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Physicians and their Patience: Redefining Healthcare Relationships through Readability Optimization

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PHYSICIANS AND THEIR PATIENCE: REDEFINING HEALTHCARE RELATIONSHIP MANAGEMENT THROUGH READABILITY OPTIMIZATION

by

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ABSTRACT

The present study takes legibility research and extends it to the medical setting. With the help of physicians in the department of Internal Medicine from the University of Central Florida, we were able to get a better understanding of some of the struggles physicians experience when reading electronic health records. UCF's Internal Medicine physicians developed six passages of medical text detailing a History of Present Illness (HPI) Report from an emergency department as well as comprehension questions for the purpose of this study. In our study, we first present an initial speed test with simple passages and comprehension questions presented in six common fonts to identify participants' fastest and slowest fonts. We then give them the medical passages in both their best and worst fonts while measuring reading speed and comprehension. This study was delivered to a population of crowd workers to help us better understand how legibility improvements can be made within specific fields. We hope that with this study we can begin the process of restructuring Electronic Health Records to be more usable and efficient for physicians.

DEDICATION

I dedicate this thesis to my friends and family who have always encouraged and supported me throughout my education.

To my father, Andrew Ball who helped me discover my passion for science.

To my mother, Franchesca Edwards, for her constant love and motivation.

To my sister, Hannah Ball, for her incredible advice and wisdom.

And to my best friend, Salim Mouloua, who taught me to never give up.

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CHAPTER 1: INTRODUCTION

Increasing use of various interfaces has resulted in the need for a comprehensive reconstruction of operations for human factors and other professionals. When professionals adopt the new technologies that come with these interfaces, there is the issue of new implementations of tasks at the possible expense of precision and efficiency. Essentially, this issue can become counterintuitive to the original intent behind the creation of these new interfaces. There are countless examples of this within the field of Human-Computer Interaction (HCI) including driving assistance (Mendoza et al., 2011), aviation (Kaber et al., 2002), and gaming (Desurvire et al., 2004). Fairbanks & Caplan (2004) detail a call to action for the need of human factors professionals in the medical field as there is a severe lack of usability testing and poor interface design in emergency settings. In these emergency settings, medical professionals do not have the time to figure out how to use their equipment (Fairbanks & Caplan, 2004). This problem is easily solved with the implementation of Human Factors professionals and usability testing, outlined in a seven-step process (Fairbanks & Caplan, 2004). It can be argued that change that negatively impacts workflow is worse than no change at all, especially when change leads to the misconception that previous systems are being improved upon.

Electronic Health Records (EHR)

An Electronic Health Record (EHR) is a digitized patient chart including readily accessible information on any patient's medical history, past and current medications, diagnoses, treatment plans, etc. (U.S Department of Health and Human Services, 2019). The EHR was made to replace paper versions of patient charts and keep patient records in one place.

In the medical community, an estimated 75% of United States hospitals had transitioned to the use of at least a basic Electronic Health Record (EHR) system by 2014 (Adler-Milstein et al., 2015). More than half of hospitals that reported to have EHR systems reported experiencing challenges with their systems such as IT issues, financial issues, or cooperative issues with physicians (Adler-Milstein et al., 2015). This leaves medical practitioners with the task of reworking their record-keeping systems while still maintaining their patients' health.

The exigency of streamlining and standardizing record keeping has been apparent in the medical community since as early as 1968. Physicians must take a multifarious approach when managing and treating multiple patients as well as keeping records of them among other time-consuming tasks (Weed, 1968). Restructuring medical record-keeping has been a long-time necessity in the medical community that is yet to be perfected. Future research should first look to develop a uniform format of EHR systems, as there is immense variety and superfluous features among systems (Weiner, 2019). Another step for future research would be the development of EHR systems that can be used proficiently. Currently, the task of entering data into an EHR system is incredibly tedious taking an average of 106 steps equating to twenty-two minutes to complete a task within the system (Saitwal et al., 2010).

Effects of EHRs on Physicians

Physicians spend nearly fifty percent of their time working on EHR data entry or other administrative tasks (Sinsky et al., 2016). This is counterintuitive to the goals of medical professionals and the expectations of their patients which is to primarily concentrate on patient health. EHRs were not designed with time in mind. Namely, these systems were initially built with the intent of saving time and effort end up becoming more time-consuming and difficult to

navigate. Excessive time spent on such menial tasks is a great indication that the advancement of medical record keeping is an essential endeavor.

Furthermore, it is counterproductive to the physician's goals to spend an inordinate amount of time on administrative tasks when they could be delivering care. This can possibly lead to a lack of motivation among physicians and could be related to higher rates of stress, burnout, and mistakes. Within human factors, performance augmentation is a critical step in alleviating stressors of the operator. When applied in this domain, we have the opportunity to better the lives of physicians as well as patients.

Asynchronous alerts within EHRs are an important example of an implementation that has been observed to do more harm than good. While initially intended to aid physicians, asynchronous alerts produce information overload for physicians who typically receive many alerts daily, increasing the likelihood of physicians missing crucial information (Murphy et al., 2012).

In a series of surveys physicians were asked to rate their stress, burnout, and job satisfaction among other things (Babbott et al., 2014). Physicians reportedly had more stress and less job satisfaction when they worked with a moderate to high usage of electronic medical records (Babbott et al., 2014). Physician's rating usability of the EHR gave it a usability score of 45.9 giving it the rank of F and were strongly correlated to burnout rates among physicians (Melnick et al., 2019). Physician stress and burnout rates have been found to be highly correlated with high EHR usage (Babbott et al., 2014; Melnick et al., 2019)

The reduction of burnout and stress rates in physicians can be directly influenced by the streamlining of electronic record keeping, allowing physicians to save their time. Since the

transition to EHR, medical practitioners have reported having less face-to-face time with patients, along with higher levels of musculoskeletal pain from attending to these medical documents so often (Hedge & James, 2014).

Risks of Poor EHR Usability

Errors made by physicians and patients are one of the key situations in which the medical community has failed a patient and might have lifelong consequences. This can result in a lasting loss of trust in medical providers. Of patient safety reports that explicitly mentioned EHRs most harm reports were due to EHR challenges with data entry, alerts, and interoperability (Howe et al., 2018). In a 1986 study performed by Lakshmanan et al., patients at the Cleveland Metropolitan General Hospital that were admitted for iatrogenic complications were observed. These were defined as cases due to mistakes made by physicians and/or patients (Lakshmanan, 1986). Nearly fifty percent of iatrogenic diseases observed were described as preventable if detected early enough (Lakshmanan et al., 1986). We hope that improving upon the quality of online medical records can allow for these errors to be caught directly at their source, strengthening the meaning of patient safety along with physician precision.

Improving EHR usability could have a life-saving impact. In a study by Moacdieh and colleagues, participants were asked to read through an EHR and diagnose a simulated patient (Moacdieh et al., 2014). Simulated EHRs that were less dense in terms of layout took physicians less time to read through and physicians were less likely to miss crucial information (Moacdieh et al., 2014). This is a strong indication that EHRs currently lack usability, a flaw that could be detrimental in a high-risk medical setting.

Rather than teaching physicians to be able to work around the inefficient EHR, these systems can be closely examined from a human factors perspective and improved upon to work in conjunction with physicians instead of forcing them to work with disjunction.

Physician-Patient Relationships

Less EHR usage means more one-on-one time with patients. Positive relationships between patients and physicians have led to better healthcare for patients, as well as more enjoyable working conditions for physicians (Hall et al., 2002). A study on the effects of interpersonal attraction on physicians and their patients found that liking between physician and patient led to better health reported among patients along with feelings of loyalty and overall satisfaction (Hall et al., 2002). More one-on-one time between physicians and patients can be achieved with the advancement of other, more business-centered, aspects of a physician's occupation. This allows physicians to focus on the part of the job they signed up for – taking care of patient's health and wellbeing.

Taking a Human Factors approach to the integration of the Electronic Health Record and physician's time and knowledge base allows for a more unified and effective form of patient-based care. Considering a complete redesign of day-to-day activities in the medical community through time-saving on medical records has incredible implications (Hancock, 2018). The medical community has not effectively streamlined the restructuring of time in this manner with record keeping as it has in other medical aspects. Doing so would greatly advance the symbiosis of physicians and patients, along with the meaning of patient safety. Saving time on simple yet necessary tasks is essential to increasing the bandwidth of the medical environment. Rather than

cutting down time spent on interacting with the patients, effective usage of time on administrative tasks will allow patients to receive higher quality and more satisfactory care.

A successful physician-patient encounter is one that properly allocates time in favor of the patient. In order to improve this area, the focus must be placed on "preserving the patient-physician relationship" (Braddock & Snyder, 2005). When physicians experience time pressure, they are not working in the patient's favor nor using their time properly. An increase in EHR usability will allow for proper time allocation and dedication to the needs of the patient. If more time were allocated towards the patient, then trust is built as the physician accomplishes the role as "patient advocate" (Braddock & Snyder, 2005). Thus, modifying how physicians spend their time on administrative tasks directly allows for physicians to place more of their focus on patient satisfaction and wellbeing.

Crowd Workers

Crowd workers are users on a crowdsourcing system that allows people to complete straightforward, one-time tasks (Ross et al., 2010). Amazon Mechanical Turk (MTurk) is a crowdsourcing system that has seen a large amount of growth since its beginning in 2005 (Mortensen & Hughes, 2018). MTurk is a platform that is able to gather crowd workers as participants at a fast rate and have high participation completion rates (Mortensen & Hughes, 2018). Crowd workers are increasingly becoming a more international group, ensuring participants that are highly variable in areas such as age, ethnicity, and education (Ross et al., 2010).

Format Alone Can Help

Increasing legibility has been shown to produce faster reading times and improved recollection among readers. Font changes alone can increase reading quality improving recall on medical texts (Gasser et al., 2005). In 2005, Gasser et al. completed a study using undergraduates who read a medical article. These participants, who were not considered to be experts in the field, saw a 9% improvement rate on information recall (Gasser et al., 2005). If experts, such as physicians or other persons in the medical field, were examined on related content their reading speed could see a larger improvement since they have a better understanding of medical texts through working in the field. In a more recent study, individuals were able to read 51% faster on average in their individual fastest font as compared to their slowest font (Wallace et al., 2020). Both studies indicate that legibility is highly variable and could greatly enhance reading speed and shorten reading time. Legibility can be used to optimize the efficacy of the EHR system and could potentially lead to increased communication levels and promote trust between patients and their healthcare providers.

CHAPTER 2: HYPOTHESIS DEVELOPMENT

To examine the impact of font on medical text on reading speed and comprehension, a within participants repeated measures design measuring legibility using differing font changes with crowd workers from Amazon Mechanical Turk as participants poses a useful stud approach for completing this goal. Speed and comprehension were congruently tested as participants read through texts testing their individualized font type. Through examining the effects of individualized font types on EHRs, the EHR can perform to the best of its ability, leaving physicians for more important tasks. Because EHRs are highly variable in their general appearance and functionality, we have decided to focus on the medical history aspect of EHRs that occur when physicians must read when patients are newly admitted.

Hypothesis 1: Legibility changes will increase reading speed levels on non-medical text.

Hypothesis 2: Legibility changes will increase reading speed levels on medical text.

Hypothesis 3: Legibility changes will increase comprehension levels on non-medical text.

Hypothesis 4: Legibility changes will increase comprehension levels on medical text.

CHAPTER 3: METHODOLOGY

Participants and Procedure

Twenty-five crowd workers on Amazon Mechanical Turk served as non-medically trained participants. Demographic information was not collected due to an error within the interface. Prerequisites for participation in the study were being 18 years of age or older, fluent in English, and having normal or corrected-to-normal vision. Participants were compensated monetarily through Amazon Mechanical Turk.

Participants took a pre-test survey. This survey was comprised of questions that prompted participants if they have been diagnosed with a reading disability, and how comfortable and proficient they were in reading text written in English. The study itself contained two stages. The first stage included a reading speed test using six common fonts (Wallace et al., 2020). Non-medical passages were presented, and comprehension questions were asked to determine the participants' fastest and slowest font based on Words Per Minute (WPM). We test this difference in legibility on medical text. Participants then read six passages (detailing a patient being admitted to emergency care and History of Present Illness (HPI) written by internal medicine physicians at UCF for the purpose of this study) in both their fastest and slowest font presented in a random order. The passages presented helped us gauge how legibility affects the reading speed and comprehension levels physicians obtain while reading an EHR. Passages in both the first and second stages were presented first in segments of about 150 each, followed by comprehension questions on a separate page to prevent participants from going back to the text. Comprehension questions in the second stage consist of five total questions: two on the first part of the passage, two on the second part of the passage, and one diagnosis question. After

participants finished reading the passages, they were directed to a post-survey asking them a variety of questions including their demographic information, if they consciously adjusted their reading speed to influence their comprehension level (much slower than normal to much faster than normal), how much time they spend reading an electronic health record per patient encounter, how well they felt they understood medical text (not at all to nearly all), and any pain points they experience when reading medical documents. The study took about 30 minutes to complete.

CHAPTER 4: RESULTS

There was a significant association between fastest WPM achieved on the non-medical text and the fastest WPM achieved on medical text ($r(24) = .849$, $p < .001$) which acted at parts one and two of the study.

Paired-samples t-tests were conducted to compare differences in WPM between participants' non-medical text fastest and slowest conditions and for participants' medical text fastest and slowest conditions. There was a significant difference in the non-medical text fastest font ($M = 310.82$, $SD = 112.15$) and slowest font ($M = 208.44$, $SD = 73.38$) conditions; $t(24) = 6.5$, $p < .001$, $d = 1.30$. This indicated that participants were 102.38 WPM faster in their fastest font as compared to their slowest when reading non-medical text. There was also a significant difference in the medical text fastest font ($M = 294.21$, $SD = 104.09$) and slowest font ($M = 259.97$, $SD = 88.25$) conditions; $t(24) = 3.48$, $p = .002$, $d = .70$. This indicated that participants were 34.24 WPM faster in their fastest font as compared to their slowest when reading medical text.

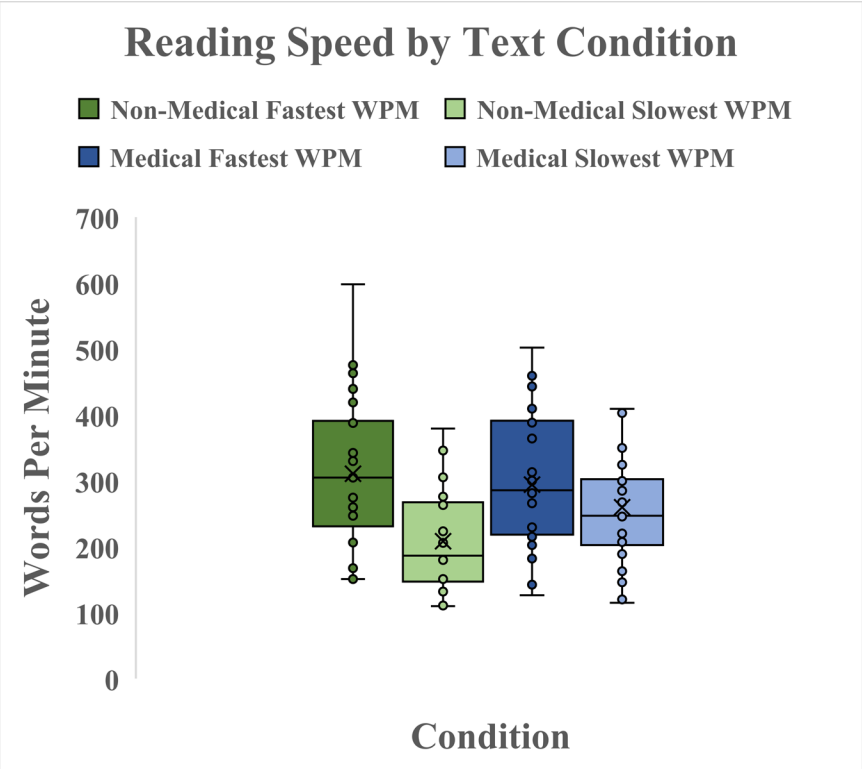

Figure 1: Differences in reading speed by text passage condition. Error bars indicate ±2 SD.

Paired-samples t-tests were conducted to compare differences in Comprehension between participants' non-medical text fastest and slowest conditions and for participants' medical fastest and slowest conditions. There was no significant difference in the non-medical text fastest (M = 92.00%, SD = 18.71%) and slowest (M = 88.00%, SD = 26.14%) comprehension conditions; $t(24) = .70$, $p = .49$. There was no significant difference in the medical text fastest (M = 73.07%, SD = 18.71%) and slowest (M = 75.73%, SD = 13.59%) comprehension conditions; $t(24) = -.73$, $p = .48$.

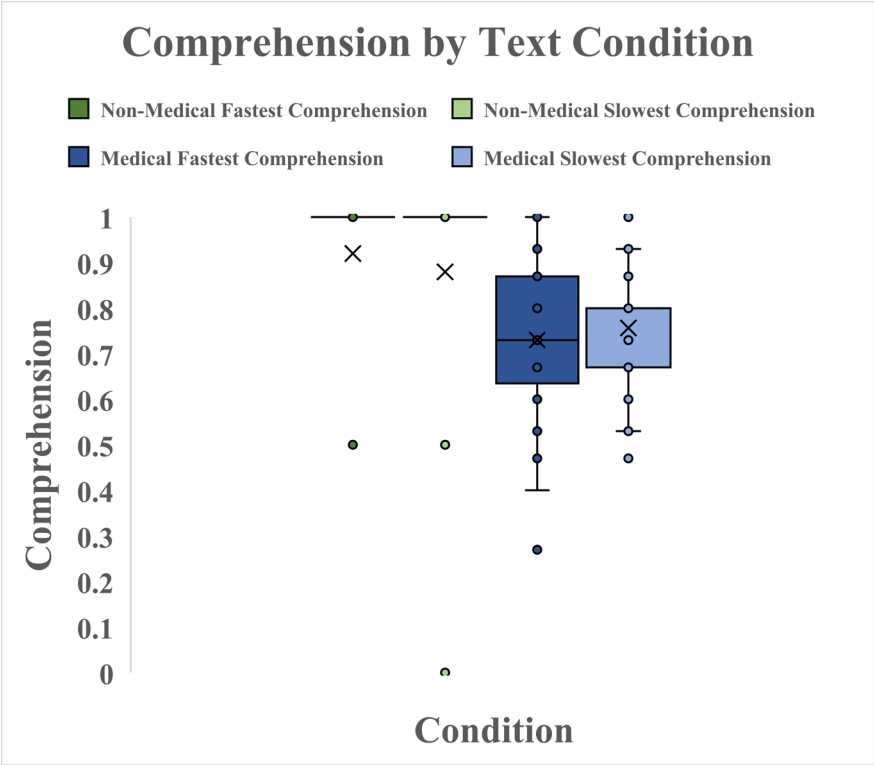

Figure 1: Differences in comprehension by text passage condition. Error bars indicate ±2 SD.

CHAPTER 5: DISCUSSION

The present study sought to analyze how participants respond to legibility changes within medical text as compared to simple text. This reflects the individual nature of legibility regarding font types and shows time-saving potential. Previous research has shown legibility changes can demonstrate great improvements to reading speed (Wallace et al., 2020). This study demonstrates a similar effect for medical text and participants improved in reading speed while maintaining comprehension with personalized legibility settings in both simple non-medical text and medical text.

The correlation between participants' fastest font with non-medical text and participants' fastest font with medical text could signify that an individual's fastest font could be applied to texts in different domains and in everyday use. The universality of these techniques to any individual provides a personalized method of improvement over a one-size-fits-all solution. Individual optimal fonts may indicate that adopting personalized font choices in every aspect of reading would be helpful for individuals.

It is noteworthy that participants demonstrated worse accuracy in the medical texts as compared to accuracy in non-medical texts while still improving their speed. This may be due to the fact that participants were non-medically trained and may have found it difficult to interpret or memorize medical jargon. This suggests benefits in a fast-paced environment such as a hospital setting, and future research should look to observe this through more naturalistic settings. The utility here for medical professionals cannot be understated – if comprehension can be held constant while gaining time, patients and physicians alike would benefit.

Limitations and Future Directions

Some limitations of the present study should be noted. The first limitation concerns the lack of demographic information, due to an error within the interface. Second, because the EHR presents data in many ways and can be highly variable, we were only able to replicate a subsection of an EHR (Weiner, 2019). Third, we explore legibility in the context of font type alone. Future research could include exploring other aspects of legibility and how they affect medical documents such as spacing or text size. For example, does increased text size improve comprehension? Continually, perhaps optimizing spacing will allow for seamless scanning by physicians.

This would also allow for an investigation of the various strategies used by physicians to conserve their time such as skimming, speed reading, etc. Alternatively, physicians could be slowing their reading to better comprehend the densely packed information on an EHR in which case solutions for improving comprehension should be explored.

This study provides evidence that changes to legibility could improve the reading speed in medical materials. A separate sample for a population of medically trained professionals is forthcoming. In the future, an examination of legibility in a more naturalistic interface would be necessary. Attaining high fidelity in the context of EHR design and considering time constraints that physicians typically face would allow for a more accurate examination of the ways EHRs are used in a real-time setting.

Studies on the effects of legibility and design of EHR systems may serve as the groundwork for the standardization and regulation of these systems to improve usability. The lack of EHR usability presents clear, sometimes fatal, consequences (Schulte & Fry, 2019). It is

important to note that increasing efficiency of the EHR should not equate to an increase in number of patients for the physician. The goal of this study is to expand the amount of time that physicians see their current patients, not to add to the work of the physician by intensifying workload. The methods of optimizing physician-patient interactions are not limited to the ones discussed here. For example, Augmented Reality systems could help physicians to connect digital information to patient's faces more easily and combine time spent reading EHRs and physician-patient time thereby combining two tasks into one. Furthermore, nationally standardized EHR requirements, layouts or devices that would ensure that all physicians are keeping the same records in the same easy-to-use format could also be advantageous.

Appendix A – Medical Passages and Comprehension Questions

*Correct answers are in bold.

Medical Passage 1

Mr. G is a 48-year-old well-nourished Hispanic male with a history of rheumatoid arthritis who presents to the emergency room with headache and generalized weakness.

He has been having a worsening global headache for the past three days that is constant, 10/10 in severity, associated with lightheadedness, nausea and vomiting to the point that he is unable to tolerate any fluids or food. The patient has been feeling extremely weak to walk or to leave his bedroom therefore he was brought to the hospital by his sister. She noticed a rash in the preauricular area that extended over the eyelids and nose which the patient did not notice before.

He also reports severe bilateral hand and knee pain and swelling, dry mouth and eyes, subjective fever, night sweats and chills and 36-pound unintentional weight loss in the past 2 months. He denies any changes in bowel movements, hematuria, hematochezia, loss of consciousness, seizure, vision changes, urinary symptoms, shortness of breath, cough.

***

Regarding his medical history, he was diagnosed with rheumatoid arthritis 4 months ago when he presented to his PCP with fatigue, bilateral hand, wrist and knee pain. He was started on methotrexate and corticosteroids. The patient stopped taking methotrexate after 2 weeks since he felt that the medication was ineffective and he developed diarrhea. He has a pending follow up appointment with his rheumatologist in 3 weeks.

Mr. G does not drink alcohol, smoke or use any illicit drugs. His mother has a history of breast cancer and systemic lupus erythematosus and his older sister has hypertension and diabetes mellitus. He works as a consultant in a law firm, but he has not been able to work at full capacity since his diagnosis. He has taken a medical leave for the past week.

What was the reason that Mr. G presented to the hospital? (first half)

- He was told to go to the ED by his PCP
- **He was extremely weak**
- He was concerned about the rash in his face
- He was running a fever

What comorbidities does Mr. G have? (first half)

- Hypertension
- Ischemic heart disease
- **Rheumatoid arthritis**
- Systemic lupus erythematosus

Which joints are affected in Mr. G? (second half)

- Feet and ankles
- Shoulders and hips
- Hips and feet
- **Hands and knees**

Why did Mr. G stop his methotrexate? (second half)

- **He felt it was not effective**
- He developed nausea and vomiting
- He could not afford it
- He forgot to pick up the medication at the pharmacy

Based on the information above, which of the following would be the next step on the management of Mr. G (?)

- Since he already has an appointment with his rheumatologist, discharge home and follow up as scheduled
- **Admit to inpatient for further workup and management of rheumatoid arthritis flare**
- Start adalimumab immediately and discharge home with an earlier appointment with his rheumatologist
- Start IV hydration in the ED and observe overnight, as he is likely just dehydrated

Medical Passage 2

Mr. S is a 53-year-old male who presented to the emergency room with right sided weakness and slurred speech that began this morning at 7 AM. The patient was at baseline health prior to 7 AM. He also reported numbness in his right arm and leg. No history of difficulty swallowing, chest pain, or shortness of breath. He does not endorse any changes in his vision or hearing. The patient lives with his wife and two children; he is very active at baseline and jogs 30 minutes

every other day. He has a known past medical history of diabetes mellitus, hypertension, and hyperlipidemia.

Two months ago, the patient presented to the emergency room with similar symptoms that lasted about one hour and resolved on their own. At the time, he underwent a CT scan of his head which showed no acute intracranial abnormalities. He was told that he had a "mini-stroke" and was advised to start taking a daily Aspirin 81 mg which he has been compliant with.

***

His wife brought him into the ER immediately after he began having right sided weakness and slurred speech. She states that his symptoms began exactly 30 minutes ago. She mentions that he is not on any anticoagulants at home and asks about whether he would be a candidate for thrombolytics. She is afraid that his symptoms will be persistent and he will remain paralyzed as well as have trouble speaking for the rest of his life.

The patient's family mention that he has been very stressed at home over the past week. The family recently lost their pet dog who had lived with them for 12 years. Ever since this happened, the patient's smoking habit has worsened and he is up to 2 packs of cigarettes daily.

What was Mr. S's initial presenting complaint? (first half)

- Loss of sensation in both of his arms
- Severe, crushing chest pain

- **Right sided weakness**
- Loss of balance

What symptoms did Mr. S have within the past few months? (first half)

- **Similar symptoms to this presentation. He was told he had a "mini-stroke"**
- Uncontrolled diabetes with severe hyperglycemia. He was started on insulin
- New onset atrial fibrillation. He was started on ASA 81 and anticoagulation
- Severe headache. He underwent a CT head.

What recent stressor happened in Mr. S's life? (second half)

- He lost his job as an accountant
- He and his wife got a divorce
- **His pet dog recently passed away**
- He found out his dad has cancer

What question did Mr. S's wife have about his management? (second half)

- She asked if he would be able to eat breakfast
- **She asked if he would be eligible for thrombolytics**
- She asked if he would proceed with mechanical thrombectomy
- She asked if he would be able to go home today

Based on the information above, what would be the best next step in Mr. S's management?

- **Thrombolytics as Mr. S presents within the appropriate window**
- Supportive care alone as patient is on anticoagulants and therefore not a candidate for thrombolytics
- Give him a loading dose of aspirin since he is outside the window for thrombolytics
- Since his symptoms are likely due to stress, he needs a referral to psychiatry

Medical Passage 3

Mr. P is a 34 year old male with a past medical history of asthma who was brought in by emergency medical services after calling 911 for shortness of breath. Mr. P is a college graduate who is very well-informed regarding his asthma diagnosis. He is compliant with his budesonide/formoterol inhaler as well as his albuterol rescue inhaler. He also has a nebulizer machine which he knows how to use when his symptoms get in the way of using his metered dose inhaler with proper technique.

Mr. P reports his shortness of breath began about 1 week ago since he moved to Florida. He also has a known history of allergic rhinitis. He says he thinks the pollen is making his asthma "act up". He went to his primary care physician who gave him antihistamines in an effort to control his symptoms. However, his symptoms have only been getting worse. He tells you he has no pets at home. He does not have any carpets and avoid strong perfumes as they can trigger his symptoms.

***

He is a never-smoker. He knows his peak expiratory flow and reports it is 500 litres per minute at baseline. He has never been hospitalized for his asthma. He has never been intubated and tells you his primary concern is that he may need to be admitted to the intensive care unit (ICU) as his breathing has never been “this bad”.

He reports for the past day, he has needed to use his albuterol nebulizer continuously. As his symptoms would not improve, he finally made the decision to call 911. In the ambulance, he received oxygen supplementation with three liters via nasal cannula to maintain an oxygen saturation of 89%. Upon arrival to the ER, he continued to desaturate and required ICU consultation for intubation.

What was Mr. P's initial complaint? (first half)

- Productive cough
- **Shortness of breath**
- Chest pain
- Fever

When did Mr. P’s symptoms begin? (first half)

- One day ago
- One month ago
- **One week ago**
- Six weeks ago

What is Mr. P baseline peak expiratory flow rate? (second half)

- 100 L/min
- 200 L/min
- **500 L/min**
- 750 L/min

What was Mr. P's primary concern? (second half)

- **That he would need to be admitted to the ICU**
- That he would miss a day of lectures at college today
- That he would develop an allergic reaction to steroids
- That he was not able to inform his family of the severity of his symptoms

Based on the above information, what would be the next best step in Mr. P's management?

- **Steroids as they would reduce airway inflammation for his severe asthma exacerbation**
- Proning as he has clear evidence for adult respiratory distress syndrome
- Extracorporeal membranous oxygenation (ECMO) as he meets criteria
- Diuretics to help him achieve a state of euvolemia

Medical Passage 4

Mr. Q is a 50-year-old male with a past medical history of non-insulin dependent DM2 without microvascular complications, who presents to the emergency department with a chief complaint

of 1 day of left sided flank pain. He also reports persistent burning sensation during urination for the last few weeks. His diabetes is not well controlled and he initially thought that his dysuria is related to high glucose levels. After cutting out sweets from his diet, his dysuria persisted and he went to see his PCP one week ago.

Mr. Q reports that his PCP prescribed a course of antibiotics for 5 days, which he completed already without resolution of symptoms. He cannot remember the name of the antibiotics. He also noted that his glucose level was indeed elevated in the PCP office, but no changes were made to his medications.

***

Mr. Q woke up in the middle of the night with an acute sharp, intermittent, non radiating left sided flank pain and feeling feverish. The pain is severe up to 7/10 when present but can go down to 2/10. He denies prior episodes, alleviating or aggravating factors. The patient has not used any medication for the pain, as he was hoping it would just pass. He also reports subjective fevers and chills, denies nausea, vomiting, cough, shortness of breath, hematuria, or change in bowel movements.

At the emergency department Mr. Q is febrile with a temperature of 101.5F, blood pressure of 92/64, heart rate of 90 beats per minute, respiratory rate of 16 and saturation of 98% on room air. Labwork is significant for elevated white blood cells of 18K, lactic acid of 3.7 mmol/L and presence of white blood cells and leukocyte esterase in the urine sample.

What is the chronicity of this patient chief complaint? (first half)

- **Acute**
- Subacute
- Chronic
- Unable to determine

What organ would you be concerned about as the etiology of this patient pain? (first half)

- Musculoskeletal
- **Urinary system**
- Gastrointestinal system
- Cardiovascular system

What helped alleviate Mr. Q pain? (second half)

- **Mr. Q did not try to take anything for the pain**
- Mr. Q took tylenol, but it did not alleviate the pain
- Mr. Q took ibuprofen, which alleviated the pain
- Mr. Q is asking for morphine to help with his pain

How would you categorize this patient's sepsis level? (second half)

- Mr. Q has sepsis based on presence of fever and leukocytosis
- **Mr. Q has severe sepsis based on presence of fever, leukocytosis and lactic acidosis**
- Mr. Q has severe sepsis based on presence of fever, leukocytosis and hypotension
- Mr. Q has septic shock based on presence of fever, leukocytosis and hypotension

Based on the above information, what would be the next best step in Mr. Q management?

- Prescribe broad spectrum antibiotics for recurrent UTI and discharge the patient home
- Start an intense insulin regimen to control his diabetes, and send him home
- **Admit to the hospital to treat severe sepsis secondary to complicated UTI**
- Admit for observation until you can find out which antibiotics Mr. Q took last week

Medical Passage 5

Mrs. H is a 78 year old caucasian woman with a history of atrial fibrillation, diabetes mellitus and hypertension who presents to the emergency department due to epigastric pain for the past two days. The pain is dull, 7/10, not radiating, and is associated with nausea and 4 episodes of melena. Mrs. H has tried Tums (calcium carbonate) tablets with no improvement of symptoms. She does not identify any aggravating factors to her pain. She denies any vomiting, hematochezia, hematemesis, lightheadedness, or chest pain. She reports that this is the first time that she has had this type of pain.

Mrs. H drinks a glass of red wine every other day on average and never more than one at a time. She eats home-made food and did not change her diet recently. She smoked briefly as a young woman, and still enjoys a cigarette occasionally. She never used any illicit drugs.

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Mrs. H reports that two weeks ago she went to urgent care due to acute lower back pain after she was moving some heavy boxes at home. She was prescribed ibuprofen 800 mg every 8 hours and cyclobenzaprine 10 mg before going to bed. Her back pain has been improving with the help of these medications. Last time she took ibuprofen was the night prior to presentation to the

emergency department. Her regular medications are apixaban 5 mg every 12 hours and metoprolol tartrate 50 mg every 8 hours and metformin 850 mg three times a day with meals.

On arrival to the emergency room, she was afebrile, with a blood pressure of 127/76, heart rate of 115 beats per minute, irregularly irregular, respiratory rate of 18 respirations per minute and pulse oximetry of 99% on ambient air. Her abdomen was tender on palpation of the epigastric area. There was no guarding or rebound.

What is the chief complaint of Mrs. H? (first half)

- Chest pain
- Shortness of breath
- **Abdominal pain**
- Generalized weakness

Which of the following medications did Mrs. H try for her symptoms? (first half)

- Omeprazol
- Ranitidine
- **Calcium carbonate**
- Acetaminophen

Why did Mrs. H visit the urgent care two weeks ago? (second half)

- **She had back pain after lifting boxes**
- She was vomiting
- She had chest pain after lifting boxes

- She was not able to walk.

Which of the following medications does Mrs. H take on a daily basis? (second half)

- Rivaroxaban
- Warfarin
- Edoxaban
- **Apixaban**

Based on the above information, what would be the next best step in Mrs. H management?

- Obtain arterial blood gas
- **Obtain hemoglobin and hematocrit**
- Obtain urinalysis
- Obtain troponin level

Medical Passage 6

Mrs. L is a 67 year old woman, who is brought to the ER after being found unresponsive at home. Per her daughter, she was in her regular state of health this morning, but seemed distracted. She went to her room after breakfast, and did not come when the daughter called her for lunch. The daughter came into the room to find the patient lying in bed unresponsive. Upon arrival, EMS found her to have glucose level of 15 and administered D50, which resulted in the patient becoming more awake.

The patient has a past medical history of HTN, CAD, CHF and IDDM. There was no recent change in medications, and the patient has seen her PCP about a month ago. Her most recent

labwork was unremarkable and her last A1c was 7.4. Her medications include insulin glargine 50 units at night, insulin lispro 18 units before meals, ASA 81mg, Carvedilol 12.5pm BID, Simvastatin 40mg daily, Lisinopril 20mg daily, Furosemide 20mg BID.

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At baseline the patient is fully independent, lives with her daughter and 2 pet dogs. She has a remote history of smoking about ½ pack per day for 10 years, quit 40 years ago. She drinks 1 glass of red wine daily and never used illicit drugs. She is a retired school teacher and a widow. Today is the anniversary of her husband's passing. Per the daughter, they were "the perfect couple" and her mother never really got over his sudden death from cardiac arrest 2 years prior.

In the ER she appeared tearful, scared and confused. She can not fully recall what happened and says she "just blacked out" and that she "feels so guilty". She does not remember how much insulin she took after breakfast and says "it's all a blur". In the ER her measured glucose is 64. She is started on D5W drip and admitted to the hospital.

What was the patient's initial presentation? (first half)

- Unresponsiveness due to septic shock
- **Unresponsiveness due to profound hypoglycemia**
- Unresponsiveness due to opioid overdose
- Unresponsiveness due to a syncopal episode

What are the patient's diabetic medications? (first half)

- **She takes insulin at a total daily dose of about 100 units**

- She takes insulin at a total daily dose of about 30 units
- She takes metformin and januvia
- She is well controlled with diet and her A1c is 7.4

What is the patient's emotional stressor? (second half)

- Her favorite dog died
- A fight with her daughter
- No acute stressor - she is chronically depressed
- **Anniversary of husband's passing**

How much insulin did the patient take at home after breakfast? (second half)

- She took 64 units of her glargine
- She took 64 units of her lispro
- **She could not recall**
- She denied taking any insulin

Question 5 - Based on the information above, what would be the next best step in management of this patient?

- Watch her overnight and discharge in the morning if glucose >70
- **Mandatory psychiatric evaluation for a possible suicide attempt and continue D5W drip overnight**
- Discontinue all insulin and send her home
- Mandatory psychiatric evaluation for a possible suicide attempt and stop the D5W drip

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