Agilent Case Study: Dako Omnis Workflow

Lab Achieves 74% Increase in Same-Day Patient Case Completion

Agilent Dako

Improved patient case management through an optimized staining workflow

Accurate and timely results are at the center of patient care

Pathology services are an essential part of patient case diagnosis, particularly in cancer diagnostics and precision medicine. As modern medicine continues to become more complex with many possible treatment options, so has the pathologist's testing arsenal increased in both number of markers and different technologies. The accurate and timely results of the diagnostic tests are at the center of cancer patient care.

Designed to handle patient cases

The Dako Omnis solution is designed with patient case management in focus. The solution can process both immunohistochemistry and in situ hybridization assays, even simultaneously. The philosophy behind the design is to process entire patient cases the same day the test requests are received. To achieve this, the engineers who designed Dako Omnis created a huge reagent storage compartment with 60 temperature-controlled reagent positions, leaving up to 50 positions for specific antibodies or ISH probes together with the ~10 visualization system reagents. This high capacity enables many test panels to be ready onboard the instrument so entire patient cases can be started quickly, without having to shuffle antibodies or split cases between instruments.

Racks on Dako Omnis can also be loaded continuously. This means that patient cases with two or more racks can be loaded right after one another so they are completed at about the same time, depending on protocol times.

Dako Omnis

IHC and ISH automated on the same platform, coupled with fully optimized and validated protocols, enables a fast turnaround time of patient cases. Dako Omnis supports your lab to deliver consistent quality and optimal results day after day and slide after slide for increased certainty.

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Dako Omnis implementation in Dutch pathology laboratory

To test if the Dako Omnis design concept had any effect on the promise of more same-day patient case completion with easier slide handling and less hands-on time, we did a pre- and post-installation workflow analysis in a pathology laboratory located in the Netherlands.

Lab details

- ~22,000 IHC slides per year
- Open Mondays through Friday with two runs on Mondays and one run all other week days
- Working hours is usually from 7:00 to 16:30/17:00 depending on the amount of patient cases to be handled
- One overnight run from Monday to Thursday
- Switched from four competitive platforms to two Dako Omnis solutions

Data collection method

We conducted a two-day pre-installation workflow study at the site where the laboratory's setup was observed by a member of the Agilent Workflow Team, who was onsite to record all hands-on times and processing steps. All times were recorded using a stopwatch by the Workflow Team member. Four competitor platforms were in use in the lab during the pre-Dako Omnis observation period.

To compare, we observed and timed the same processes during a similar period after installation of two Dako Omnis platforms.

There are never two identical days in a pathology lab with identical numbers of patient cases, identical test requests, and identical hands-on processes performed by the same technicians. This inherent issue in the experimental design cannot be directly mitigated. However, we have extrapolated the hands-on times as if the same number of slides were processed in the pre- and post-installation studies.

Working in patient case management mode

The major difference between working in slide batching mode and patient case mode is that in batching mode the slides are sorted by which instrument holds the antibody, whereas in patient case mode the slides for a patient case are kept together in the same slide rack on the same instrument.

On Dako Omnis, there is rarely a need to split up a patient case depending on which instrument has the needed antibody onboard. When a patient case is not split, there is no need to re-assemble the case after staining, as the antibodies needed for the case are all used in the same run on the same instrument in the same slide rack. This level of patient case management is not possible on any other platform currently on the market, thus reducing hands-on time for pre-run sorting of slides to instruments and eliminating the need for post-run reassembly of most patient cases.

An analysis of the Dutch lab's actual tests per patient case showed that the majority of patient case requests need five or fewer slides to complete the request.

Slides per patient case

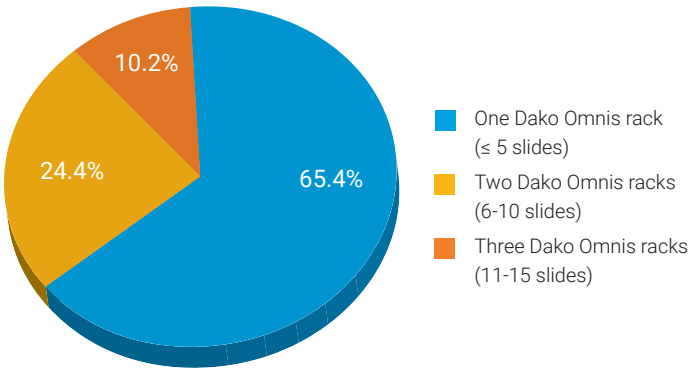

Figure 1. Distribution of slides per request for 49 cases, 225 slides. Of the 49 cases, 32 cases could be analysed using 5 or fewer slides, 12 cases needed between 6 and 10 slides, while 5 cases were analyzed using 11 to 15 slides.

A similar observation was made at University of Rochester Medical Center, USA, where 90% of all patient cases (N=301) were completed with 5 or fewer slides.

From design theory to practical implementation

The workflow and hands-on times are greatly impacted by the day-to-day business of the lab and which tests are processed. We selected similar days to conduct pre- and post studies. In the pre-Dako Omnis installation study, hands-on times were recorded for a subset of the 49 cases, i.e. 28 cases with 144 slides. In the Dako Omnis installation study, hands-on time were recorded for a subset of the 37 cases, i.e. 27 cases with 131 slides. To have comparable hands-on time results, we have multiplied with a factor 1.1 (10%) for the Dako Omnis times to account for the slightly fewer slides, i.e. 131 vs 144 slides. The times presented in Table 1 are thus adjusted so data are comparable for the two studies. Hands-on time in Table 1 does not include maintenance.

The major time gains are seen in the first and last time steps related to sorting. These gains are a result of working in patient case mode, not in batching mode. This shows that the LEAN way of handling slides in patient case mode combined with the superior number of free positions for antibodies in Dako Omnis give a large reduction in hands-on time.

Table 1. Hands-on time in hours:minutes:seconds for individual steps in the IHC process before and after Dako Omnis installation.

Process Steps	Before Dako Omnis installation (hh:mm:ss) N = 28, n = 144	After Dako Omnis installation (hh:mm:ss) [1] N = 27, n = 131	Time reduction with Dako Omnis
Cut, mount, sorting [2,3]	3:37:00	2:21:36	38%
Load slides	0:20:00	0:13:11	34%
Prepare reagents and load/unload reagents	0:52:00	0:18:53	64%
Unload slides and re-rack	0:19:00	0:11:13	41%
Wash slides	0:07:00	N/A	N/A
Dehydrate, coverslip, unload	0:09:00	0:09:33	-5%
Sort, QC, sign out	1:23:00	0:53:48	35%
Total hands-on time	6:37:00	4:08:20	37%

[1] Presented times have been multiplied with factor 1.1
[2] Before Dako Omnis Installation: Cut, mount and sort slides per antibody and instrument
[3] After Dako Omnis Installation: Cut slides and rack at cutting station, and then place them in the baking oven

One of the Dako Omnis instruments went through a scheduled maintenance[1] during the observation period which added 21 minutes of hands-on time. When including this extra time, Dako Omnis still reduced the total hands-on time by 32%.

Patient case throughput

For the Dutch laboratory, converting from a batch workflow to a patient case workflow not only reduced the hands-on time, but enabled them to complete a higher number of full patient cases on the same day as the test request was submitted.

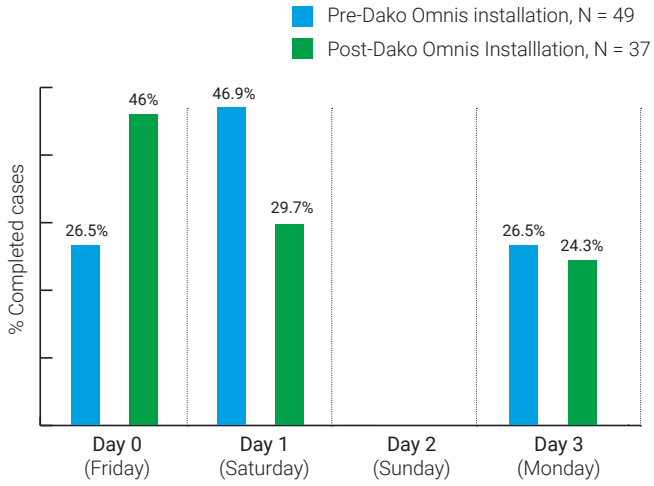

Figure 2. Time in days after request for patient case delivery for pathologist assessment.

As shown in Figure 2, the lab managed to complete 26.5% of cases using the batching workflow, but switching to a patient case workflow on Dako Omnis increased the percentage of cases that were completed the same day as requested to 46%. The patient cases that were delivered on Day 3 were sentinel node IHC tests. These requests were automatically made in the LIS system when the tissue arrived in the lab on a Friday; blocks were ready Monday morning, was cut, stained and delivered on Monday end of the day. Thus Friday = Day 0, Saturday = Day 1, Sunday = Day 2 and Monday = Day 3.

The increase in patient cases delivered for assessment on Day 0 was 74% using Dako Omnis. In the batching mode, the lab had to "catch up" with patient case delivery on the following day, see Figure 2, blue bar, Day 1. One of the two Dako Omnis instruments went through scheduled maintenance during one of the study days, so capacity may have been even higher without that. Furthermore, additional opportunities for workflow improvements were identified in the study.

1. All automated IHC stainers also require extended maintenance on regular intervals. This type of maintenance was not conducted during any of the test days for the two setups, thus not included in Table 1.

Conclusions

When the Dutch lab switched to Dako Omnis and fully implemented the patient case mode in their workflow, they experienced a reduction in hands-on time and were able to complete more patient cases within the same day as the requests were received.

Benefits from Dako Omnis and patient case management workflow

- No need to divide patient cases between multiple instruments
- Total hands-on time reduced by 37% mainly due to:
  - Decrease in slide sorting before and after a run
  - Decrease in sorting of reagents
- Number of patient cases finalized the same day increased by 74%

Acknowledgement

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