Draft

Periodic Health Examination (PHE)

In-Flight Crew	Intelligent Integrated Medical Data System (MDS)	Ground Medical Mission Control
Pre-work		
Routine lab work, hearing assessments, nutrition assessment, radiation dosimeter readings are done	The Medical Checklist and the associated Assisted Medical Procedures guide patient and CMO through procedures for pre-work. Patient data are received by the MDS and help guide the procedures	Data from EMR are provided to Ground Medical Team: Flight Surgeon, Behavioral Health Program (BHP), Astronaut Strength, Conditioning and Rehabilitation (ASCR)
Psych evaluation (questionnaire, evaluation tools)	Pre-work results are populated in EMR	Medical Team members analyze data to provide health care recommendations to CMO
		Recommendations are captured in the EMR
In-Flight encounter		
CMO opens and reviews EMR		
CMO does interval history and records in EMR.	EMR pulls up interval history (exercise countermeasures, radiation dosing)	
CMO performs PHE (vitals, physical exam, dental exam)		
CMO generates PHE report	PHE report captured in EMR	
Subsequent encounter		
Follow up on any abnormal findings from initial encounter	CMO report is captured in EMR	Ground Medical Team reviews EMR

Draft

Corneal Abrasion

In-Flight Crew	Intelligent Integrated Medical Data System (MDS)	Ground Medical Mission Control
Patient presents with chief complaint		
CMO opens EMR		Ground is notified that an off-nominal EMR encounter has been opened
CMO takes history of chief complaint	EMR displays patient's medical history	
CMO performs focused physical exam: General unaided inspection of surface of the eye and eyelid, eye movements, and pupillary response.	The MDS provides the CMO with appropriate section of Medical Checklist, which is linked to the Assisted Medical Procedures, to guide the eye exam. Medical consumables and their inventory location are provided as well	
CMO uses digital ophthalmoscope to exam the eye	Still images/video are recorded to EMR	
CMO performs evaluation with fluorescein stain dye		
CMO diagnoses patient with a mild corneal abrasion	Still images/video are recorded to EMR	
CMO uses decision support to balance severity of case and consumables remaining—may choose "watchful waiting" to conserve consumables.	Appropriate section of Medical Checklist, Assisted Medical Procedures, medical consumables and their inventory location are provided to the CMO to guide treatment of corneal abrasion	
CMO decides on treatment plan	Diagnosis captured in EMR	
CMO forwards updated EMR to ground		
Treatment plan is implemented	Integrated Medical Model looks at resources available and likelihood of future conditions that might need similar treatment consumables	
Follow up as necessary		Ground medical team reviews EMR, diagnosis and treatment plan

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Nephrolithiasis (Kidney Stone)

In-Flight Crew	Intelligent Integrated Medical Data System	Ground Medical Mission Control
Patient presents with chief complaint	EMR displays patient's medical history	
CMO opens EMR		Ground is notified that an off-nominal EMR encounter has been opened
CMO takes history of chief complaint	The MDS provides the CMO with Medical Checklist linked to Assisted Medical Procedures for diagnosis of flank pain. Medical consumables and their inventory location are provided as well	
CMO performs focused physical exam: vitals, abdominal exam, GU exam	Lab analysis results captured in EMR	
CMO performs lab analysis: Urine analysis, CBC, chemistry including kidney and liver function tests	Smart decision support provided based on lab analysis	
CMO performs imaging: ultrasound scan	Patient's baseline lab tests and images are provided to CMO	
	Still images/video captured in EMR	
	Smart ultrasound categorizes stone as greater than 8mm	
CMO diagnoses kidney stone, categorizes it as "unpassable"	The MDS provides the CMO with Medical Checklist linked to Assisted Medical Procedures for treatment of a kidney stone. Medical consumables and their inventory location are provided as well.	Ground medical team reviews EMR and concurs with diagnosis
		Urologist consultant check
CMO provides pain medications and fluids		Ground team determines treatment plan utilizing HIFU break up of stone. Protocol is developed and uplinked
CMO follows protocol to break up stone using HIFU; procedural holds are in place for the ground to examine progress during the procedure	Assisted Medical Procedures are updated with the High-Intensity Focused Ultrasound (HIFU) protocol	External consultants are available virtually (video conference, WebEx, etc.) during the procedure
CMO completes procedure, does follow-up examination and determines procedure was successful		Ground Team confirms results

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Appendicitis

In-Flight Crew	Intelligent Integrated Medical Data System	Ground Medical Mission Control
Patient presents with chief complaint of abdominal pain		
	EMR displays patient's medical history	
CMO opens EMR	The MDS provides the CMO with Medical Checklist linked to Assisted Medical Procedures for diagnosis of abdominal pain. Medical consumables and their inventory location are provided as well	Ground is notified that an off-nominal EMR encounter has been opened
CMO takes history of chief complaint		
CMO performs focused physical exam: vitals, abdominal exam, GU exam		
CMO performs lab analysis: CBC, chemistry including kidney and liver function tests, urine analysis	Lab analysis results captured in EMR	
	Smart decision support is available if needed	
CMO performs imaging: ultrasound scan	Patient's baseline lab tests and images are provided to CMO	
	Still images/video captured in EMR	
CMO diagnoses appendicitis	Smart ultrasound detects non-compressible appendix	
		Ground medical team reviews EMR and concurs with diagnosis and conservative treatment plan
CMO provides pain medication, fluids, and antibiotics		
Frequent follow up exams are performed	EMR captures data	
2 months later patient returns with fever and right lower-quadrant pain		

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Appendicitis (cont)

In-Flight Crew	Intelligent Integrated Medical Data System	Ground Medical Mission Control
CMO opens EMR	EMR displays patient's medical history	
	The MDS provides the CMO with Medical Checklist linked to Assisted Medical Procedures for diagnosis of abdominal pain. Medical consumables and their inventory location are provided as well	
CMO takes history of chief complaint		
CMO performs focused physical exam: vitals, abdominal exam, GU exam		
CMO performs lab analysis: CBC, chemistry including kidney and liver function tests, urine analysis		
CMO performs imaging: ultrasound scan		
	Patient's baseline lab tests and images are provided to CMO	
CMO diagnoses peri-appendicular abscess		Ground medical team reviews EMR and concurs with diagnosis and treatment plan utilizing guided percutaneous draining of the peri-appendicular abscess
	Still images/video captured in EMR	
	Smart ultrasound detects a peri-appendicular abscess	
		Previously developed and verified procedures are uploaded
CMO prepares local sterile field, and administers IV or IM anxiolytics, local anesthetics, and IV antibiotics	Assisted Medical Procedures are updated for guided percutaneous drainage techniques	
CMO performs drainage procedure		
Medic assists with ultrasound scanning		
	Patient care monitor data are transmitted in real time to Medical Mission Control	Ground Ops and consultants are virtually available throughout the procedure
Patient vitals are monitored by a patient care monitor and alerts are generated if vitals go out of bounds.		
Frequent follow-up exams are performed		
	EMR captures follow-up data	

Appendicitis (cont)

In-Flight Crew	Intelligent Integrated Medical Data System	Ground Medical Mission Control
One week later, patient presents with fever and abdominal pain		
CMO opens EMR	EMR displays patient's medical history	
	The MDS provides the CMO with Medical Checklist linked to Assisted Medical Procedures for diagnosis of abdominal pain. Medical consumables and their inventory location are provided as well	
CMO takes history of chief complaint		
CMO performs focused physical exam: vitals, abdominal exam, GU exam		
CMO performs lab analysis: CBC, chemistry including kidney and liver function tests, urine analysis	Lab analysis results captured in EMR	
CMO performs imaging: ultrasound scan	Smart decision support provided based on lab analysis	
CMO diagnoses recurrence of peri-appendicular abscess	Patient's normal physiology images are provided to CMO	Ground medical team reviews EMR and concurs with diagnosis and treatment plan utilizing surgery to remove the inflamed appendix.
	Images/video captured in EMR	Previously developed and verified procedures are uploaded
	Smart ultrasound detects a peri-appendicular abscess	
CMO prepares local sterile field, and administers IV conscious sedation	Assisted Medical Procedures are updated with a surgical procedure for removing patient's appendix	
CMO performs surgical procedure with the medic assisting		
Patient vitals are monitored by a patient care monitor and alerts are generated if vitals go out of bounds	Patient care monitor data are transmitted in real time to Medical Mission Control	Ground Ops and consultants are virtually available throughout the procedure.

Appendicitis (cont)

In-flight Crew	Intelligent Integrated Medical Data System	Ground Medical Mission Control
Predetermined procedural holds will be in place for step-wise completion of the procedure Ground concurrence will be required at each hold before the in-flight procedure proceeds	Assisted Medical Procedures are running, the EMR is being updated with the real-time data; multiple video views of the surgical theater are presented	Ground consultants will follow progress and analyze data streams to help guide procedure
CMO performs post-procedure exam and then closes abdomen.		
Frequent follow -up exams are performed	EMR is updated with follow-up exam data	
CMO determines the surgery a success		Ground team concurs that surgery was a success