inability to communicate with the Emergency Departments, pre- or post-care. Another example can be the frustration of the both hospital and prehospital emergency providers from the burden of trauma in their practice; yet there has been limited activity targetinh the development of a cohesive reliable trauma system that can connect and secure all the important elements. The list can go on. We needed to develop a functional reliable system and not only a number of its components. We needed to establish and develop an Emergency Care System with its critical components: the governance, the prehospital care, the hospital care, and the system-wide elements. I intentionally focused my Master of Public Health (MPH) capstone at Johns Hopkins Bloomberg School of Public Health on that same

topic and highlighted the challenges and the opportunities of our system.

Upon my return to the UAE, I was fortunate to be able to discuss the status of the emergency care and the challenges voiced by my colleagues and also the outcome of my MPH with senior officials. Interestingly, they were very positive and eager to support whatever it takes to develop an efficient system. This was obviously driven by numerous factors, including the rapid evolution of the healthcare sector in general and the importance of having an equivalent emergency system to support that. Other factors could be the pressure from the community on the government to provide reasonable care in case of emergencies. At that time, the government was keen to build a robust and resilient system. Therefore, we used that vision to bring some focus on the emergency care projects, and we managed to shed some lights, under the objective of “Disaster Preparedness.” I recall several meetings where we had to convince officials that building “a trauma system” will serve as a strong backbone to their coveted Disaster Preparedness. With this approach, we were able to secure some funding for trauma care training and to establish the first regional Trauma Registry in the UAE, in the Emirate of Abu Dhabi, with over 20,000 cases to date. We also used this as an opportunity to successfully submit and pass our own national form “Good Samaritan Law.” This followed several incidents of unfortunate outcomes due to the lack of bystander first aid assistance, which had widely received the community attention. ESEM used this opportunity and conducted a panel discussion on December 2016; involving the Ministry of Health, the Ministry of Justice, EMS providers and Non-for-Profit organizations; This resulted in official recommendations that we then submitted to the national government.. Although slower than expected, the approval process is steadily moving forward; and ESEM and its partners in this initiative are making every effort to expedite it. Additionally, ESEM collaborated with other national stakeholders to promote and secure the recent establishment of local STEMI and stroke programs. Several other initiatives followed the same approach of using opportunities to seed ideas or start a project, that

can add more pieces to the bigger picture. Today, ESEM has become a well-respected national and regional entity by the UAE government and the GCC; and the collaboration will hopefully continue for years to come.

I cannot describe EM in the UAE without highlighting the great work which has been done by our prehospital care colleagues. The enthusiasm I feel every time is something we should all be proud of. Despite their obstacles and difficulties, they fight vigorously to improve their performance, and there is a comforting cohesiveness among the different providers. After several mass casualty events in the country, we worked with the Ministry of Health (MOH) to establish a taskforce to focus on coordinating emergency medical efforts during disasters. A ministerial decree formed the taskforce in 2016 and appointed three teams to focus on Command and Control, prehospital preparedness and hospital preparedness. The three teams report directly to the Undersecretary of the MOH and have managed to progress in several levels and directions. The prehospital providers played a crucial role in the success of this project and contributed tremendously over the years in many other projects.

A missing cornerstone for the advancement of emergency care was the lack of official professional representation of “Emergency Medicine” as a specialty in the country. Many people underestimate the importance of having a national society to unify the efforts and set the agenda for the future. I was blessed to be surrounded by talented colleagues who shared the same interest and immediately answered the call towards the foundation of our society, the Emirates Society of Emergency Medicine (ESEM). With just 28 emergency physicians and EM residents, ESEM was officially announced on August 28, 2012. This was a landmark step in our journey and reshaped the way we think. We immediately applied for and secured membership as a voting member with the International Federation for Emergency Medicine (IFEM)<sup>22</sup>. Within just two years, the first ESEM board was able to gain some momentum by increasing the memberships to over 300 members, launch a website, social media accounts, conduct several community outreach programs and workshops. The first edition of ESEM



annual scientific conference was in December 2014 with over 600 delegates. The ESEM conference now attracts over 1200 delegates from all over the world and became one of the leading Emergency Medicine (EM) conferences worldwide and the most significant EM in the Middle East and North Africa (MENA) region. For ESEM, the conference was not just a scientific meeting, rather an excellent platform to exchange ideas and showcase our local abilities. We wanted the conference to aim for international standards in term of the content and the way it was conducted. The scientific and the organizing committees work for months every year to put together an evidence-based and up-to-date conference. The tracks and the workshops focused on building fundamentals and essential skills for emergency providers. We involved EM residents and medical students as volunteers and that by itself build an outstanding team, along with the organization and scientific committees, as well as the other committees involved. The exceptional success of the first two conference editions encouraged us to bid for IFEM's leading conference, the International Conference for Emergency Medicine (ICEM). We were honored to win the bid to host ICEM 2021 in Dubai, something sharply boosted our energy to do more and assured us that we are going in the right direction towards developing EM in the UAE. We used the ESEM model to encourage other regional societies to work together, and we made sure that there is a local representation from as many countries as possible at our conferences. Such professional gatherings were indeed very productive and resulted in exciting projects. The main project that came out of the ESEM conference networking was the foundation of the Gulf Federation of Emergency Medicine (GFEM). ESEM proposed the idea during the ESEM 2014 conference, and the federation was launched in 2017.

The federation consists of the 6 Gulf Corporation Countries (GCC), namely the UAE, Bahrain, Saudi Arabia, Oman, Qatar, and Kuwait. To encourage EM in Bahrain, the UAE passed its term as chair of the federation to Bahrain, with Dr. Ghada Alqassim as the first general secretary of GFEM and Dr. Asaad Shuja from Saudi Arabia as her deputy. It was agreed that the appointment of the general secretary and the deputy would follow the

GCC official sequence as stated above, and both should serve for two years term<sup>23</sup>. The deputy is usually from the upcoming country that will lead in the next term, and their own national societies nominate both positions. GFEM was approved as an Ex-officio member of IFEM in December 2017. The vision for GFEM is evident as it is meant to coordinate and promote collaborative efforts and activities among the member countries and to support and boost the specialty of EM throughout the GCC. With that, GFEM has a vital regional role and will need activism and leadership commitment and contribution to succeed.

In the meantime, in the UAE, the society wanted to tackle crucial aspects of EM; therefore, the board formed several committees to address various challenges and needs. The committees included ED administration, emergency ultrasound, toxicology, prehospital/disaster medicine, women in EM, and EM-interest group development. That list undoubtedly grew as the specialty matured. A major challenge of any professional society lies in the availability and commitment of its members. It is hard to secure dedicated time from members given the nature of our specialty, and our family, personal and social obligations. For a society and specialty to prosper, we need to directly or indirectly answer an important question that frequently comes from our colleagues: "What's in it for me to join the society?". Although some expect short-term benefits, many continued to share the belief of the long-term value of a society, namely to support the specialty. We tried to the best of our abilities to be as inclusive as possible and to reach out to the different emergency providers; namely physicians, nurses, paramedics, residents, and medical students. Our efforts reached out to different parts of the countries, and we offered free registrations to hundreds, if not thousands of providers over the years. We figured such participation in our educational activities would help them all deliver better emergency care. We also focused on identifying excellent speakers and involving them in our activities. This was a good motivator for many and generated an encouraging interest over the years.

At an academic level, EM has progressed rapidly in the country. Currently, 4-year programs



residency programs are accredited by the Arab Board of Health Specializations.<sup>24</sup> The first program was launched in 2008 in Tawam Hospital, at Al Ain City under the leadership of Dr. Abdel Noureldin, one of the pioneers of EM education in the UAE. Several programs were established since then. The UAE currently have five programs in total and a sixth one in the pipeline. The five programs are Tawam Hospital, Mafraq Hospital, Sheikh Khalifa Medical City, Rashid Hospital, and Zayed Military Hospital. We have over a hundred residents in total, and several more graduated and have worked in the country. To make EM as an attractive specialty to pursue, we organized several “EM awareness” sessions for medical students, in collaboration with their universities. We also added individual tracks at the ESEM conference dedicated for residents and medical students. This effort was an essential step to make EM programs one of the most competitive specialties in the UAE. It was important to teach future generations about EM as a specialty, the importance of it, the lifestyle of emergency physicians, its future opportunities, and even how to prepare a resume or to get ready for an interview. We also included medical students and residents as volunteers in our activities to make sure they feel the vibe of the specialty. Our local programs receive hundreds of applicants yearly and have become highly competitive with a strong reputation. Several programs are accredited by the Accreditation Council for Graduate Medical Education- International (ACGME-I).<sup>25</sup> Such accreditation strengthens the international recognition of our programs, and hence provides our graduates additional and better career and academic opportunities. Currently the establishment of fellowship programs and EM subspecialties are among our top priorities. This is being synchronized with the UAE governmental plans, such as Disaster Medicine, Toxicology, Ultrasound, and Administration..

Another milestone was the launch of the ESEM Newsletter in early 2013 to keep the ESEM’s audience informed about important news and initiatives and, most importantly, seek their engagement. Initially biannual, it is now a monthly edition and disseminated to thousands of people. The ESEM newsletter is currently run by our own

skillful residents; and we hope to grow it into a scientific journal.

Finally, although the picture I have painted may appear rosy, our road is not as easy as it seems. Some of the persisting challenges include the lack of an official body, I mean here within governments, to govern and “own” EM as a whole. This is the primary hurdle and directly reflecting on the inconsistent practices we see daily. Having strong governance should help lead and fund critical projects and basically “connecting the dots” within the system. They should set the tone and serve as the Maestro. This should include advancing EM in rural areas, working on accrediting training programs for Emergency Nursing and paramedicine, improving the ED operations and standardizing and empowering triage systems to divert away non-urgent cases from EDs. As a society, and in association with the government, we need to further promote the value of EM in the healthcare to ensure sustainable funding and cost-effective utilization of the emergency resources. In addition to our advocacy and educational efforts and activities, the advancement of research is a priority. This can include studies of quality improvement measures. Numbers and evidence are most valuable in supporting our efforts to secure resources for emergency care and the specialty!

We still have a long way to go to reach our ultimate goal of having a developed EM system. However, we have the will and the way to move it forward. The future of EM in the UAE is very bright and evident through all the strength and the enthusiasm we have demonstrated so far! The secret of success is to remember that “If you can’t fly then run, if you can’t run then walk, if you can’t walk then crawl, but whatever you do you have to keep moving forward”. *Martin Luther King, Jr.*<sup>26</sup>

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