THE 10TH WORKSHOP ON VISUAL ANALYTICS IN HEALTHCARE

VAHC 2020

NOVEMBER 14, 2020

VIRTUAL MEETING

AMIA 2020 Pre-symposium Workshop

VAHC 2020 (10th workshop on Visual Analytics in Healthcare)

	Time (EST)	Title	Author(s) or Presenter(s)
Morning Session	**Introduction & Keynote**		
	10:00 - 10:15	Welcome and Introduction	Danny Wu
	10:15 - 11:00	**Keynote** *"Information Visualization: Perspectives from My Roles as Researcher, Educator, and Editor"*	Suzanne Bakken
	Presentation #1 – COVID-19		
	11:00 - 11:10	**Poster 1:** The Visual Evolution of a COVID-19 Dashboard: Merging Clinical Operations with Public Health	Rhemar Esma, **Christina Guerrier**, Heather Kendall, Daniel Norez, Ian Tfirn, Guillame Labilloy, and Jennifer Fishe.
	11:10 - 11:20	**Poster 2:** Daily Visualization of Statewide COVID-19 Healthcare Data	Brian Dixon, Shaun Grannis, Umberto Tachinardi, Jennifer Williams, Connor McAndrews, and **Peter Embí**.
	11:20 – 11:35	**Paper 1:** Visual Analysis of Multi-scale Trends of COVID-19	**Huan He**, Sijia Liu, Liwei Wang, Andrew Wen, Ming Huang, Yanshan Wang, and Hongfang Liu
	11:35 – 11:50	**Paper 2:** Communicating on Multivariate and Geospatial Data supported by ergonomics criteria: COVID-19 case	**Hugues Turbé**, Victor Garretas Ruiz, Mina Bjelogrlic, Jessica Rochat, Christian Lovis
	11:50 – 12:15	COVID and Emerging Issues Discussion	Harry Hochheiser
Break	12:15-12:45	Lunch Break / Meet and Greet	Swami Kandaswamy
Afternoon Session I	**Presentation #2**		
	12:45 – 1:00	**Paper 3:** Sanguine: Visual Analysis for Patient Blood Management	**Haihan Lin**, Ryan Metcalf, Jack Wilburn, Alexander Lex
	1:00 - 1:15	**Paper 4:** Visualization Co-Design with Prostate Cancer Survivors who have Limited Graph Literacy	**Lauren Snyder**, Ayan Anandkumar Saraf, Regina Cassanova-Perez, Sarah E. Connor, Sheba George, Amelia Wang, Darwin Jones, Georgina Mendoza, John Gore, Mark S. Litwin, and Andrea Hartzler
	1:15 - 1:30	**Paper 5:** HealthDashboard: A Urban Public Health Geospatial Visualization Platform	Gabriely Pereira, **Lucas Stankus**, Gustavo Carlos, Eduardo Pinheiro, Rafael Manzo, Kelly Braghetto, Fabio Kon, and Paulo Meirelles.
Break	*1:30 - 1:45*	Break	

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Afternoon Session II	**Presentation #3**		
	1:45 - 1:55	**Poster 3:** A visual approach for analyzing readmissions in intensive care medicine	**Jan Scheer**, Till Nagel, and Thomas Ganslandt
	1:55 - 2:05	**Poster 4:** Feature Extraction and Visualization of Respiratory Therapist Notes for Pediatric Long-Term Ventilator Dependent Patients	Nathan Pajor, Lindsay Nickels, Ezra Edgerton, **Danny Wu**, Dan Benscoter, and James Lee
	2:05 – 2:15	**Poster 5:** Evaluation of a Data Dashboard to Support Resident Learning and Competency Assessment	**Scott Vennemeyer**, Milan Parikh, Shuai Mu, Benjamin Kinnear, Danny Wu
	2:15 – 2:30	**Closing**	Danny Wu

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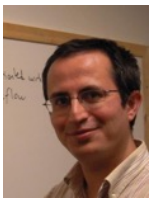

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Keynote

10:15 – 11:00

Dr. Suzanne Bakken

Information Visualization: Perspectives from My Roles as Researcher, Educator, and Editor

Suzanne Bakken, PhD, RN, FAAN, FACMI, FIAHSI, is the Alumni Professor of Nursing and Professor of Biomedical Informatics at Columbia University. Following her doctorate in Nursing at the University of California, San Francisco, she completed a post-doctoral fellowship in Medical Informatics at Stanford University. Her program of research has focused on the intersection of informatics and health equity for more than 30 years and has been funded by AHRQ, NCI, NIMH, NINR, and NLM. Dr. Bakken's program of research has resulted in > 300 peer-reviewed papers. At Columbia Nursing, she leads the NINR-funded Precision in Symptom Self-Management (PriSSM) Center and Reducing Health Disparities Through Informatics (RHeaDI) Pre- and Post-doctoral Training Program.

She is a Fellow of the American Academy of Nursing, American College of Medical Informatics, International Academy of Health Sciences Informatics, and a member of the National Academy of Medicine. Dr. Bakken has received multiple awards for her research including the Pathfinder Award from the Friends of the National Institute of Nursing Research, the Nursing Informatics Award from the Friends of the National Library of Medicine, the Sigma Theta Tau International Nurse Researchers Hall of Fame, and the Virginia K. Saba Award from the American Medical Informatics Association. Most recently, she was the first nurse recipient of the Francois Gremy Award from the International Medical Informatics Association. Dr. Bakken currently serves as Editor-in-Chief of the Journal of the American Medical Informatics Association and as a member of the Board of Regents of the National Library of Medicine.

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Presentation #1

11:00 – 11:50

Poster 1: The Visual Evolution of a COVID-19 Dashboard: Merging Clinical Operations with Public Health

Rhemar Esma, MD[1], **Christina Guerrier, MBA, SSBBP[2]**, Heather Kendall, BSN, RN, SSBBP[1], Daniel Norez, MPH[2], Ian Tfirn, MPH[2], Guillaume Labilloy, ME, MBA[2], Jennifer Fishe, MD[2]

[1]Quality Management, University of Florida Health – Jacksonville; [2]Center for Data Solutions, University of Florida College of Medicine – Jacksonville.

Abstract: *Many governmental bodies and healthcare organizations have developed dashboards to track key metrics related to the COVID-19 pandemic. We describe the visual and content evolution of a COVID-19 dashboard for a large academic healthcare organization located in Northeast Florida. Our dashboard's evolution illustrates the importance of merging hospital operational / clinical data with regional public health information.*

Keywords: *COVID-19, data analytics, forecasting, operations, public health, visualization.*

Poster 2: Daily Visualization of Statewide COVID-19 Healthcare Data

Brian E. Dixon, PhD[1,2], MPA, Shaun J. Grannis, MD, MS[1,3], Umberto Tachinardi, MD, MS[1,3], Jennifer L. Williams, MPH[1], Connor McAndrews, MS[1], **Peter J. Embí, MD, MS[1,3]**

[1]Regenstrief Institute, Inc.; [2]Indiana University – Fairbanks School of Public Health; [3]Indiana University School of Medicine

Abstract: *To manage a localized outbreak or global pandemic like COVID-19, Public Health agencies (PH) and health systems utilize a variety of information systems. Although existing PH information systems enable capture of data on laboratory- confirmed cases of COVID-19, the current pandemic has illuminated several deficits in the existing U.S. information infrastructure, including gaps in access to and visualization of near-real- time (daily) impacts to the healthcare system. To address these gaps, we leveraged our state-wide health information exchange- derived dataset that represents nearly all healthcare facilities in Indiana. The resultant dashboard has evolved to present data on hospitalization, emergency department utilization, and other metrics of interest to PH and a broader constituency across the state.*

Keywords: COVID-19. Coronavirus. Dash- board. Health Information Exchange. Public Health Informatics. Visualization.COVID-19. Coronavirus. Data Visualization.

Paper 1: Visual Analysis of Multi-scale Trends of COVID-19

Huan He, Sijia Liu, Liwei Wang, Andrew Wen, Ming Huang, Yanshan Wang, Hongfang Liu.

Division of Digital Health Research, Department of Health Sciences Research, Mayo Clinic

Abstract: *The fast spread of the coronavirus disease 2019 (COVID-19) sig- nificantly impacts people's lives in all regions. Timely identifying the regional trend of COVID-19 pandemics is crucial for both local disease prevention and policymaking. However, due to the large volume of continuously generated COVID-19 data, it is challeng- ing to capture and explore specific regions' trends. To address this challenge, we proposed new indicators to describe both the current status and trend. Moreover, we designed a trend chart for showing our proposed indicators and developed a visual analytic dashboard to track and analyze the regional COVID-19 pandemics. Based on our dashboard, we validated and identified some geographical and temporal patterns in the COVID-19 data.*

Keywords: Human-centered computing, Visualization, Visualization techniques; Human-centered computing,, Visualization systems and tools

Paper 2: Communicating on Multivariate and Geospatial Data supported by ergonomics criteria: COVID-19 case

Hugues Turbé[1,2,*], Victor Garretas Ruiz[1,2,*], Mina Bjelogrlic[1,2,*], Jessica Rochat[1,2], Christian Lovis[1,2]

[1]Medical Information Sciences Division, Department of Radiology and Medical Informatics, University of Geneva, Switzerland; [2]Medical Information Sciences Division, Diagnostic Department, University Hospitals of Geneva, Switzerland; [*]these authors contributed equally to this work

Abstract: *Since Fall 2019, the rapid spread of SARS-CoV-2 virus has changed everyday life routines globally. Public health confinement measures have been taken to contain the propagation of the pandemic. An international effort has been made to model and predict the spatio-temporal evolution of the pandemic . Today, a main question arises on how to communicate complex multivariate, geospatial and time dependent information efficiently. A further challenge consists in communication these information without any bias or place for misinterpretation, and for the largest targeted audience. In this regard the following paper will first identify ergonomics criteria for efficient data visualization, and then present several visualizations in a pre/post fashion, reflecting how visualizations initially proposed by data scientists can be improved after the application of ergonomics guidelines.*

Keywords: *Data visualization, Ergonomics, Infectious Disease*

Presentation #2

12:45 – 1:30

Paper 3: Sanguine: Visual Analysis for Patient Blood Management

Haihan Lin[1], Ryan A. Metcalf [2], Jack Wilburn[1], Alexander Lex[1]

[1]University of Utah; [2]ARUP Laboratories – University of Utah

Abstract*: Blood transfusion is a frequently performed medical procedure in surgical and nonsurgical contexts. Although it is frequently necessary or even life-saving, it has been identified as one of the most overused procedures in hospitals. Unnecessary transfusions not only waste resources but can also be detrimental to patient out- comes. Patient blood management (PBM) is the clinical practice of optimizing transfusions and associated outcomes. In this paper, we introduce Sanguine, a visual analysis tool for transfusion data and related patient medical records. Sanguine was designed with two user groups in mind: PBM experts and clinicians who conduct transfusions. PBM experts use Sanguine to explore and analyze transfusion practices and its associated medical outcomes. They can compare individual surgeons, or compare outcomes or time periods, such as before and after an intervention regarding transfusion practices. PBM experts then curate and annotate views for communication with clinicians, with the goal of improving their transfusion practices. Such a review session could be in person or through a shared link. We validate the utility and effectiveness of Sanguine through case studies.*

Keywords: Human-centered computing—Visualization— Visualization application domains—Information visualization

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Paper 4: Visualization Co-Design with Prostate Cancer Survivors who have Limited Graph Literacy

Lauren Snyder[1], Ayan Anandkumar Saraf [1] , Regina Casanova-Perez[1] , Sarah E. Connor[2] , Sheba George[3,4] , Amelia Wang[1] , Darwin Jones[1] , Georgina Mendoza[2], John Gore[5] , Mark S. Litwin[2,3,6], Andrea Hartzler[1]

[1]Department of Biomedical Informatics and Medical Education, University of Washington, Seattle, WA; [2]Department of Urology, University of California, Los Angeles, CA; [3]Department of Community Health Sciences, The Fielding School of Public Health, University of California, Los Angeles, CA; [4]Center for Biomedical Informatics, Charles R. Drew University of Medicine and Science, Los Angeles, CA; [5]Department of Urology, University of Washington, Seattle, WA; [6]School of Nursing, University of California, Los Angeles, CA

Abstract*: Visualizing patient-reported outcomes overtime has become a common strategy to help patients track their health. However, traditional line graphs and bar charts might be less accessible to people with limited numeracy and graph literacy. Although patient- reported outcomes (PRO) among prostate cancer survivors may be collected with extant validated instruments, such as the Expanded Prostate Cancer Index (EPIC-26), survivors with limited numeracy and graph literacy may not have access to or understand personal trends in their PRO data. The Graphical Representation of Symptoms of Prostate Cancer (GRASP) research team embarked on a 4-stage design process with prostate cancer survivors with limited graph literacy to investigate design considerations for timeline visualizations, including preferences, acceptability, and understandability. Through focus groups, surveys, and the recurring engagement of a community-based Patient Advisory Board, we identified 3 design approaches that reflect the needs of low graph literacy patients as well as show promise to increase acceptance and comprehension. We are developing these designs into interactive prototypes for evaluation through user testing. Findings from our design process provide insight into effective strategies for engaging vulnerable patients for visualization co- design using in-person and remote methods. Finally, the design considerations we identified for prostate cancer survivors with limited graph literacy that may provide insight for visualizations of PROs for other vulnerable groups.*

Keywords: graph literacy, prostate cancer, patient reported outcomes

Paper 5: HealthDashboard: A Urban Public Health Geospatial Visualization Platform

Gabriely Pereira[1], **Lucas Stankus[1]**, Gustavo Carlos[1], Eduardo Pinheiro[1], Rafael Manzo[1], Kelly Braghetto[1], Fabio Kon[1], Paulo Meirelles[1]

[1]Free/Open Source Software Competence Center, Institute of Mathematics and Statistics (IME), University of São Paulo (USP)

Abstract*: Public healthcare systems generate large amounts of heterogeneous data that can provide valuable insights to inform public policy design. However, extracting relevant information from extensive heterogeneous datasets might be challenging. To address this problem, in a government-academia collaboration, we are developing an interactive visual dash- board for large-scale data analysis based on the Brazilian National Health System (SUS) hospitalization data. Its soft- ware architecture enables integration with the Hospital In- formation System (SIH-SUS) datasets from any region of Brazil so that health professionals can use it in hundreds of different cities. We defined an architecture that tames code complexity and brings modularity to the system. The platform processes SIH-SUS data and stores it into a geolocated relational database. Expert users can then perform advanced queries on the data with composite filters. Results are then displayed via multiple map visualizations, graphs, and tables. We expect that this open-source platform will become a useful tool for science-based public health policy- making, influencing Brazilian public managers in the future to adopt an evidence-based, data-driven approach to health- care management.*

Keywords: Human-centered computing—Visualization; Software and its engineering—Open source model

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Presentation #3

Poster 3: A visual approach for analyzing readmissions in intensive care medicine

Jan Scheer[1,2], Till Nagel[1], Thomas Ganslandt[2]

[1]Faculty of Computer Science, Manheim University of Applied Sciences; [2]Department for Biomedical Informatics, Heinrich-Lanz-Center for Digital Health, University Medicine Mannheim

***Abstract**: Intensive care units (ICUs) are under constant pressure to balance capacity. ICUs have a limited number of resources and therefore effective monitoring of planned and unplanned transfers is crucial. Transfers can result in critical readmissions, i.e. "down" transfers from ICUs to a normal ward or an intermediate care unit (IMC) and back "up" to an ICU within a short time span. In this work, we present a tool to visually analyze such readmissions. Patient transfer data is extracted from a clinical data warehouse via HL7-FHIR. The interactive prototype consists of a timeline of readmission cases, an aggregated view of transfer flows between wards, and histograms and calender heatmaps to show a set of key performance indicators. The aim of our tool is to support identifying peaks, discovering temporal patterns, comparing wards, and investigating potential causes. We report on our user centered approach, describe the data pipeline, present the visualization and interaction techniques of the functional prototype, and discuss initial feedback.*

Keywords: patient transfers, intensive care units, temporal sequence visualization, flow visualization

Poster 4: Feature Extraction and Visualization of Respiratory Therapist Notes for Pediatric Long-Term Ventilator Dependent Patients

Nathan M. Pajor, MD[1,3], Lindsay Nickels, PhD[2], Ezra Edgerton, BS, BA[2], Danny T.Y Wu, PhD[3], MSI, Dan T. Benscoter, DO[1,3], James J. Lee, PhD[2]

[1]Division of Pulmonary Medicine, Cincinnati Children's Hospital Medical Center; [2]Digital Scholarship Center, University of Cincinnati; [3]University of Cincinnati College of Medicine

***Abstract:** Children with long-term ventilator dependence are a growing population that generate substantial cost to the healthcare system and require very lengthy admissions to initiate support. Respiratory therapy notes contain free-text descriptions of key respiratory events during these admissions but are underutilized. Using a retrospective electronic health record data set from 101 patients, we identified more clinically concerning patients, extracted key features from the free-text notes that differentiated these patients, and displayed those features in a timeline visualization that has implications for clinical decision support.*

Keywords: linguistic analysis. information visualization. pediatrics

Poster 5: Evaluation of a Data Dashboard to Support Resident Learning and Competency Assessment

Scott Vennemeyer[1], Milan Parikh[1], Shuai Mu, MDes[1], Benjamin Kinnear, MD[1,2], Danny T.Y Wu, PhD, MSI[1]

[1]University of Cincinnati College of Medicine; [2]Cincinnati Children's Hospital Medical Center

***Abstract:** This study aimed to evaluate a dashboard designed by the Internal Medicine Residency Program Clinical Competency Committee at the University of Cincinnati by conducting semi- structured interviews and a card-sorting activity. We found that users of the system were well equipped to share actionable insights about the current system and that they provided useful commentary that will inform the design of a new system that is more dynamic and that will fit the needs of the current users more effectively.*

Keywords: user-centered design, health IT, visual analytics