THE 13TH WORKSHOP ON VISUAL ANALYTICS IN HEALTHCARE

VAHC 2022

NOVEMBER 5, 2022

IN-PERSON MEETING, WASHINGTON DC

AMIA 2022 Pre-symposium Workshop

VAHC 2022 (13th workshop on Visual Analytics in Healthcare)

Schedule

	Time (EST)	Title	Presenters / Organizers
Morning	08:30 – 08:40	**Welcome and Introduction**	Danny Wu
	08:40 – 09:10	**Keynote**	Victor Lin
	09:10 – 09:40	**Didactic Session 1**	Swami Kandaswamy
	09:40 – 10:00	**Lightening Talks** (moderated by Danny Wu)	Max Adulyanukosol, Abraham Kim, Gargi Rajput, Andy Gao, Scott Vennemeyer, Derek Shu, Sunyung Fu, Huan He, and others
	10:00 – 10:30	**Poster Presentation 1 | AMIA Coffee Break**	Poster Presenters
	10:30 – 11:00	**Didactic Session 2**	Max Adulyanukosol
	Podium Presentations (moderated by Michael Tsai)		
	11:00 – 11:20	**Podium 1.** Patterns of Social Vulnerability – An Interactive Dashboard to Explore Risks to Public Health on the US County Level	Klaus Mueller
	11:20 – 11:40	**Podium 2.** Browser-based Infographic Tailoring Self-service Interface (BITSI)	Adriana Arcia
	11:40 – 12:00	**Podium 3.** Applying Visual Analytics to Develop a Clinical Workflow Analysis Tool (CWAT) to Explore Time and Motion Data in Healthcare	Danny Wu
Noon	12:00 – 13:15	Lunch Break / Student Mentorship	Scott Vennemeyer Max Adulyanukosol
Afternoon	**Podium Presentations** (moderated by Huan He)		
	13:15 – 13:35	**Podium 4.** The Effects of Data Visualization on User Perceptions of a Health Chatbot	Weichao Yuwen
	13:35 – 13:55	**Podium 5.** Evaluation of Data Visualizations for an Electronic Patient Preferences Tool for Older Adults Diagnosed with Hematologic Malignancies	Elizabeth Kwong
	13:55 – 14:15	**Podium 6.** An In-depth Needs Analysis to Design a Data Visualization Dashboard Prototype for Critical Care Setting	Humayera Islam
	14:15 – 14:30	**Design Activity 1**	Swami Kandaswamy
	14:30 – 15:00	**Poster Presentation 2 | AMIA Coffee Break**	Poster Presenters
	15:00 – 16:00	**Design Activity 2**	Diana Lin
	16:00 – 16:30	**Closing & Feedback**	Danny Wu

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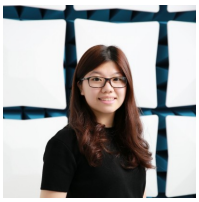

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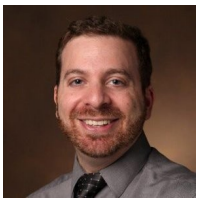

Jeremy Warner, MD
Vanderbilt University

Danny Wu, PhD, MSI
University of Cincinnati

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Keynote

08:40 – 09:10

Victor Lin, MD, MS, FAMIA

Visualizing Beyond the Frontiers of Healthcare

"A picture is worth a thousand words." This is the time-honored adage that reflects the human brain's immense capacity to efficiently receive and interpret visual information. With the ever-increasing data quantity and complexity within healthcare, data visualization becomes an invaluable tool to enable healthcare providers and organizations to make informed decisions which optimize the health of individuals and the population, as well as business practices. Furthermore, emerging capabilities such as artificial intelligence (AI), machine learning (ML), and natural language processing (NLP) showcase the tremendous power of healthcare data analytics. Visualization incorporating these capabilities harnesses this power, and truly pushes the frontiers of visual analytics and health informatics. When it comes to the future of healthcare data visualization and data analytics, the sky is the limit.

Victor is a United States Navy physician with combat experience. Board-certified and fellowship-trained in clinical informatics, he is a Fellow of AMIA intensely passionate about applying technology to improve healthcare and health. Victor currently serves as the Chief Medical Informatics Officer for the Pacific region of Navy Medicine. In this role, Victor continuously pushes the frontiers of what is possible with health informatics and analytics, leading the development and implementation of not only clinical information systems for hospitals and clinics, but also unique solutions for our Fleet and Fleet Marine Forces. In his spare time, he enjoys traveling the world with his wife Diana who is a fellow informaticist.

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Poster Presentations

09:40 — 10:00 (Lightening Talk), 10:00 — 10:30, 14:30 — 15:00

Poster 1 (#1001): Expanding the existing Cadence event visual analysis tool to support the standardized data model OMOP CDM

Natthawut (Max) Adulyanukosol[1], David Gotz[2]

[1]Carolina Health Informatics Program, University of North Carolina at Chapel Hill; [2]School of Information and Library Science, University of North Carolina at Chapel Hill

Abstract*: The differences in health data models obstruct the use of analytics tools on new datasets or at other institutions. This work presents a data conversion tool that converts data from the standardized Observational Medical Outcomes Partnership (OMOP) Common Data Model (CDM) to be compatible with the existing Cadence event visual analysis tool. The tool is available as a web-based application with an interactive data quality report, which makes the data conversion process more observable visually. Users may detect anomalies and unexpected data distributions in the converted data, and solve the issues prior to uploading the data to Cadence. This conversion and visual assessment concept could be applied to other existing analytics tools in healthcare by leveraging the OMOP CDM, and could improve data quality for subsequent analyses.*

Keywords*: Data harmonization, Data quality, Visual data mining of EMRs, Longitudinal clinical data*

System Demo: *https://youtu.be/I7QzVN_jWZU*

Poster 2 (#1002): Examining Athletic Trainers' Impact on Student Athlete Emergency Room and Urgent Care Visits Using Electronic Health Records and Visual Analytics

Abraham Kim[1], Scott Bonnette[2], Chen Xin[1], Victoria L. Graham[3], Kelsey Logan[1,2], Danny T.Y. Wu[1]

[1]University of Cincinnati College of Medicine, Cincinnati, OH; [2]Division of Sports Medicine, Cincinnati Children's Hospital Medical Center, Cincinnati, OH; [3]American Public University System, Charles Town, WV

Abstract*: Athletic Trainers (ATs) are crucial to the process of coordinating care and preventing injuries for student athletes. Despite this, not all high schools have ATs for various reasons. Therefore, it is imperative to examine the impact of ATs. In this mixed methods study, we examine student athlete's electronic health records (EHRs) and conduct semi-structured interviews to determine the influence of AT presence on the number of Emergency Room visits. To facilitate the statistical analysis of the quantitative data, a R-shiny application was developed utilizing visual analytics. This application allowed the research team to explore with the EHR data through interactive visualization and see statistical comparison results immediately. The R-shiny application is being refined to further explore the data and provide empirical evidence to the qualitative themes.*

Keywords: *Sports Medicine, Electronic Health Records, Interactive Dashboard, Implementation*

System Demo: *https://youtu.be/GzT_ndeG6M8*

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Poster 3 (#1011): Exploring the Sleep Patterns of Students in a Medical Sciences Baccalaureate Program using Self-Reported Data and Visual Analytics

Gargi Rajput[1], Andy Gao[1], Ching-Tzu Tsai[1,2], Jennifer R.V. Molano[1], Danny T.Y. Wu[1]

[1]University of Cincinnati College of Medicine, Cincinnati, OH; [2]DAAP School of Design

***Abstract**: Poor sleep patterns have been commonly linked to college students. However, this study targets a gap in literature by exploring the sleep patterns in pre-medicine college students. Using self-report measures, student's perception on their sleep quality and stress level was measured, along with their Pittsburgh Sleep Quality Index score. The collected data was analyzed via R-shiny visualization system. As a result, pre-med students turned out to sleep for an adequate duration but had poor sleep quality. They also experienced worse sleep than they had perceived. Hence, there is a need for self-monitoring amongst pre-meds to increase awareness and sleep hygiene.*

***Keywords**: Sleep Patterns, Pre-Med Students, Survey, Interactive Dashboard, Implementation*

***System Demo:** https://youtu.be/wODAjzm3yyo*

Poster 4 (#1017): Assessing User Experience on Fitbit Sleep Data Visualization: A Pilot Study

Gargi Rajput[1], Ching-Tzu Tsai[1,2], **Andy Gao**[1], Danny T.Y. Wu[1,2]

[1]College of Medicine; [2]DAAP School of Design, University of Cincinnati, Cincinnati, OH

***Abstract**: The collection of patient-generated health data has become more common through tracking apps and wearables, such as Fitbits. While these devices collect and arrange data through simplified visualizations to aid user comprehension of the data, their true understandability is unknown. This pilot study aimed to explore the Fitbit Inspire 2 watch along with the Fitbit app to determine the usefulness and perception of current visualizations of sleep data. The study assessed user feedback through two rounds of data collection. Feedback data from a focus group and semi-structured interviews revealed five sweet points and four major pain points. The themes determined in this study informed design and visualization recommendations to improve the usability and understandability of Fitbit sleep data visualizations.*

***Keywords**: Sleep Patterns, User Perception, Data Visualization, Usability*

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Poster 5 (#1016): Applying Visual Analytics to Support Clinical Competency Assessment for Internal Medicine Residents

Scott Vennemeyer[1], Andy Gao[1], Siyi Zhu[1], Ezra Edgerton[3], James Lee[3], Benjamin Kinnear[2], Daniel P Schauer[2], Michelle I. Knopp[2], Eric Warm[2], Danny T.Y Wu[1]

[1]Department of Biomedical Informatics; [2]Department of Internal Medicine; [3]Digital Scholarship Center, University of Cincinnati College of Medicine, Cincinnati, OH, USA

***Abstract**: Clinical Competency Committees (CCC) assess the progress and readiness to practice of medical residents in their programs. Working with the CCC at our institution, we employed user-centered design to implement an interactive dashboard that would assist their competency assessment process. In this system demonstration poster, we discuss the dashboard that we have built and how visual analytics can be used to improve the resident competency assessment process.*

***Keywords**: Residency Training, Visual Analytics, User-Centered Design*

***System Demo:** xxx*

Poster 6 (#1020): Applying Visual Analytics to Develop a Web Application to Collect Real-time Clinician Well-being Levels in an Adult Academic Health System

Catherine T. Xu[1], **Derek Shu[1]**, Hager Hamed[1], Somya Pandey[1], Virginia Walls[2], Kristen Tenney[2], Abby Lewis[2], Lisa Melink[2], Jennifer Molano[1], Danny T.Y. Wu[1]

[1]University of Cincinnati College of Medicine, Cincinnati, OH; [2]University of Cincinnati Academic Health System, Cincinnati, OH

***Abstract**: Well-being is multi-dimensional and is influenced by many factors that interact together within one's environment. This study aimed to develop a web application to consistently collect clinical well-being levels and provide real-time feedback to clinicians and administrators. A Well-being Check app was developed in a user-centered manner with two components: customizable survey and interactive visualization. Once enough data is accumulated, a large-scale analysis will be conducted with connections to the electronic health records to help inform organizational interventions.*

***Keywords**: Clinician Well-being, Survey, Interactive Dashboard, Usability, Implementation*

***System Demo**: https://youtu.be/hbGpEbp3czo*

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Poster 7 (#1018): Visual Text Analysis for NLP System Evaluation and Development

Huan He[1], **Sunyang Fu[1]**, Liwei Wang[1], Andrew Wen[1], Sijia Liu[1], Sungrim Moon[1], Kurt Miller[1], Hongfang Liu[1]

[1]Department of Artificial Intelligence and Informatics, Mayo Clinic, Rochester, MN, USA

Abstract*: With the rapid development of big data and deep learning techniques in recent years, natural language processing (NLP) systems have been widely used in the healthcare domain. Due to the low error tolerance for clinical use cases, such as clinical decision support and precision medicine, performance evaluation is a crucial task in developing and refining an NLP system. However, evaluating an NLP system for a specific clinical use case is challenging due to the complexity of the gold standard corpus creation and the evaluation process. In response, we proposed using web-based data visualization techniques to promote the whole process and developed several visual analysis modules based on a text annotation tool.*

Keywords*: Visual Analytics, Natural Language Processing, Corpus Development, Text Annotation*

System Demo*: https://youtu.be/lD-YJ1Ku3I4*

Poster 8 (#1027): Towards Real-time Visual Exploration of Multiple Pairwise Meta-analysis Results of Clinical Outcomes

Huan He[1], Irbaz Bin Riaz[2,4,5], Syed Arsalan Ahmed Naqvi[2], Rabbia Siddiqi[3], Noureen Asghar[3], Mahnoor Islam[3], M. Hassan Murad[4], Hongfang Liu[1]

[1]Department of Artificial Intelligence and Informatics, Mayo Clinic, Rochester, MN, USA; [2]Department of Oncology, Mayo Clinic, Phoenix, AZ, USA; [3]Dow University of Health Sciences, Karachi, Pakistan; [4]Mayo Clinic Evidence Based Practice Center, Mayo Clinic, Rochester, MN, USA; [5]Mass General Brigham Hospital, Harvard Medical School, Boston, MA, USA

Abstract*: An interactive and balanced presentation and interpretation of results from a pairwise meta-analysis (PWMA) can immensely facilitate evidence synthesizing in clinical research and practice. However, exploring the PWMA results for clinicians and researchers is challenging as the complexity of clinical questions increases and the vast number of involved studies and outcomes. In response, we proposed a web-based visual analytics system to facilitate the real-time exploration of massive PWMA results.*

Keywords*: Visual Analytics, Pairwise Meta-analysis*

System Demo*: https://youtu.be/_uQLHQLyeeo*

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Podium Presentations

11:00 — 12:00, 13:15 — 14:15

Podium 1 (#1006): Patterns of Social Vulnerability – An Interactive Dashboard to Explore Risks to Public Health on the US County Level

Darius Coelho[1], Nikita Gupta[2], Eric Papenhausen[1], **Klaus Mueller[1, 2]**

[1]Akai Kaeru LLC; [2]Stony Brook University

***Abstract**: Social vulnerability is the susceptibility of a community to be adversely impacted by natural hazards and public health emergencies, such as drought, earthquakes, flooding, virus outbreaks, and the like. Climate change is at the root of many recent natural hazards while the COVID-19 pandemic is still an active threat. Social vulnerability also refers to resilience, or the ability to recover from such adverse events. To gauge the many aspects of social vulnerability the US Center of Disease Control (CDC) has subdivided social vulnerabilities into distinct themes, such as socioeconomic status, household composition, and others. Knowing a community's social vulnerabilities can help policymakers and responders to recognize risks to community health, prepare for possible hazards, or recover from disasters. In this paper we study social vulnerabilities on the US county level and present research that suggests that there are certain combinations, or patterns, of social vulnerability indicators into which US counties can be grouped. We then present an interactive dashboard that allows analysts to explore these patterns in various ways. We demonstrate our methodology using COVID-19 death rate as the hazard and show that the patterns we identified have high predictive capabilities of the pandemic's local impact.*

***Keywords:** Visual analytics, pattern recognition, information visualization, multivariate data, epidemiology, public health, geospatial visualization*

Podium 2 (#1001): Browser-based Infographic Tailoring Self-service Interface (BITSI)

Adriana Arcia[1], Daniel Chen[2], Katherine South[3]

[1]Columbia University, University of San Diego; [2]University of British Columbia, RStudio PBC; [3]Columbia University School of Nursing

***Abstract**: Tailored infographics are useful tools for communicating health information to patients and research participants, particularly those with low health literacy, but software is required to automate the tailoring. The Browser-based Infographic Tailoring Self-service Interface (BITSI) is a bespoke software solution for tailoring infographics. BITSI produces batches or single PDFs of tailored infographics in English and Spanish of Asthma Control Test scores at one or two time points using a number line format. This opensource software uses R and a LaTeX compiler; development of a Shiny web application supported a user-friendly, browser-based interface. We improved upon previous infographic tailoring solutions by streamlining installation and creating a user-friendly point-and-click data entry interface. Due to its interface, BITSI is amenable to interfacing with other systems through application programming interfaces, such as with electronic health record systems. These improvements make deployment of tailored infographics in clinical and research settings feasible and practical.*

***Keywords**: Comprehension, audiovisual aids, information visualization, patient-reported outcomes.*

***System Demo:** https://youtu.be/AAQkpj3_jjY*

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Podium 3 (#1021): Applying Visual Analytics to Develop a Clinical Workflow Analysis Tool (CWAT) to Explore Time and Motion Data in Healthcare

Danny T.Y. Wu[1], Derek Shu[1], Khanh Le[1], Ruthik Abbu[1], Kai Zheng[2]

[1]Department of Biomedical Informatics, College of Medicine, University of Cincinnati; [2]Department of Informatics, School of Information and Computer Science, University of California, Irvine

Abstract*: Understanding clinical workflow is a crucial first step to improve the quality, safety, and efficiency of patient care delivery. It enables quality improvement processes and provides a basis to compare and quantify workflow improvements. A common source of data for studying clinical workflow is through time and motion studies, which generates multi-dimensional datasets that are challenging to analyze. Visual analytics can be an effective technique to show patterns and bottlenecks in the time and motion data. Moreover, workflow analysis often involves mixed-method design. The triangulation between the quantitative and qualitative data would require the support of a powerful data exploration tool. To address these challenges, we applied visual analytics to develop a clinical workflow analysis tool (CWAT) that allowed for easy identification of significant workflow patterns. In this system demonstration paper, we describe the visualization design choices and validation through case studies.*

Keywords*: clinical workflow, visual analytics, time and motion studies, electronic health records.*

System Demo*: https://youtu.be/z3obuvSdLeg*

Podium 4 (#1009): The Effects of Data Visualization on User Perceptions of a Health Chatbot

Ha-Kyung Kong[1], Ruijia Zhu[2], Audrey Zhixin Lu[2], Mingao He[2], **Weichao Yuwen**[3]

[1]Seattle University, Seattle, Washington; [2]University of Washington, Seattle, Washington; [3]University of Washington, Tacoma, Washington

Abstract*: Chatbots are increasingly used in healthcare as an accessible and scalable means to communicate information. While visualization can provide summaries of health data, their impact on the comprehension, perceived usefulness, and trustworthiness of chatbots is yet unknown. We examined the effects of visualization (intervention group) of health data compared to text-only representation (control group) among 96 family caregivers in a randomized controlled trial. The results showed that visualizing the relationship between symptom levels (e.g. stress) and health solutions had a significant impact on the comprehension of the health trends and the perceived effectiveness of the solution. While there was an increased trust level in the visualization group, the difference was not statistically significant. The qualitative feedback aligned with the quantitative results. We discussed future directions in leveraging the synergistic effects of visualization and chatbots to increase health literacy and encourage technology adoption.*

Keywords*: Human-centered computing, Visualization, Empirical studies in HCI, Applied computing, Health Informatics*

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Podium 5 (#1035): Evaluation of Data Visualizations for an Electronic Patient Preferences Tool for Older Adults Diagnosed with Hematologic Malignancies

Elizabeth Kwong[1], Amy Cole[1], Amro Khasawneh[2], Carl Mhina[3], Lukasz Mazur[1], Karthik Adapa[1], Daniel R. Richardson[4]

[1]UNC-Chapel Hill; [2]Mercer University; [3]Duke University; [4]Lineberger Comprehensive Cancer Center

Abstract*: Patients diagnosed with hematologic malignancies account for 10% of cancer related deaths. The growth of treatment options for hematologic malignancies has led to increased focus on treatment decision-making. However, little research has been done integrating patient-generated data and shared decision making to facilitate patient-clinician collaboration and understand patient preferences in cancer care. Our study aims to develop and evaluate data visualizations to support an electronic healthcare tool (EHT) to facilitate patient understanding of treatment outcomes using human-centered design methods. Data visualizations were developed and updated based on feedback from healthy volunteers, older adults with hematologic malignancies (patients), caregivers, and clinicians. We conducted a content analysis on the qualitative data gathered from participants. Our findings showed that users preferred easy to understand visualizations with simple, explanatory text compared to visualizations that were not immediately intuitive. Users also preferred visualizations that were more reflective of the individual's cancer treatment rather than a comparison to the patient population. Iterative improvements were made to the visualizations to reflect user feedback and will be used to inform the next iteration of visualizations for user testing in the clinic. This paper demonstrates the benefit of human- and user-centered design to iterate on data visualizations used to support a patient preference tool.*

Keywords*: data visualization, user-centered design, patient preference, patient-centered care, electronic healthcare tool, oncology*

Podium 6 (#1045): An In-depth Needs Analysis to Design a Data Visualization Dashboard Prototype for Critical Care Setting

Humayera Islam[1], *Xiaoxia* Li[1], Kamruz Zaman Rana[1], Khuder Alaboud[1], Tanmoy Paul[1], Abdullah Maruf[1], Abu Saleh Mohammad Mosa[1]

[1]University of Missouri, Columbia, Missouri, USA

Abstract*: Intensive Care Units (ICUs) regularly generate a high volume of data for their patients. ICU care providers often find interpreting and presenting the voluminous data generated to be timeconsuming during daily care routines. In the same light, a medical ICU at the University of Missouri (MU) Hospital in Columbia, Missouri, employed a visualization dashboard for effective team communication from easily accessible patient data visualization. However, the current dashboard has been underutilized due to many internal and external factors. Therefore, we aimed to redesign the ICU data visualization dashboard called IC-DASH that can overcome the challenges in the existing dashboard and seamlessly integrate it into the workflow of critical care. This paper presents the steps of an in-depth needs analysis implemented to build an ICU data visualization prototype called IC-DASH.*

Keywords*: ICU data visualization dashboard, needs analysis, mixed approach, reduce workload in critical care, promote team communication*
