Data & Analytics Innovation in Public Health

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Recommendations

It is recommended that the Board of Health receive this report for information.

Key Points

- WDG Public Health continues to lead Ontario Public Health Units (PHUs) in application of innovative technologies to improve health outcomes and organizational efficiency.
- Creation of a data inventory improves data discoverability, supporting agency decision making.
- A future data inventory for external partners is poised to strengthen relationships with community organizations and the rest of the local health system.
- Embracing open-source projects reflects a commitment to transparency, knowledge sharing and collaboration within the public health sector.
- Improvements to the Immunization of School Pupils Act (ISPA) notification process, and Chatbot show a continued focus on client experience.

Background

The innovation report series stories WDG Public Health's commitment to improving its efficiency in operation, and capacity to support the health of the community through innovative applications of technology.

Like the previous report, BH.01.JUN0723.R17 *Public Health Innovations in Analytics*, this report discusses five projects or initiatives that have strong potential for impact in public health practice.[1] Some of these topics are updates on long-term initiatives, while others are entirely new. This year the innovation report reflects on:

1. Transitioning to a more flexible tool for generating Immunization of School Pupils Act (ISPA) notices;
2. Continued strengthening of data governance at WDG Public Health, and its relation to the application of Artificial Intelligence (AI);
3. Adoption of an AI platform to streamline development of new automation and machine learning applications;
4. Continued development and expansion of WDG Public Health's open-source initiative; and
5. Partnerships to expand use of WDG Public Health's Chatbot, and opportunities for monitoring emerging public health concerns using AI.

Each of these projects exemplifies WDG Public Health's dedication to the use of emerging tools to deliver public health outcomes to the region, particularly in the realm of data and analytics.

Discussion

Immunization of School Pupils Act (ISPA) Notification Process

The Immunization of School Pupils Act (ISPA) is a legislative framework mandating the immunization of children attending school in Ontario. This act covers vaccines against diseases like diphtheria, tetanus, polio, measles, mumps, and rubella, ensuring that students are protected against these significant health threats. Public Health Units (PHUs) play a crucial role in enforcing ISPA by maintaining immunization records, issuing notices for overdue vaccinations, and facilitating the catch-up of missing vaccines. PHUs must ensure compliance with ISPA, which involves considerable administrative effort to track and communicate with families about their children's vaccination status.

While ISPA mandates certain vaccines, WDG Public Health also emphasizes the importance of other recommended vaccines like Hepatitis B (Hep B) and Human Papillomavirus (HPV). Though not mandated under ISPA, these vaccines are crucial for preventing serious diseases that can affect students' health later in life.

For the 2023/24 school year, WDG Public Health moved away from the rigid provincial tool for generating ISPA notices. Instead, the Agency used available data in combination with an internally built document generation tool. By doing this, WDG Public Health gained complete flexibility in notice content. During the 2023/24 school year, WDG Public Health mailed over 12,000 immunization notices utilizing this new approach. This strategic shift allowed for:

- **Comprehensive Coverage**: Including immunization status of both ISPA-mandated and WDG Public Health-recommended vaccines.

- **Complete Health Record**: Offering a more complete health record of all vaccines on record, rather than just those of ISPA-mandated vaccines on the notice.

- **Improved Clarity**: Gaining full control over the layout and content of the notices, enabling straightforward, clear and easy-to-understand information for families.

- **Operational Efficiency:** Messaging improvements reducing the number of families requiring additional support from WDG Public Health staff to update their records.

- **Reduction of Manual Work:** Eliminating manual modification of each notice with WDG Public Health-specific instructions — a task that previously consumed significant staff time.

Any changes to how sensitive health information is processed and shared must protect privacy and ensure information security. Significant internal auditing ensured that the gains made through this initiative with communication, operational efficiency and population health did not come with increased privacy risk.

Using an innovative approach to the traditional ISPA process helped WDG Public Health move beyond simply addressing the legislative requirements to provide more comprehensive information on childhood vaccinations. The success of this initiative has led to adoption of similar technical approaches for enhancing operational efficiency and communication in other public health processes.

Data Governance

WDG Public Health's data management strategies have evolved from informal processes to a more intentional, structured data governance framework. One of the Agency's first priorities with regards to data governance was to inventory its most regularly used data assets. This effort was completed in 2023 and includes descriptions (such as name, category, and a written summary) as well as key contact details (ownership information and internal contacts) for working with each data asset. This inventory increases data discoverability, accessibility and supports overall data literacy in the agency.

WDG Public Health's data governance model promotes a shared responsibility to understanding, maintaining, and improving the quality of the agency's data assets. Data stewardship responsibilities are distributed across divisions, ensuring that those that have developed expertise interacting with the data have a role in its maintenance.

Reliable solutions using artificial intelligence (AI) can only be developed when there is a strong foundation of effective data governance. WDG Public Health's work in data governance positions it for innovative and efficient public health approaches leveraging AI in the future.

In the next stage of the Data Governance initiative, WDG Public Health is preparing to share its data inventory with external partners. The Agency is also reviewing its data collection approaches, particularly for sociodemographic information in agency-developed surveys.

WDG Public Health's data governance initiative is not solely focused on transparency but is aimed at fostering collaborative efforts to address public health challenges more effectively through shared knowledge and resources.

AI Platform

WDG Public Health is a leader amongst Ontario PHUs in exploring and applying advanced data science and automation technologies to optimize public health practice. For the past year, The Agency has been piloting an AI platform based on an open-source project called Kubeflow.[2] This platform streamlines the process of taking an automation or machine learning model from the development stage to being utilized in production. The platform also supports best practices for project management, isolation, reproducibility, and security. These practices are critical in public health, where accountability and collaboration are essential to the success of projects and for trust in the organization. Kubeflow has been adopted by many prominent private sector organizations and a few savvy public sector organizations, including Statistics Canada with their *Advanced Analytics Workspace*.[3]

The adoption of an AI platform at WDG Public Health demonstrates a proactive approach to harnessing the power of AI and data science to improve public health activities and outcomes. It reflects a broader strategy to not only address current health challenges but also to build a resilient and adaptable public health infrastructure capable of meeting the future needs of the community.

Open-Source

Since the previous innovation report, WDG Public Health has continued to utilize open-source approaches as a strategy to advance public health analytics and operational efficiency. The Agency fosters an environment of transparency, collaboration, and shared innovation by making the code underlying solutions it develops freely and publicly available. This approach not only amplifies WDG Public Health's internal capabilities but also extends its reach by offering tools and methodologies that can benefit other PHUs and collaborators.

There is a slate of new and forthcoming open-source projects aimed at advancing public health practices through technological innovation and collaboration. Each project, while distinct in application, aligns with broader objectives of enhancing operational efficiency, transparency, and collaboration amongst PHUs.

Wastewater-Based Epidemiology Automation and Analyses: Wastewater surveillance is used as a key indicator of disease activity for public health organizations at the local, provincial and national level. This forthcoming open-source project provides automated retrieval and modelling of wastewater data for disease surveillance. This project was initially developed to provide intelligence of COVID-19 activity but has increased its scope to include other disease targets. The project now supports surveillance of SARS-CoV-2 (the virus that causes COVID-19), Influenza A, Influenza B, and can be further extended if data on new disease targets becomes available. This project provides transparency in how the WDG Public Health analyzes wastewater surveillance data. Output of the analysis is shared every week publicly through the Agency's Respiratory Illness Activity Dashboard (see **Figure 1**).[4] This project is successful at WDG Public Health due to the Application Programming Interface (API)-based access to the Wastewater Surveillance Initiative (WSI) platform, with continued dedication to the project from laboratories at the University of Guelph, and through use of WDG Public Health's advanced data infrastructure. This project could be leverage by any organization with involvement in the WSI, which includes all Ontario PHUs and university research laboratories.
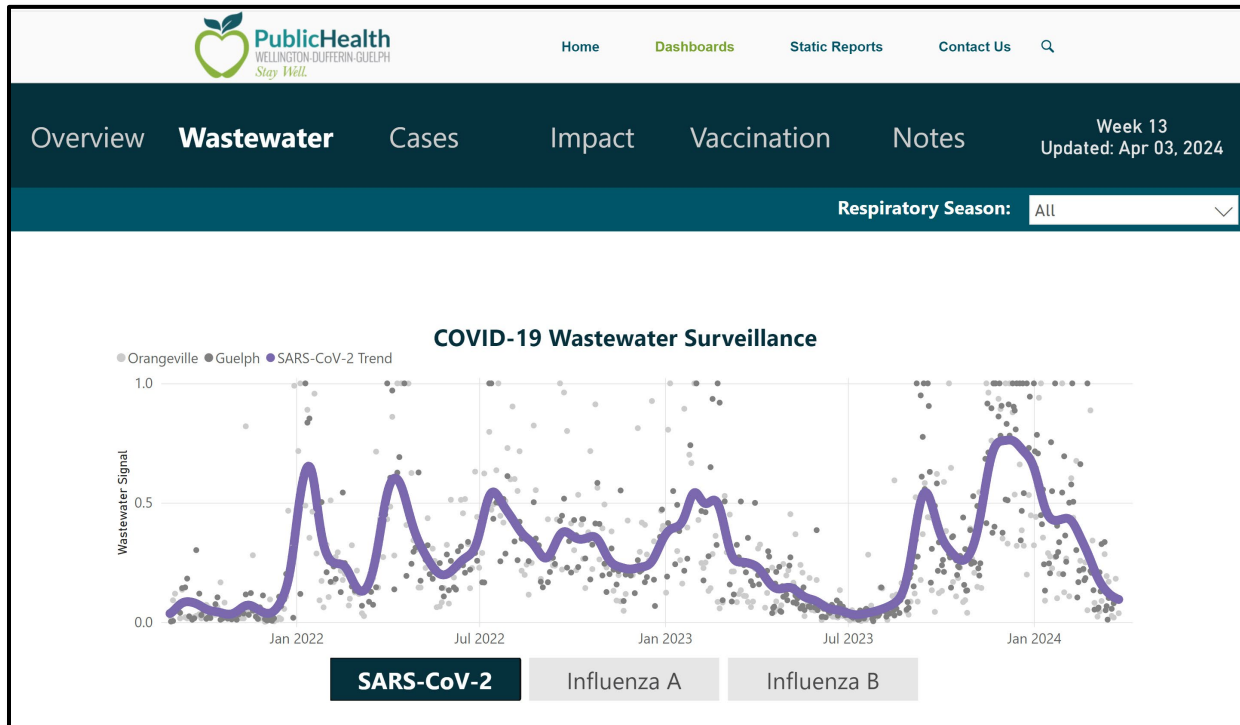
Figure 1: WDG Public Health's wastewater-based epidemiology analysis results are shared publicly each week through its Respiratory Illness Activity Dashboard. The automated process for creation of this analysis will be open-sourced in the near future. Analyses for COVID-19 as well as Influenza A and B are provided.

Well Water Testing Data Retrieval Pipeline: WDG Public Health estimates over 30,000 people in the region are reliant on privately owned wells for their water. It is strongly recommended that private wells are routinely tested for bacterial contamination due to the ability of bacterial contaminants to cause disease. Currently, private well water testing is offered for free by the province, and conducted at Public Health Ontario Laboratories (PHOL). WDG Public Health serves as a key node for WDG residents by distributing test kits, transporting collected samples to PHOL, and promoting the importance of regular well water testing to residents.

PHOL mails test results to residents and also provides the test data back to PHUs for their regions. Monitoring trends in testing rates and adverse results can guide PHUs in targeted promotion efforts for well water testing. The data can also support direct follow up with residents that have received adverse results to ensure that they are taking the steps necessary to protect their health. PHOL makes these data available to PHUs through a secure web portal that requires PHU staff to manually login to retrieve results.

This open-source project automates the daily process of retrieving well water testing data from the PHOL web portal, enhancing PHU efficiency in monitoring and responding to private well water safety. The approach of this project is generalized such that it can be easily used by other

Ontario PHUs. A project specifically for this is necessary as an API is not available for these data, and a more complex automation is required. WDG Public Health continues to advocate for API access to all the information systems it interacts with because of the transformative automation opportunities that having reliable programmatic interfaces to these systems enables.

Developer's Guide: This living document, hosted on GitHub, outlines best development practices for open-source projects at WDG Public Health. [5] The guide contains specific considerations relating to security, privacy, reproducibility, and project management. The guide can assist in code review, internal training and outlines expectations of external collaborators open-source projects that fall under WDG Public Health's purview. For the many developers which now utilize generative AI (gen AI) coding assistants, including the guide in the gen AI's knowledge store can help ensure recommendations are consistent with WDG Public Health's documented best practices. Overall, the developer's guide represents an important step in WDG Public Health's open-source initiative, helping to ensure that the agency's open-source projects maintain a standard of excellence, security, and reliability.

Vaccination History Visualizer: This tool transforms complex vaccination history data into accessible visuals that can be shared with clients and their health care providers. This project was a key element of the Agency's ISPA notification process this past year and could be used by any other PHU looking to take a customized approach to their ISPA notifications. This project will be released later this year, well in advance of the next school year's ISPA non-compliance notification period. This release schedule provides ample time for other PHUs to test and implement the approach themselves if they choose.

WDG Public Health's continued progress with its open-source initiative stands as a testament to the organization's commitment to innovation, transparency, and collaborative problem-solving. By sharing resources and expertise, WDG Public Health not only enhances its service delivery but also contributes to a collective knowledge base that can elevate public health practices across Ontario and beyond.

Chatbot

In Fall 2023, WDG Public Health launched a chatbot on its public website (shown in **Figure 2**), a first amongst Ontario PHUs. The chatbot recognizes and responds to the most common questions the Agency receives. The chatbot assists clients particularly in periods of high call volume, for afterhours accessibility, and for sensitive issues that they may not wish to self-identify or speak on the phone about. The knowledgebase of this chatbot has been continually improved as questions emerge in the community.

The early success of this project has attracted interest from other PHUs. By expanding this project through partnerships with other PHUs, there is opportunity to collaborate on responses, and to share costs. As participation and use of the chatbot increases, there is potential for application of AI-based detection of conversation content as well. Such a project could serve as a unique and powerful tool for identifying emerging public health concerns, not only locally, but across the province.
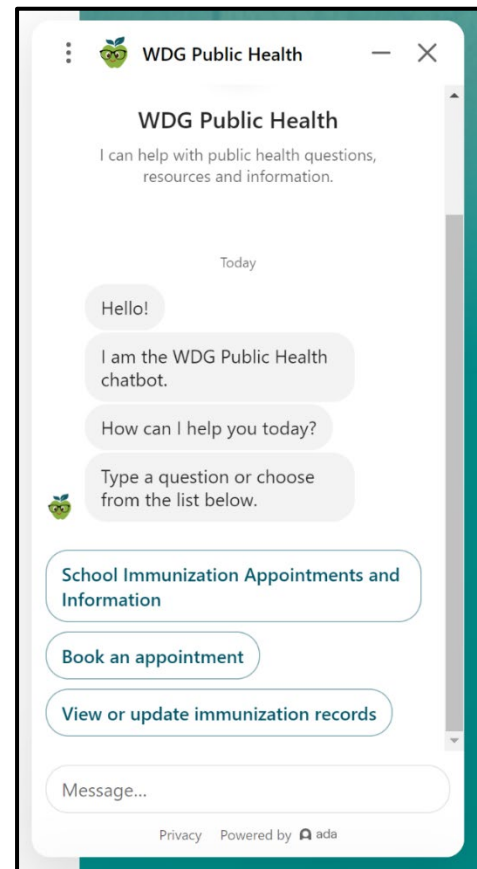

Figure 2: WDG Public Health's chatbot can be accessed from the health unit's homepage, wdgpublichealth.ca, and can assist with many common Public Health questions. The chatbot undergoes continuous improvement in its ability to respond to users.

Health Equity Implications

Innovations at WDG Public Health must be aligned with agency goals, including most importantly *improving health outcomes* in a manner that is equitable to the population the agency serves.

While AI can increase productivity, it can also exacerbate biases when applied with insufficient considerations and safeguards. WDG Public Health must continue to support the training of staff using AI in ways that promote equity.

The work of standardizing sociodemographic data collection under the data governance initiative will ensure that when these data are collected, they are done following current best practices, that is representative and respectful of the diverse identities of individuals residing in WDG.

Of the innovations discussed, the chatbot deployed on the Agency's public website is the primary tool that directly interacts with clients. Importantly, this tool is only one of several ways clients can access information on Public Health services. The chatbot undergoes continuous improvement, such that its success is maximized across its diverse users.

Conclusion

This year's innovation report has highlighted five initiatives that have stood out in their potential to significantly impact and enhance public health services within WDG Public Health. The dynamic nature of public health challenges necessitates agile, collaborative, and responsive strategies to address them.

Through ongoing collaboration, and a commitment to equity and inclusivity, WDG Public Health will ensure that its technological and operational advancements remain aligned with the evolving needs of the community.

Ontario Public Health Standards

Foundational Standards

☒ Population Health Assessment

☐ Health Equity

☒ Effective Public Health Practice

☐ Emergency Management

Program Standards

☐ Chronic Disease Prevention and Well-Being

☐ Food Safety

☐ Healthy Environments

☐ Healthy Growth and Development

☒ Immunization

☐ Infectious and Communicable Diseases Prevention and Control

☒ Safe Water

☒ School Health

☐ Substance Use and Injury Prevention

2024-2028 WDGPH Strategic Goals

More details about these strategic goals can be found in [WDGPH's 2024-2028 Strategic Plan](#).

☒ Improve health outcomes

☒ Focus on children's health

☒ Build strong partnerships

☒ Innovate our programs and services

☒ Lead the way toward a sustainable Public Health system

References

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