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NARRATIVE

Staff Experiences Transitioning to Digital Dermatopathology in a Tertiary Academic Medical Center: Lessons Learned From Implementation Science

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Abstract

Digital pathology (DP) transforms practice by replacing traditional glass slide review with digital whole slide images and workflows. Although digitization may improve accuracy and efficiency, transitioning to digital practice requires staff to learn new skills and adopt new ways of working and collaborating. In this study, we aimed to evaluate the experiences and perceptions of individuals involved in the day-to-day work of implementing DP in a tertiary academic medical center using Normalization Process Theory, a social theory that explains the processes by which innovations are operationalized and sustained in practice. Between September 2021 and June 2022, dermatopathologists, referring clinicians, and support staff at Mayo Clinic (Minnesota, Florida, and Arizona) participated in interviews (n=22) and completed surveys (n=34) concerning the transition. Normalization Process Theory informed the selection of validated survey items (Normalization Measure Development Questionnaire) and guided qualitative analysis. Participants reported high agreement with statements related to shared understanding and potential value of DP for workflow integration and working relationships. Qualitative themes reflecting the way organization and social context enable these processes were mapped onto implementation stages and related key activities. We found that earlier processes of implementation (understanding and working out participation) were better supported than later stages (doing it and reflecting on it). Our analysis helps identify targets for further intervention to hasten and help sustain implementation, including additional support in software and technological integration, workflows and work redesign, and regular monitoring and feedback systems. The use of implementation theory, such as Normalization Process Theory, may provide useful pointers to enable other similar digital system transition efforts.

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Clinical practices are increasingly being digitized to improve efficiencies and information access.[1] The field of pathology has experienced such a transition, from glass slides to digital scans of whole scanned images. Given the substantial promise achieved over the past decade, use of digital images has received validation by the College of American Pathologists and approval by the Food and Drug Administration for primary diagnosis.[2] Potential benefits of digitization include enhanced diagnostic accuracy,[3,4] expedited review and turnaround time,[5] easier consultation and collaboration between pathologists and referring clinicians,[6] expanded learning,[7] and opportunities for integrating artificial intelligence–based tools.[4] To realize these benefits, substantial investments in technologies and equipment are needed[8,9] as is consideration of the social and contextual factors involved in implementation of complex interventions.[10]

Assessment of individual experiences and the context in which a new intervention is

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implemented can identify facilitators and barriers to effective and quicker uptake, integration, and sustainment of a new intervention,[11,12] providing clues for areas needing attention for effective implementation. The field of implementation science offers methods and theories to guide and evaluate implementation and strategies for success. The use of theory in implementation research can also serve to connect learnings across studies, thus creating more generalizable findings.[13] Normalization Process Theory (NPT) is an implementation theory that supports understanding and explanation when implementing complex interventions and technologies, including the ways in which they are embedded and routinized in organizational contexts.[14,15] Normalization Process Theory has been used in evaluations of complex interventions for more than a decade.[15,16] Core constructs of NPT address process mechanisms like "how do stakeholders understand the work involved?" (coherence); "how do these stakeholders plan and work out participation to do this work?" (cognitive participation); "what work do stakeholders do to make the transition happen in practice?" (collective action); and "how do they assess, reflect and react to the impact of their work?" (reflexive monitoring).

We used NPT and constructs from realist evaluation, which considers how implementation context triggers mechanisms of change,[17,18] to assess our tertiary medical center's experience shifting to digital pathology (DP) in a single pathology practice. The objective of this narrative is to describe how key stakeholders normalized the changes necessary to transition from traditional microscopy to DP and to offer our work as an example for how this implementation science approach can be used during the implementation of complex digital interventions, like DP, to identify targeted improvement strategies for further normalization into practice.

Methods

Context and Participants. This study took place between September 2021 and June 2022 in a large tertiary academic center in the United States, spanning 3 geographic sites (Minnesota, Florida, and Arizona). The first site was in the midtransition phase of the move to DP, whereas the second and third sites were in the initial phase of transition to DP. Participants included dermatopathologists, referring clinicians, dermatologic surgeons, academic trainees, and support staff. Dermatopathologists, whose work is governed by the DP technology being implemented, were considered "primary users" directly impacted by the transition. Other clinicians (eg, referring clinicians and surgeons), members of the dermatology department who care for patients in the inpatient and outpatient clinics and who also perform skin biopsies, review pathology reports of those skin biopsies, and make treatment decisions were considered "secondary users." These clinicians were indirectly impacted through their access and interaction to artifacts (final pathology reports and accompanying whole slide images created by the new system, available to end-users) generated by the new DP in the electronic medical record (EMR). Trainees and support staff were also considered "secondary users." Dermatopathologists, referring clinicians, and dermatologic surgeons received an e-mail inviting them to participate in a survey. All dermatopathologists and support staff, and a purposive sample of referring clinicians and dermatologic surgeons, received a separate e-mail inviting them to participate in an individual or group interview, depending on their availability and preferences.

Data Collection and Analysis. This study used surveys and qualitative interviews of participant experience and perceptions of implementation context. Surveys were developed after a review of the literature and with expert input from dermatopathologists as primary users of DP and implementation scientists on the study team, and included items from the validated Normalization Measure Development instrument[19] adapted for this intervention. Surveys were administered electronically using Qualtrics software (Qualtrics). Up to 2 additional e-mail reminders were sent to nonresponders. Responses were analyzed according to primary and secondary users; responses from referring clinicians and dermatologic surgeons as end-users of the DP work product (final pathology report and accompanying whole slide images) were combined. Normalization Measure Development responses are presented as

frequencies (5-point scale: 1=strongly disagree to 5=strongly agree). Analysis was performed using SAS software, v9.4.

Individual and group interviews were conducted using video conference software.[20] The interview guide was guided by constructs of NPT and included questions on process mechanisms and activities involved in implementation. Individual and group interview data were transcribed verbatim for analysis. Qualitative analysis included both "sort and sift" methodology[21] and thematic analysis[22] to identify barriers and facilitators of key implementation activities, organized by the NPT process mechanisms. Two qualitative researchers (C.C.K., S.M.) coded transcripts, reviewed codes, addressed discrepancies, and categorized themes in terms of the NPT framework, specifically contextual factors, and their impact on actions of stakeholders to normalize DP into their everyday routine of work.[23]

Results

During April and May 2022, 34 dermatopathologists and referring clinicians completed surveys (33% and 62% response rates, respectively). Results are summarized in Table 1[24] by primary and secondary user groups. Most respondents agreed or strongly agreed with statements related to shared understanding and potential value of DP, ability to integrate it into the workflow, and its impact on working relationships. Secondary users more often reported that DP disrupted working relationships (ie, patterns of collaboration and communication and working partnerships they were accustomed to, as part of the earlier system of working) and less often reported sufficient training and resources (compared with primary users, ie, dermatopathologists), but differences were not statistically significant.

Between February and June 2022, 12 individual and group interviews were conducted with 22 individuals, including dermatopathologists (n=10), dermatologists (n=4), trainees (n=4), and support staff (n=4). Qualitative themes are summarized in Table 2 using the NPT framework and the 4 NPT process mechanisms of implementation. Our identified themes, relating to contextual facilitators and barriers are mapped onto the respective

TABLE 1. Survey Results by Group (Primary and Secondary Users)

Please rate how strongly you agree or disagree with the following	Primary users[a] (n=8)	Secondary users[a] (n=26)
Staff in my unit have a shared understanding of the purpose of digital pathology, n (%)		
Strongly disagree	0 (0.0)	0 (0.0)
Disagree	2 (25.0)	0 (0.0)
Neither agree nor disagree	0 (0.0)	1 (4.0)
Agree	2 (25.0)	9 (34.6)
Strongly agree	4 (50.0)	14 (53.8)
Missing or not relevant to my role	0 (0.0)	2 (7.7)
I can see the potential value of digital pathology for my work, n (%)		
Strongly disagree	0 (0.0)	0 (0.0)
Disagree	0 (0.0)	0 (0.0)
Neither agree nor disagree	0 (0.0)	0 (0.0)
Agree	1 (12.5)	4 (15.4)
Strongly agree	7 (87.5)	21 (80.8)
Missing or not relevant to my role	0 (0.0)	1 (3.8)
There are key people who drive digital pathology forward and get others involved, n (%)		
Strongly disagree	0 (0.0)	0 (0.0)
Disagree	0 (0.0)	0 (0.0)
Neither agree nor disagree	0 (0.0)	5 (19.2)
Agree	1 (12.5)	4 (15.4)
Strongly agree	7 (87.5)	15 (57.7)
Missing or not relevant to my role	0 (0.0)	2 (7.7)
I am open to working with my colleagues in new ways to use digital pathology, n (%)		
Strongly disagree	0 (0.0)	0 (0.0)
Disagree	0 (0.0)	0 (0.0)
Neither agree nor disagree	0 (0.0)	2 (7.7)
Agree	1 (12.5)	7 (26.9)
Strongly agree	7 (87.5)	16 (61.5)
Missing or not relevant to my role	0	1 (3.8)
I can easily integrate digital pathology into my existing work, n (%)		
Strongly disagree	0 (0.0)	0 (0.0)
Disagree	0 (0.0)	0 (0.0)
Neither agree nor disagree	0 (0.0)	2 (7.7)
Agree	1 (12.5)	7 (26.9)
Strongly agree	7 (87.5)	16 (61.5)
Missing or not relevant to my role	0	1 (3.8)
Digital pathology disrupts working relationships, n (%)		
Strongly disagree	6 (75.0)	9 (34.6)
Disagree	2 (25.0)	7 (26.9)
Neither agree nor disagree	0 (0.0)	2 (7.7)
Agree	0 (0.0)	1 (3.8)

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TABLE 1. Continued

Please rate how strongly you agree or disagree with the following	Primary users[a] (n=8)	Secondary users[a] (n=26)
Digital pathology disrupts working relationships, n (%), continued		
Strongly agree	0 (0.0)	2 (7.7)
Missing or not relevant to my role	0	5 (19.2)
I have confidence in other people's ability to use digital pathology, n (%)		
Strongly disagree	1 (12.5)	0 (0.0)
Disagree	0 (0.0)	1 (3.8)
Neither agree nor disagree	0 (0.0)	1 (3.8)
Agree	3 (37.5)	13 (50)
Strongly agree	4 (50.0)	9 (34.6)
Missing or not relevant to my role	0	2 (7.7)
Sufficient training is provided to enable staff to use digital pathology, n (%)		
Strongly disagree	1 (12.5)	0 (0.0)
Disagree	0 (0.0)	3 (11.5)
Neither agree nor disagree	0 (0.0)	5 (19.2)
Agree	1 (12.5)	9 (34.6)
Strongly agree	6 (75.0)	3 (11.5)
Missing or not relevant to my role	0	6 (23.0)
Sufficient resources are available to support digital pathology (eg, time, staff, and hardware), n (%)		
Strongly disagree	1 (12.5)	1 (3.8)
Disagree	0 (0.0)	3 (11.5)
Neither agree nor disagree	0 (0.0)	6 (23)
Agree	2 (25.0)	7 (26.9)
Strongly agree	5 (62.5)	4 (15.4)
Missing or not relevant to my role	0	5 (19.2)
Feedback about digital pathology can be used to improve it in the future, n (%)		
Strongly disagree	0 (0.0)	0 (0.0)
Disagree	0 (0.0)	0 (0.0)
Neither agree nor disagree	0 (0.0)	3 (11.5)
Agree	4 (50.0)	7 (26.9)
Strongly agree	4 (50.0)	14 (53.8)
Missing or not relevant to my role	0	2 (7.7)

[a]Primary users refer to dermatopathologists, the clinician group, whose work is governed by the technology being digitized. Secondary users refer to other clinicians including referring clinicians, surgeons, and trainees, who care for patients in the inpatient and outpatient clinics and who also perform skin biopsies, review pathology reports of those skin biopsies, and make treatment decisions and support staff who support dermatopathologists.

Items adapted from the Normalization Measure Development Questionnaire (NoMAD).[24]

process mechanisms and related implementation activities in Table 2.

Our midtransition analysis highlighted the following 6 key findings: (1) The complex DP intervention involved implementation of 2 distinct processes: diagnostic processes and clinical application and software integration for the primary user group (dermatopathologists). Implementation effort largely involved the latter; dermatopathologists in fact experienced relatively minimal disruption to the former. In terms of diagnostic processes, primary users reported experiencing advantages to diagnostic capabilities and anticipated future benefits especially those associated with artificial intelligence applications (eg, quality control, specimen defect identification, and workflow optimization algorithms that enable classification and triaging of pathology cases). However diagnostic processes, although benefiting from DP, were minimally impacted by its implementation. (2) The earlier implementation mechanisms of "understanding" and "working out participation" were more aided than impeded by contextual factors. Facilitators included the clear top-down mandate by institutional leadership, which was supported by strong divisional leadership, enabling widespread staff buy-in. Further, the early experiences of clinical practice benefits by all stakeholders (primary and secondary users) far exceeded expectations of efficiency, speed, and access, including improved communication, coordination, collaboration, and safety. These factors boosted intrinsic motivation to adopt the new intervention. (3) The later implementation processes of "doing it" and "reflecting on it" needed further support at the time of this evaluation. Specifically, barriers centered on appropriate sequencing, distribution, and allocation of work for primary users, and meeting the needs of secondary users, or end-users, through the EMR interface. (4) Patient care and resident teaching benefited from dermatopathologists' and other clinicians' positive early experiences, whereas research benefits were yet to be realized. (5) The index site, which was larger and more complex, was more challenged in implementation than were the smaller sites, which benefited from vicarious learning from the early adopting index site and the flexibility associated with smaller size. (6) Secondary users (support staff and referring clinicians) understandably reported coming into the process late and having limited information to prepare given their position as end-users of the artifacts of DP.

TABLE 2. Qualitative Themes on Impact of Context on NPT Implementation Processes[a]

Key activity[b]	Facilitators[c]	Barriers[d]
Understanding: How do people work together in everyday settings to understand and plan the activities to put digital pathology (DP) into practice?		
Stakeholders distinguish DP from conventional microscopy	Most primary users and secondary users[e] reflected clarity about difference between the use of digital images and that of glass slides	Primary and secondary users initially conflated clinical software transitions (requiring IT support) with diagnostic process transitions. The latter process in fact underwent minimum change
Stakeholders collectively agree about the purpose of DP	Most primary and secondary users had clarity about goals of DP (eg, efficiency, access, information, reduced glass slide transfers, and need to modernize)	No midtransition barriers perceived on this factor
Stakeholders understand what DP requires of them	Primary users described key facilitators: • Effective educational modules that informed them of their new work roles • Comfortable and personal pace for staff learning and transition in larger pilot site Smaller satellite sites vicariously learned from experiences of the larger site. Smaller size and strong leadership in at least 1 satellite site enabled clear delineation and understanding of roles and responsibilities	Most primary and secondary users had no working experience with DP Some secondary users (referring clinicians and support staff) appeared to be less informed about the nature and timing of transitions and learned about the process as it unfolded Some secondary users (referring clinicians and support staff) expressed being given little training and direction on use of intervention
Stakeholders construct potential value of DP for their work	Most primary and secondary users experienced benefits of access, remote collaboration, efficiencies, education, and ergonomics with new intervention Some primary users (dermatopathologists) also saw potential opportunity to create a digital archive with benefits to research, education and practice and use of AI applications Some secondary users (trainees) saw potential value in saving time, better coordination, access to previous cases and use of machine learning algorithms	Not all staff saw value: • Some primary users, typically older, expressed discomfort and unfamiliarity with new technology • Some secondary users (support staff) appeared to be worried about redundancy of their jobs
Working out participation: How do stakeholders work together to create participation around DP and its components?		
Key individuals drive DP forward	Most primary users in all 3 sites perceived supportive and proactive leadership	No midtransition barriers perceived on this factor
Stakeholders agree that DP should be part of their work	Institutional and divisional mandate for digitization facilitated agreement that this transition was essential, despite most staff lacking experience working with DP	Clinical software support (requiring IT support) and workflow transitions were not totally ironed out for primary users, causing confusion in responsibilities between work groups
Stakeholders buy into DP	Most primary and secondary users experienced positive benefits over time. Benefits included remote work, "revolutionized changes to the practice," access to information, ability to conference from various locations, better ergonomics than looking into a microscope, better education (everyone does not have to crowd around the	No midtransition barriers were observed on this factor

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TABLE 2. Continued

Key activity[b]	Facilitators[c]	Barriers[d]
	microscope), quicker turnaround time for trainees, better annotation of slides, less time tracking down slides, potential for a digital archive (benefits to research, education, and practice), and potential use of AI technology Secondary users (referring clinicians) had real time digital access to slides instead of delays involved in requesting glass slides Secondary users (trainees) valued time saved not tracking glass slides, better coordination with faculty, access to previous cases, and the potential machine learning algorithms	
Stakeholders continue to support DP	Most primary and secondary clinician users experienced positive benefits in patient care, including lower adverse events and potential for shared decision-making in patient care Most staff (particularly primary users) expressed that there was no looking back or returning to the old way of doing things	Many primary users had early experiences of longer work times with the new intervention Primary users felt that although benefits were evident for patient care and teaching activities, research activities had not benefited yet Most primary and secondary clinician users wanted better technical software support One group of secondary users (support staff) were fearful for their jobs and appeared to be less supportive
Doing it: How do stakeholders work together to enact DP and its components?		
Stakeholders perform the tasks required by DP	Most primary users in the larger site appreciated the time given to transition to new tasks Primary users in the smaller satellite sites benefited from the flexibility in time to transition Most primary users successfully learned to navigate the new software, including the special mouse units that worked with the software	Some primary users expressed concerns that necessary reevaluation and reallocation of work had not yet happened Secondary users (support staff) expressed opinion that they could be better used to iron out work queue issues and help with related tasks
Stakeholders maintain their trust in each other's work and expertise through DP	Most staff (primary and secondary users) expressed strong relationships of mutual trust in each other's work within clinical teams	Primary users felt the following: • DP could cause "judgments" of interpretations by colleagues and make mistakes more likely to be uncovered • DP may have some negative medical/legal implications (due to digital memory) • Tracking of time could be "used" against dermatopathologists • Jobs were being taken from support staff (eg, owing to self-reporting)

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TABLE 2. Continued

Key activity[b]	Facilitators[c]	Barriers[d]
		Secondary users (support staff) were concerned about errors in reports generated by dermatopathologists and trainees
The work of DP is allocated appropriately to stakeholders	Primary users were helped by the deliberate slow approach to new work roles in larger site that enabled most staff to transition at a comfortable and personal pace Satellite sites' smaller size and strong leadership helped with clear delineation and understanding of roles and responsibilities	Some primary and secondary users felt that midtransition workflow needs were yet to be fulfilled Some primary users expressed the need for improved worklists for dermatopathologists to improve clarity of daily tasks
DP is adequately supported by the organization	Primary users' leadership group was instrumental in moving DP along Abundant resources were available in larger site for launch of DP All sites benefited from well-designed educational modules Satellite sites benefited from vicarious learning from larger site's early experience	Some primary users expressed the need for the following: • better integration of pathology reports into the digital path window • home setup for eligible medical staff • higher power scanning of slides • readout stations and large screens to support education (like multiheaded scope) Some secondary users (trainees) expressed the need for search functionality using diagnosis codes without PHI for their own databases Some secondary users (clinicians) felt that better technology support and sequencing for software integration with the EMR was needed to improve turnaround times Some secondary users (referring clinicians) felt some of their needs were not yet fulfilled: • education and access to software • poorly scanned slide delays because of need for rescanning • better software system for uninterrupted workflow for pathology consults
Reflecting on it: How do stakeholders work together to appraise DP and its components?		
Stakeholders access information about the effects of DP	Primary user group division leadership commissioned these focus groups as one form of midtransition feedback Secondary user group (support staff supervisor) generates and shares regular and limited reports of metrics on efficiency	More informal than formal, systematic plan for performance review Prioritization for high quality data collection/metrics Improvement to systematic access to ongoing data on metrics More informal than formal plan for dissemination of performance data on effects of DP
Stakeholders collectively assess DP as worthwhile	Primary user group engaged in informal collective feedback at division meetings	No formal plan to review performance metrics at departmental level No formal plan to elicit positive/negative

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TABLE 2. Continued

Key activity[b]	Facilitators[c]	Barriers[d]
		attitudes concerning DP for future improvement
Stakeholders individually assess DP as worthwhile	Primary users engaged in informal personal audits on productivity and other experiences with DP Primary users provided informal individual feedback to division leadership	No formal plan for individual clinicians to access individual performance metrics
Stakeholders modify their work in reports to their appraisal of DP	No formal evidence perceived on this factor	No formal plan or documentation of individual adjustment to DP effects although this may occur informally

[a]AI, artificial intelligence; EMR, electronic medical record; IT, information and technology; NPT, Normalization Process Theory; PHI, Protected Health Information.
[b]Key activities that reflect the essential activities or processes of "normalization" under each stage of implementation according to NPT.
[c]Facilitators refer to contextual factors that aid the key activity under each stage of implementation, facilitating the process of implementation or normalization of new technology and associated work routines.
[d]Barriers refer to contextual factors that slow down or impede the key activity, hampering the smooth implementation or normalization of new technology and associated work routines. These are areas that may need focused attention to enable faster implementation.
[e]Primary users refer to dermatopathologists, the clinician group, whose work is governed by the technology being digitized. Secondary users refer to other clinicians including referring clinicians, surgeons, and trainees, who care for patients in the inpatient and outpatient clinics and who also perform skin biopsies, review pathology reports of those skin biopsies, and make treatment decisions and support staff who support dermatopathologists.

Discussion

In this multimethod study of the implementation of DP, we present complementary findings from quantitative survey data and qualitative analysis of interviews and focus groups collected from all primary and secondary users, variably involved in the transition to the new system. Survey data highlighted high agreement with statements of successful early stages of implementation among all participants, while demonstrating some differences between dermatopathologists, the primary users of DP and referring clinicians, users of the artifacts generated by DP in the EMR. Group and individual interviews went into further depth on experiences of implementation with rich information, tangible examples of successes and failures and insights into areas for improvement. Together, both methods provided a holistic picture, bringing together that which might have been ordinarily invisible with just surveys or interviews.

We suggest that focused effort on the latter stages of implementation of doing it and reflecting on it (eg, learning from regular and well-designed feedback loops on implementation progress) for the larger index site are needed for a smoother transition from glass slides to DP as routine practice. The 2 smaller sites that gleaned lessons from the index site had the added advantage associated with a smaller, less complex practices. Given the midtransition timing of our surveys and focus groups, it is not surprising that we found greater strength in earlier relative to later processes of implementation.

Our analysis identified targeted areas for improvement that would benefit from further intervention, including better workflow such as processes involving workload distribution to dermatopathologists by support staff. Further, both primary and secondary users highlighted attention to coordination, technology integration and support, effective communication between all stakeholders, and real time monitoring and feedback systems to enable a continuous cycle of learning, especially during the early phase of implementation. These factors would hasten the pace of embedding and integration of DP into the practice. Some of our findings are similar to those in other studies on the implementation of DP systems.[25,26] Implementation strategies targeted at working out persistent kinks across settings needs to be a priority to achieve optimal implementation.

The contextual understanding for differences in responses to DP implementation between primary users (dermatopathologists) and secondary users (other clinician/surgeon

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groups) is important. Digital pathology implementation described in this study was by design focused on dermatopathologists as the primary user group. Other clinicians were impacted indirectly, in terms of access to the whole slide images and the corresponding pathology report in the EMR made available for secondary viewing, generated by DP. This context is important to put into perspective feedback differences and conclusions about the implementation process, as reflected in Table 2. For example, provision of specific training/resources within the EMR was largely out of scope of this implementation; referring clinicians' experience concerning lack of training, while notable and real, provides a less than optimal picture of positive and real success experienced by dermatopathologists, the primary users of DP. Nevertheless, feedback from secondary users play an important role in system wide implementation over time.

Despite the value, potential, and investment made in this promising technology, this study demonstrates the complexity of implementation and integration into an existing clinical practice. Our use of theory helped to identify facilitators and barriers facing stakeholders, using insights from those experiencing the transition to the new digital system in real time. By identifying factors in their working environment that help or hinder the process of implementation, we can design further targeted implementation strategies, based on systematic investigation rather than assumptions about the contextual relevance of certain approaches. This theory-based approach may be generalizable to other digital transformations of practice.

Our conclusions are limited by the fact that this was a midtransition process, which may account for some of the results, such as relative neglect of the later processes of implementation, such as reflection and course correction. Stakeholder feedback of subsequent phases of implementation should be pursued to provide further clarity on attention to these later processes of implementation. The small size of our convenience sample may have skewed the perspective reflected here. However, this sample included all key players, including leadership at the 3 sites and representatives of all stakeholder groups, reassuring us that these perspectives are representative of all stakeholders.

Conclusion

New digital practices are challenging to implement, embed, and sustain. Our implementation framework, highlighting the role of context, aided the interpretation of survey data and analysis of focus group interviews with stakeholders engaged in the digital transformation of their work in real time. We found several examples of successful transition as well as areas for improvement and targets for strategies to aid and hasten implementation of DP into practice. This multimethod approach may be generalizable to other efforts to digitize health care practices.

POTENTIAL COMPETING INTERESTS

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Abbreviations and Acronyms: **DP,** digital pathology; **EMR,** electronic medical record; **NPT,** normalization process theory.

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