SHM_ES018

Green Lab, Clean Future:

Reducing Carbon Footprint through Digital Transformation in the Clinical Biochemistry Laboratory at the Singapore General Hospital

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Singapore General Hospital
SingHealth

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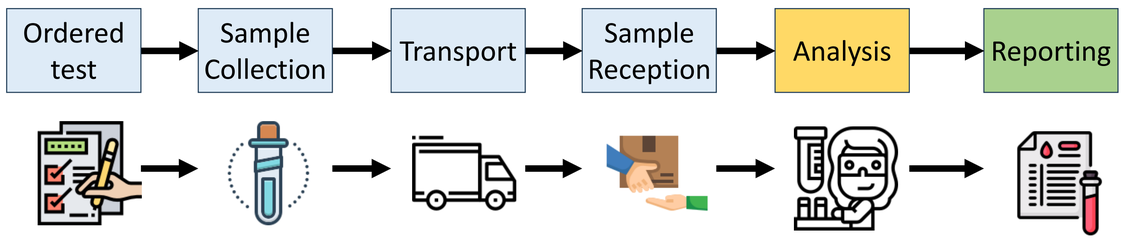
Introduction



Documentation is critical in the clinical laboratory

In a clinical laboratory, the journey of a specimen from order to result reporting involves three crucial phases: preanalytical (light blue), analytical (yellow), and post-analytical (green).

Each phase requires extensive documentation to demonstrate that:

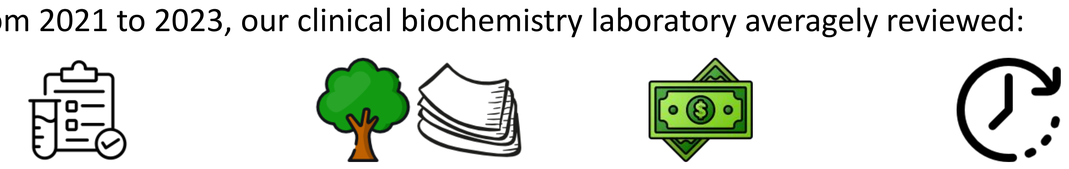
1. **Appropriate tests are ordered** for the correct patient
2. **Correct collection processes** and **transportation processes** are adhered to
3. **Correct patient sample** is analyzed
4. Analytical procedures are producing laboratory **test results that are high quality and safe**
5. Patient reports undergo **a secondary review** any potential errors

Documentation is done physically for the following reasons:

1. Previous lack of knowledge/technology to digitalize processes
2. Ability to prepare and present audit materials readily

The problem of hardcopy secondary reviews

From 2021 to 2023, our clinical biochemistry laboratory averagely reviewed:



No of reports	Amount of paper	Price of paper*	Time spent printing*
1 million	**5,376 kg**,	**SGD$13,988**	**101 days**

**Other considerations that could not be factored in included the financial costs required to dispose of confidential patient records, maintain the printing equipment, manhours to working on logistical Arrangements for the paper and time spent archiving documents physically.*

As workload increased yearly, the current processes would be unsustainable operationally, financially, logistically, and environmentally.

To advance towards the company and national goal in achieving net zero emissions, the laboratory aims to **eliminate hardcopy printing of patient reports by fully digitalizing the secondary review process**.

Results and Discussion

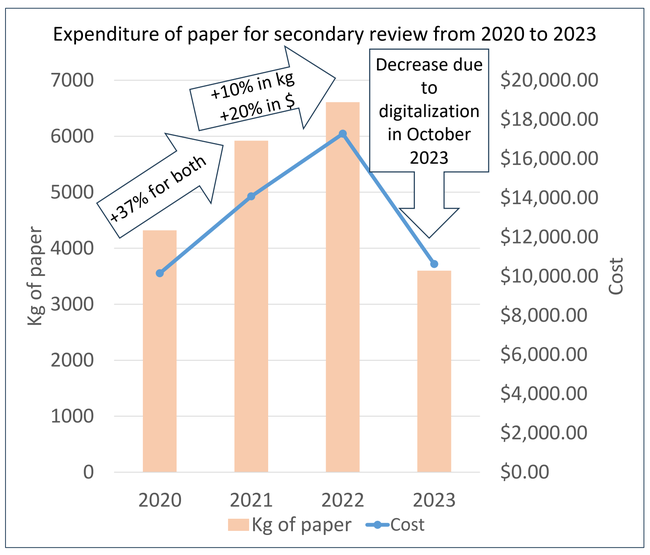
Towards zero paper usage

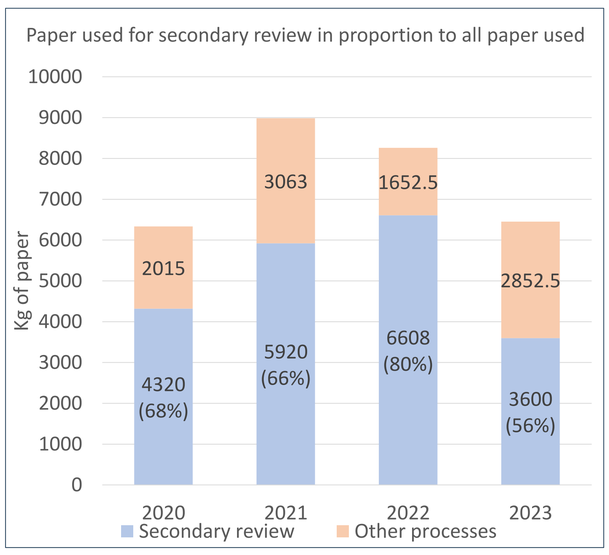
The laboratory had effectively digitalized the secondary review process from October 2023, eliminating the need to purchase paper for secondary review.

Financial and Time savings

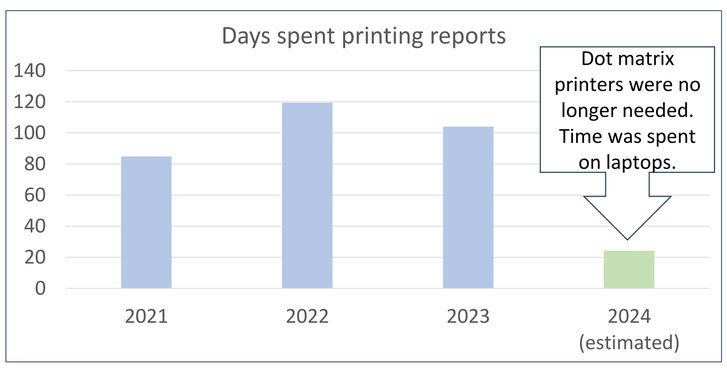
The Increasing demands in laboratory testing had resulted in an increase in expenditure, with its peak in 2022 of ~$17,000 (~6600 kg of paper purchased, left graph), which was approximately 80% of total paper used in the lab (right graph). The significant decrease in purchases in 2023 was attributed to the implementation of the digital solution in 2023.

The laboratory had stopped purchasing the paper in preparation for the subsequent months in early 2024.





Digitalization also eliminated the need to operate additional equipment (i.e. dot-matrix printers), allowing electricity to be saved.



Other benefits that digitalization brought included:

1. Portability of work using corporate laptops.
2. Reduction in number of reports to review by filtering only necessary reports.
3. Displayed information easily (e.g. a patient's previous historical result for review). Hardcopy reports could not display historical trend of results and required the staff to perform additional steps to review historical results on the LIS.

Method

The digital solution to hardcopy reviews

The laboratory developed and implemented a digital method on the laboratory information system (LIS) that allowed a digital report to be generated.

The development of the solution included:

1. Discussions with stakeholders on optimizing the look and feel of the reports
2. Creating advanced algorithmic and expert rules on the LIS program
3. Constructing an archival source on the corporate shared folders for long term storage of reports

Comprehensive training programs and straightforward instructions were established, which were essential for achieving complete adoption of the process.

Expenditure, usage and time spent data

Quantity and price of the paper (9.5" X 11" A4 1 ply 2000 fans computer forms) was extracted from annual invoices recorded from 2021 to 2023.

Data on the net weight of paper was derived from online retailers at 8kg per carton. (source: U Trading & Supplies online)

Time spent generating reports were extracted from the LIS.

Conclusion

A net zero carbon change process is achievable when it is technically feasible and there is complete buy-in from all stakeholders. To this end, the laboratory created concise and easy-to-follow user instructions and offered additional benefits like time savings and user flexibility to encourage adoption with its internal users.

This digital transformation represents a significant milestone in the SGH Clinical Biochemistry Laboratory's quest to become a net zero carbon facility. The next objective of the laboratory is to digitalize other internal processes.