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Use of electronic health record messaging to manage patients with pregnancy of unknown location

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Dear Editor,

As your readers are likely aware, ectopic pregnancy is a significant source of pregnancy-related morbidity and mortality. Pregnancy of unknown location (PUL) is defined as a positive pregnancy test in the absence of ultrasound findings diagnostic of either intrauterine or ectopic pregnancy [1]. The best method to follow patients with PUL is not known. The use of secure electronic messaging has been shown to effectively ensure follow up [2] and improve health outcomes [3]. At our institution, secure electronic messaging is available via My Health Connection (MHC) within the Epic system. We hypothesized that patients with PUL would be willing to enroll in secure messaging through MHC and that enrollment may improve follow up.

To this end, we conducted a prospective study of all patients presenting to the University of Colorado Hospital emergency department diagnosed with PUL from January 1, 2020 through March 31, 2020. Patients were excluded from the study if they were non-English speaking, unable to read, declined follow up or lacked access to an electronic device. During the three-month study period, an OBGYN resident provided counseling to patients diagnosed with PUL and explained that MHC was the preferred means for communication. Residents added patients to a secure Epic list in order to facilitate follow up. Patients were contacted if they failed to obtain the recommended 48 h follow up bhcg test or any subsequent visit and were followed until pregnancy resolution.

Of the 58 patients included in our cohort, 43 (74.1%) enrolled in MHC and 15 (25.9%) did not. In bivariate comparisons, patients who enrolled and did not enroll in MHC were similar in regard to age, self-reported race, insurance carrier, parity, and presence or absence of prior ectopic pregnancy (Table 1).

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Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Patients in the MHC group were more likely to present for their first bhcg (97% in the MHC group vs 60% in the non-MHC group). There was also a higher number of resolved pregnancies in the MHC group (88% vs 46%, $p < 0.05$). MHC enrollees had a higher prevalence of being treated surgically (11% vs 0%), a higher prevalence of intrauterine pregnancy (39% vs 6%), and were less likely to be lost to follow-up (11% vs 53%), $p < 0.05$.

Individual univariate poisson models with robust error variance were used to observe the likelihood of individual outcomes by a woman's enrollment in MHC (Table 1 part B). Enrollment in MHC was associated with an increased likelihood of women getting their first bhcg drawn (RR 1.7 [1.1,2.5]) and pregnancy resolution (RR 1.9 [1.1,3.3]), and a reduced likelihood of receiving additional letters (RR 0.2 [0.1,0.7]) and being lost to follow-up (RR 0.2 [0.1,0.6]), $p < 0.05$.

Our study demonstrates that patients are willing to enroll in electronic patient messaging and that those enrolled had a higher rate of follow up for PUL. Enrollees had a higher incidence of surgery, which may reflect further progression of ectopic pregnancy at time of diagnosis or could be indicative of other socioeconomic qualities such as ability to miss work for postoperative recovery. We suspect those lost to follow up likely sought care at an outside hospital due to high density of medical centers in our area. Though our study was limited by small sample size, strengths included a diverse patient population. Our study suggests that electronic messaging is an appropriate and efficient method by which to follow patients with PUL, and increased patient education on enrollment in electronic messaging may be helpful to expand services. Further study with larger sample size is warranted to more thoroughly examine patient outcomes as well as provider preference and use of resources, including provider time.

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Table 1

Patient characteristics and outcomes by enrollment in electronic messaging.

1A. Patient characteristics

	Total Population (n = 58)	Did not Enroll in MHC (n = 15, 29.1%)	Enrolled in MHC (n = 43, 74.1%)	p-value
Patient Characteristics				
Age (Median/IQR)	28 [24, 32]	28 [19,30]	28 [24,32]	0.40[a]
Parity (Median/IQR)	1 [0,2]	1 [0,3]	1 [0,2]	0.82[a]
BMI				0.81[b]
Underweight	0, 0.0%	0, 0.0%	0, 0.0%	
Normal	15, 25.8%	2, 13.3%	13, 30.2%	
Overweight	12, 20.7%	3, 20.0%	9, 20.9%	
Obese	20, 34.5%	4, 26.7%	16, 37.2%	
Missing	11, 19.0%	6, 40.0%	5, 11.6%	
Prior Ectopic	2, 3.5%	0, 0.0%	2, 4.6%	1.0[b]
Missing	1, 1.7%	0, 0.0%	1, 2.3%	
Race				0.52[b]
Asian	2, 3.5%	0, 0.0%	2, 4.6%	
Black	13, 22.4%	1, 6.7%	12, 27.9%	
MultiRacial	1, 1.7%	0, 0.0%	1, 2.3%	
White	2, 3.5%	0, 0.0%	2, 4.7%	
Other	15, 25.8%	5, 33.3%	10, 23.3%	
Unknown	23, 39.6%	7, 46.7%	16, 37.2%	
Missing	2, 3.5%	2, 13.3%	0, 0.0%	
Insurance carrier				0.53[b]
CO Medicaid	29, 50.0%	7, 46.7%	22, 52.4%	
Private	24, 41.4%	6, 40.0%	18, 42.9%	
None	4, 6.9%	2, 13.3%	2, 4.7%	
Missing	1, 1.7%	*	*	
Outcomes of Pregnancy of Unknown Location				

1A. Patient characteristics

	Total Population (n = 58)	Did not Enroll in MHC (n = 15, 29.1%)	Enrolled in MHC (n = 43, 74.1%)	p-value
Number of Calls	3 [1,5]	4 [2,7]	3 [1,5]	0.11[a]
Number of Letters	0 [0,0]	0 [0,2]	0 [0,0]	0.07[a]
	0, 0.0%	0, 0.0%	0, 0.0%	
First HCG				**<0.001** [b]
Yes	51, 87.9%	9, 60.0%	42, 97.7%	
Missing	1, 1.7%	0, 0.0%	1, 2.3%	
Pregnancy Resolution				**0.002** [b]
Yes	45, 77.6%	7, 46.7%	38, 88.4%	
Missing	0, 0.0%	0, 0.0%	0, 0.0%	
Outcome of Pregnancy				**0.007** [b]
Treated Surgically	5, 8.6%	0, 0.0%	5, 11.6%	
Treated Medically	6, 10.3%	2, 13.3%	4, 9.3%	
Spontaneous Abortion	15, 25.9%	4, 26.7%	11, 25.6%	
Intrauterine Pregnancy	18, 31.0%	1, 6.7%	17, 39.5%	
Other	1, 1.7%	0, 0.05%	1, 2.3%	
Lost to Follow-Up	13, 22.4%	8, 53.3%	5, 11.6%	

1B. Relative Risk of Outcomes by Enrollment in MHC

	RR	CI	P-Value
Likelihood of Receiving More Letters	0.2	0.1, 0.7	0.008
Likelihood of Getting First hCG Drawn	1.7	1.1, 2.5	0.02
Likelihood of Pregnancy Resolution	1.9	1.1, 3.3	0.03
Likelihood of Lost to Follow-up [c]	0.2	0.1, 0.6	0.002

C: the reference for lost to follow up was having a known outcome for the “outcome of pregnancy variable”; this was made a dichotomous variable for this component of the analysis.

Note: all results are from individual univariate poisson models with robust error variance.

a: kruskall-wallis test.

b: fisher’s exact test.

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*. unknown whether one missing data point was in MHC group or not.