Clinical Pearl:
The Clinical Utility of the 'World Wide Web' with Historical Perspective from Tim Berners-Lee's Book 'Weaving the Web'

Joseph R. Hageman, MD, Kelty Allen, PhD, Tatiana Anderson, PhD, Mitchell Goldstein, MD.

Introduction

I am amazed every time I take a minute to "Google" a clinical question using the 'World Wide Web'! Since I have had the opportunity to collaborate with Drs. Kelty Allen and Tatiana Anderson at the SIDS Summit (1) and learn from their recent article about research analysis of big data just published in Neonatology Today (2), I felt like I wanted to learn more about who invented the 'world wide web' and how it was developed. So I asked "Siri," and she told me it was Tim Berners-Lee and gave me the link to his book, which is entitled "Weaving the Web: The Original Design and Ultimate Destiny of the World Wide Web (3)". I then used "electronic mail" and asked if they would be interested in helping me write an article about the clinical utility of the World Wide Web (WWW) with some historical perspective (3). I also communicated with Dr. Mitchell Goldstein, our Editor-in-Chief and Chair of the Section on Advances in Therapeutics and Technology, American Academy of Pediatrics, to provide his perspective about the clinical utility of the WWW, and he agreed to help.

"In reading this interesting and amazing story, Berners-Lee states, "the vision I have for the Web is about anything being potentially connected with anything" (3-p1). He also notes, "inventing the World Wide Web involved my growing realization that there was a power in arranging ideas in an unconstrained, web-like way."

In reading this interesting and amazing story, Berners-Lee states, "the vision I have for the Web is about anything being potentially connected with anything" (3-p1). He also notes, "inventing the World Wide Web involved my growing realization that there was a power in arranging ideas in an unconstrained, web-like way. And that awareness came to me through precisely that kind of process" (3-p3). Finally, "I articulated the vision, wrote the first Web programs, and came up with the now pervasive acronyms URL (then UDI), HTTP, HTML, and of course, World Wide Web" (3-p2).

The fact is, as clinicians, we need to have a basic solid understanding of the Web works, what information is available, since nowadays, our patients and their families come to us with all kinds of clinical information and knowledge from a variety of different sources from all over the world and present it to us as clinically reliable, up to date and state of the art since they found it on the internet. It is clear that Tim Berners-Lee, the son of mathematicians, who is currently the director of the World Wide Web Consortium and 3Com Founders Chair at the MIT Laboratory for Com-

puter Science, has accomplished what he started out to do. This resource is an asset that has both made our job easier and harder at the same time.

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national data sets, and communicate and collaborate with other investigators, using the WWW, I realized how little I really knew and how much I wanted to know about the clinical utility of the World Wide Web. I hope you will find this information useful and

helpful as I have.

Now we are in the midst of the COVID-19 pandemic, and data about pregnant mothers and their infants are coming from all over the world almost daily, via the World Wide Web! We have been presenting new COVID-19 related clinical pearls monthly as strategies for universal screening of pregnant women presenting to labor and delivery have been variable and ongoing depending on the hospital system and organization (3-5). Universal screening COVID-19 positive rates for pregnant women varied from 7%-14% depending on where and when mothers were screened during the pandemic (6-8). About three-quarters of the women were clinically asymptomatic (8). Here is one example from the Mass General Questions and Answers regarding the reasoning for universal screening:

Q: I have heard that some hospitals are testing all women for COVID-19 who arrive to the hospital for labor—even women without any symptoms. Will I be tested when I arrive at Mass General?

A: With guidance from infection control specialists and our colleagues in other states, Mass General, along with all our partner hospitals, is testing all women arriving at Labor and Delivery for COVID-19. Some patients who have no symptoms may be identified as COVID positive, and this information will allow us to take the best care of all the mothers and babies on the unit (6).

Clinical manifestations of pregnant and recently pregnant women with suspected or confirmed COVID-19 disease and their infants have been reported from all over the world (7-9). The studies were summarized in a systematic review and meta-analysis in the British Medical Journal by Allotey and colleagues, which included 77 cohort studies from the United States (26), China (24), Italy (7), Spain (6), United Kingdom (3), France (3), and one each from Belgium, Brazil, Denmark, Israel, Japan, Mexico, the Netherlands, and Portugal (8). The pregnant or recently pregnant women most commonly presented with fever (40%) and cough (39%); lymphopenia (35%) and elevated C reactive protein levels (49%) were the most common laboratory findings compared with non-pregnant women with COVID-19 disease (7). A total of 73 women (out of 11,580 women) with confirmed COVID-19 disease died from any cause (7). Thirteen percent of these women were diagnosed with severe COVID-19, 4% were admitted to the intensive care unit, 3% required invasive ventilation, and 0.4% required extracorporeal membrane oxygenation (7). In this review, maternal risk factors associated with severe COVID-19 were increasing age, high body mass index, chronic hypertension, and pre-existing diabetes mellitus (7).

On the newborn infant side, pregnant women with COIVD-19 had an increased risk of delivering a preterm infant and having their newborn infant admitted to the neonatal intensive care unit (NICU) (7). There were six neonatal deaths (26 studies with 1728 neonates) and 18 stillbirths (27 studies; 2837 offspring); however, this was considered to be low or "negligible" risk (7).

In another study of pregnant women presenting to labor and delivery in Sweden, RT-PCR testing was done and among the 2682 patients presenting, 156 (5.8%) tested positive for COVID-19 (9). A total of 65% of women were clinically asymptomatic (10). The COVID-19 positive pregnant women were matched with COVID-19 negative pregnant women, and those testing positive were more likely to have preeclampsia, and there was no difference in 5-minute APGAR scores or birthweight for gestational age in their newborn infants (9).

The value of access to data from all over the world via the World Wide Web to clinicians, researchers, and public health professionals is evident from this brief review. Again, as Berners-Lee states, "the vision I have for the Web is about anything being potentially connected with anything" (3-p1). He also notes, "inventing the World Wide Web involved my growing realization that there was a power in arranging ideas in an unconstrained, web-like way (3)".

Although these web-like manifestations are the substance that makes the World Wide Web so enduring to us, we must remember its potential as "an internet." The very fact that it provides connection, content, and context is the basis for our ability to amalgamate data from myriad sources to provide the raw material for big data and predictive analytic solutions that would have been improbable just twenty years ago.

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References

1. Hageman, JR. SIDS Summit. Pediatric Annals 2020; 49(1): e1-e2. https://doi.org/10.3928/19382359-20191211-02
2. Anderson TM, Allen K. Clinical Pearl: "What Does Research Analysis of "Big Data" Really Mean to the Pediatric Provider Regarding Sudden Unexpected Infant Death and Safe Sleep Recommendations? Neonatology Today 2020; 15(1): 75-76.
3. Berners-Lee T, Fischetti M. Weaving the web. New York: HarperCollins, 1999. P.18.
4. Sutton D, Fuchs K, D'Alton M, Goffman D. Universal screening for SARS-CoV-2 in women admitted for delivery. N Engl J Med 2020; 382(22): 2163-2164.
5. https://www.acog.org/clinical/clinical-guidance/practice-advisory/articles/2020/03/novel-coronavirus-2019.
6. https://www.massgeneral.org/obgyn/news/faq-coronavirus-during-pregnancy.
7. Allotey J, Stallings E, Bonnet M et al. Clinical manifestations, risk factors and maternal and perinatal outcomes of coronavirus 2019 in pregnancy: Living systematic review and meta-analysis. BMJ 2020; 370 doi: https://doi.org. 10.1136/bmjm3320.
8. Perlman J, Oxford C, Chang C et al. Delivery room preparedness and early neonatal outcomes during the COVID-19 pandemic in New York City. Pediatrics 2020; 146(2): E20201567.
9. Ahlberg M, Neovius M, Saltvedt S et al. Association of SARS-CoV-2 test status and pregnancy outcomes. JAMA 2020; Published September 23, 2020.

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