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ENHANCING NATIONWIDE IMPLEMENTATION OF STANDARDIZED STRUCTURED REPORTING (SSR) IN PATHOLOGY: A MULTIFACETED DIGITAL STRATEGY FOR ONCOLOGY CARE

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ABSTRACT
While some new surgeons are trusted with major cases from the start, facing surgical residency programs is a big challenge for them. Due to the trend of more chronic diseases in elderly people, new surgeons find it hard to get surgical jobs for training. The main problem is that big cities reached their maximum medical capacity at the same time villages and rural areas can't draw qualified staff because of the lack of infrastructure. Because of increased use of advanced surgeries, the number of general surgery specialists in community hospitals is low, decreasing the services offered to patients. Because of their big medical expenses and low wages for their efforts, veterans struggle with job-related obstacles and have difficulties finding work. Those who practice surgery in outpatient settings by performing minimally invasive operations should put a strong emphasis on learning new skills. Medical experts starting their surgical careers now need to have physical, IT skills, business knowledge and be adaptable. Mixing guidance-based mentoring, improved health support in villages, along with helping medics get funding, is vital for specialists to be skilled and have their loans written off. It considers the key difficulties of new general surgeons to demonstrate that improving staff layout will better ensure there are competent workers to address health needs in advance.

Keywords: Clinical practice guidelines, Effect evaluation, Guideline adherence, Healthcare quality improvement, Information technology, Implementation, Oncology, Process evaluation, Standardized structured reporting

INTRODUCTION
Oncological care is improved by constantly introducing new healthcare innovations. Sticking strictly to oncological clinical practice guidelines is necessary as evidence shows many procedures are done differently or not at all among the population [3–5], mainly regarding new digital solutions. More work on strategies and evaluation should be done to answer the implementation gap [6]. There is now a growing number of authors who believe that carefully examining multiple strategies together helps improve implementation practice [7, 8]. It is important in the evaluation that both the effects seen from the strategy and the steps taken to execute it be deeply reviewed, to learn which

things helped or hindered the strategy's outcome [6]. Studies show that using SSR leads to superior reporting and current evidence suggests SSR may influence positive patient diagnostic results [9-11]. National and worldwide oncology guidelines confirm that SSR mechanisms are suitable for use in pathology diagnostics [2, 12]. On the other hand, the International Collaboration of Cancer Reporting templates are being followed by more countries which has raised the number of SSRs [13 and 14]. There is a lack of standardization in many countries as well as inside nations over which features are tested and the techniques and lab types used, leading to differences in care and patient treatments [13, 15-18]. Our previous research identified various factors holding back SSR as well as things that encourage its implementation [19, 20]. Since the COVID-19 pandemic began, using approaches that match to changing factors represents a successful and useful way to execute a strategy [21]. Little information is available to show that switching to a digital approach for SSR can be done effectively. Our first research involved studying our technique to assess the usefulness of using our customized approach for highlighting SSR cases while reporting tumors in gastrointestinal, gynecological and urological cancers [22]. It was important to carry out a national review to confirm the results identified by the pilot study. The study seeks to check if a promising approach to combining different practices is practical, efficient and fits well into national clinical practice. This research study is based on the following specific objectives:

METHODS

By studying time-series data and measuring uptake of SSR implementation among every pathology lab, we assessed a new version of the modified approach. Various areas of our strategy were checked to see the level of safety in laboratories and to obtain feedback from pathologists and residents as well as WEBSITE liaisons regarding barriers to and the adoption of SSR. We assessed the importance of each influencing element as well as their collective contribution to whole implementation success. The study workflow has been displayed in Fig. 1 as illustrated by the authors. The study applies the guidelines set out in the Standards for Reporting Implementation Studies (StaRI) [23]. It is necessary for pathologists to use uniform ways to write down their findings. Pathologists are encouraged to rely on SSR templates, since multiple national [24, 25] and international [26, 27] guidelines serve as their support. Standardized templates are available in the system to assist with nineteen unique tumors [28]. The templates draw information from the International Collaboration of Cancer Reporting datasets and also from oncology guidelines. All templates are approved by the Quality and Professional Practice Committee of the Dutch Association of Pathologists following their creation [29]. The results of previous barrier and enabler studies on SSR were included in an integrated toolkit which is included in Additional file 1. Most of the difficulties in implementing something happen because of the nature of SSR materials and how simple they are to understand [19, 20]. Users can use any piece of the toolkit as a computer application if preferred. More details about the changes made to the initial small-scale toolkit assessment are found in Additional file 2. There were certain steps included in the approach for implementation:

• A specially designed website

Instructional videos about SSR usage are presented through the eLearning platform.

The information sheet about SSR now appears within SSR template documents.

The system includes a "Feedback button" as a part of the improved feedback mechanism

• Audit and feedback reports displaying local SSR usage

• A communication manual

Effect evaluation

Study design and population

A national analysis of interrupted time series followed the use of SSR templates for gastrointestinal, urological and gynecological oncology at all pathology laboratories. The study was carried out on a national level, so no particular entry criteria were used. This section explains step by step how and

when the communication should be distributed. A collection of pathology records is available from that period. As the study's main unit, pathology report numbers were used for assessing effectiveness. Supplementary file 5 clearly describes how the book was selected. All reports of malignancy suspects (end result diagnosis independent) in biopsies and resections were entered into the medical section by medical practitioners, even if the diagnosis could have been accommodated in the gastroenterological or gynecological or urological SSRs for tumors. Colon biopsy template reports were excluded because they are included in the national bowel screening program and the new strategy does not apply to them.

Data analysis

Statistics from our main results were analyzed using IBM SPSS Statistics V25.0 and reported in an intuitive way. An interrupted time series analysis was carried out to check how well the national strategy worked [32]. We used segmented regression to analyze changes in SSR use and its linear trend both before and after the new strategy went into effect. We prepared a data sheet that combined all the national, weekly aggregates of SSR samples tested by dutch pathology laboratories. The researchers based the results on the number of times SSR was detected in pathology reports. These following covariates were considered by the ARIMA analysis:

Phase is used to separate the time before (0) and after (1) the strategy was put in place to measure instant modifications in the mean percentages after implementation.

The percentage change before the strategy launch was analyzed by using weeks into the study as an ordinal variable.

This variable uses the time after the strategy was put in place (measured in weeks) to see the percentage changes that happened each week after that.

Because the strategy was being put into action, researchers eliminated data corresponding to the implementation phase [33]. Assessing the impact of the strategy was done in three parts involving (1) reporting on gastrointestinal, gynecological or urological cancers, (2) biopsies and resections and (3) non-academic versus academic pathology laboratories with differences depending on the type and retrieval of tumors and laboratory features. Our previous analysis showed that specific factors greatly affected different subsets of pathology reporting [19, 20]. We wanted to examine whether the way we clustered participants would affect the results. Both the gastrointestinal group and the biopsy group, as were the non-academic laboratory group, were selected as reference groups. "Group" was used as a measurement in the construction of interaction variables corresponding to strategy phase, time and time since strategy introduction. Every variable was part of the ARIMA model. Two-sided statistical significance was found when the p-value was less than 0.05. To understand the data, we measured the average percentage of SSR use among all activities in laboratory pathology before the strategy was put in place for each tumor type. Subgroup analysis was done for cancers in the gastrointestinal, gynecological and urological systems, as well as biopsies and resections of all kinds, at academic and non-academic institutions.

Data collection

For evaluating our implementation strategy components, we brought together Google Analytics for usage, Cuble for engagement data in learning with statistics for template implementation. We were able to record usage of eLearning, the Feedback button and audit and feedback reports at the lab level for the active aspect of the intervention. Because of the General Data Protection Regulation, we were no longer allowed to gather Internet Protocol addresses from visitors to our website. We surveyed users all around the country to learn about the effectiveness of SSR, the way strategies are being utilized, challenges with access and opinions on the strategies' content and how easy they are to use. Survey questions also covered challenges to SSR implementation and methods for making it better. Direct emails were sent to both liaisons and existing interested pathologists on available mailing lists for the eSurvey. People were notified through internet site, its LinkedIn group and the association's two eNewsletters. The survey recorded that the research explored the target groups,

collected the data and analyzed the responses anonymously. Respondents gave their consent to use their anonymous data before starting the eSurvey. All target groups spent about 10 to 15 minutes filling out the questionnaire and the survey did not allow unanswered questions. Response rates were increased by following the advice from Fan & Yan [37] in developing and sharing the survey [37].

Data analysis

To look at how much information about strategy elements was accessible, statistics analysis was used. The total active strategy component exposure figure ignored laboratories that did not use Synaptic Systems Relay since only SSR-linked templates have the "Feedback" button. Results used in the eSurvey came only from people who completed at least 50% of the questions. We used IBM SPSS Statistics V25.0 to analyze the information from the eSurvey. The analysis was carried out without missing value information which was indicated in the data as missing. It was revealed by descriptive statistics how many SSR users reviewed how doable and effective each strategy component seemed to them. How eLearning and the use of feedback buttons compared to training on audit and feedback reports was measured between laboratories that joined the project and those that did not. We compared the way SSRs were used in the weekly reports from pathology laboratories that had this feature ("eLearning," "Feedback button," audit & feedback) to those that didn't have them. We left out the two pathology laboratories that did not use SSR templates in the analysis of the "Feedback" button, since the button is only useful with SSR templates. The analysis divided users into groups to study how using two to three active elements might increase SSR usage, with users who used two to three, one or none compared to the reference group. Samples taken in the two laboratories that do not use SSR were not used for our analysis. For the model, all possible variables (Strategy phase, Time, Time since strategy introduction, group, Strategy phasegroup, Timegroup, Time since strategy introduction*group) were used in the ARIMA framework. Only results with p-values smaller than 0.05 were considered significant by two-sided analysis. All the outcomes from both effect and process evaluations are listed in Additional file 6.

RESULTS

A number of tables were used to judge how well each part of the strategy was delivered within the framework of the intervention. In the analysis, 42 laboratories reports were gathered and given in Table 1. Twelve of the laboratories were research facilities for academia and twenty-four were used by other organizations. Throughout the pre-measurement phase, 38 laboratories applied SSR, while there were only 4 that did not. The results of the comparison between all four treatments and the subgroup analyses are presented in Table 2. All results were divided by tumor type and retrieval method, as well as the type of laboratory involved. A significant rise in SSR adoption was recorded in reporting of gastrointestinal pathology, with a 4.0% better assessment (p=.012A) when comparing groups, but a 1.0% decline in prevalence (p=.000a) within the group. Although reporting of gynecological pathology dropped by 1.5% among groups, the same symptom was reported more frequently within each group by 1.2%. There was a small change of 0.9% in the growth pattern between all the groups, but a larger 2.4% rise among group members (p=.004A). there was a 5.5% rise (p=.003A) in SSR use in academic laboratories, regardless of the approach or the field of the laboratory. A summary of the ways implementation strategies were exposed to students appears in Table 3. More than 400 people accessed the toolbox and the website had 210 unique visitors. At the same time, the number of distinct users accessing the toolbox was 135. Between 15 and 25 laboratories had a lower use of the active strategy elements which required eLearning and feedback through a button. Our proposed feedback was delivered to 28 laboratories of the participating facilities. Table 4 shows how respondents used and evaluated the strategies used in this project. The volume and quality of SSR use increased according to feedback after adding the FAQ, SSR and feedback buttons, since the feedback button got the most positive comments at nearly half the

responses (45%). Three active components got an average evaluation score of 8, with the evaluators giving each between 6 and 10 points.

Table 1 Characteristics of Dutch pathology laboratories

Characteristics	N=42
Laboratory type	
Academic	6
Non-academic	36
Laboratory use of SSR in pre-measurement period	
Yes	38
No	4

Table 2. Outcomes of effect evaluation and subgroups

Group pathology reporting analyzed	n	Subgroup	Change in level between group (%)	p value	Change in level within group (%)	p value	Change in trend between group (%)	p value
Tumor groups	32,298	Gastrointestinal	Ref	+4.0%	p=.012 A	Ref	−1.0%	p=.000a
	120,381	Gynecological	−1.5%	p=.022 A	+1.2%	p=.898	−0.5%	p=.007 A
	60,806	Urological	+0.9%	p=.832	+2.4%	p=.004 A	+0.3%	p=.110
Retrieval method	91,705 b	Biopsies	Ref	+0.3%	p=.705	Ref	−0.1%	p=.491
	124,691	Resections	+2.0%	p=.129	+3.2%	p=.005 A	−0.3%	p=.319
Type of laboratory	188,665	Non-academic	Ref	+3.1%	p=.043 A	Ref	−0.2%	p=.527
	24,820	Academic	+5.5%	p=.003 A	−3.0%	p=.019 A	+0.8%	p=.256

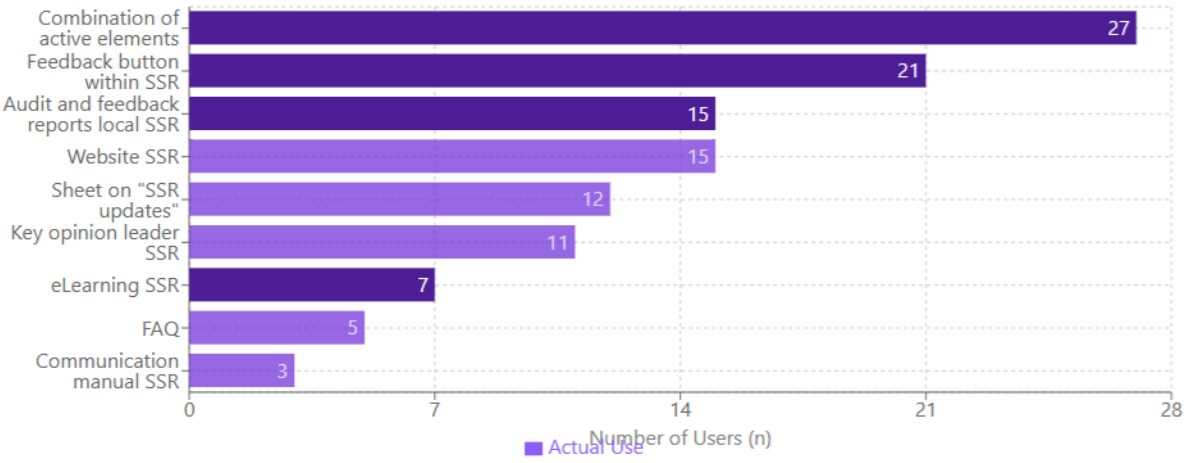
Table 3. Overview of exposure rates per implementation strategy element during strategy introduction

Implementation strategy (element)	Active/passive	Data source	Unit of analysis	Exposure rate
Toolbox (posted on webpage)	N/A	Google Analytics	Unique visitors	135
Website	Passive	Google Analytics	Unique visitors	210
Overview templates and updates	Passive	Google Analytics	Unique visitors	185
Development	Passive	Google Analytics	Unique visitors	30
FAQ	Passive	Google Analytics	Unique visitors	90
eLearning	Active	Cublea	Laboratories	15
Feedback button	Active	website	Laboratories	25
Digital information sheet	Passive	N/A	N/A	N/A

SSR updates				
Audit and feedback reports	Active	Data agreement by email	Laboratories	28
Communication manual	Passive	Google Analytics	Unique visitors	140

Table 4: Survey results on actual use, effectiveness, and score of implementation strategy elements

Implementation strategy element	Type of element	Actual use (n)	Effect: More often use of SSR (%)	Effect: Better use of SSR (%)	Recommendation score (Median)
Website SSR	Passive	15	30%	10%	6 (3–9)
• FAQ	Passive	5	15%	20%	7 (6–8)
eLearning SSR	Active	7	18%	25%	5.5 (3–7)
Sheet on “SSR updates”	Passive	12	27%	22%	6.5 (4–8)
Feedback button within SSR	Active	21	50%	45%	7.5 (5–9)
Audit and feedback reports local SSR	Active	15	35%	40%	8 (7–10)
Key opinion leader SSR	Passive	11	20%	N/A	7 (5–9)
Communication manual SSR	Passive	3	10%	5%	9 (8–10)
Combination of active elements	Active	27	55%	60%	8 (6–10)



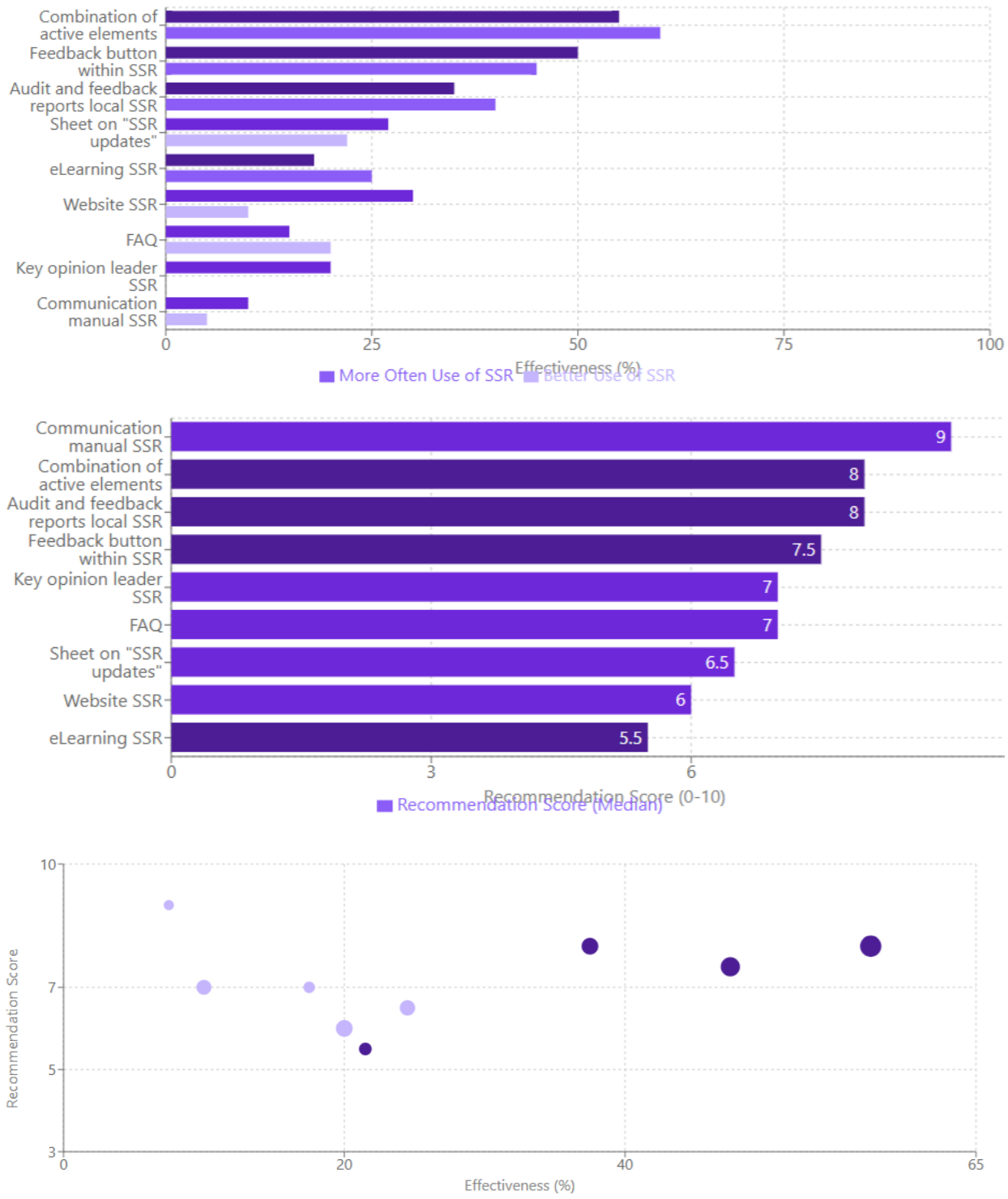


Figure 1. Survey results on actual use, effectiveness, and score of implementation strategy elements

DISCUSSION

We wanted to increase SSR in all states by using an only digital approach and evaluating various elements in real environments. Following this approach, the results indicated that improving guideline implementation is possible. Evaluation of the results found a strong rise in the use of SSR for reporting gastrointestinal, urological and resection tumors. There was no effect on reporting statistics observed among the three tumor groups, the sections for gynecology or biopsies. According to the study, academic laboratories are not like non-academic laboratories. After the new

strategy was put into place, thirty-three out of forty-two laboratories saw improvements in their use of sexual strategy record (SSR). Self-assessments during the process evaluation confirmed the findings from the original study but also showed that some other strategies had extra impact on them. Even though our digital assets were accessible, we decided that embedding them into the framework's templates would likely make them more accessible. Many pathologists and pathology residents found that using Structured Reporting faced major challenges which were mostly related to stiff templates, longer time needed to complete reports and issues regarding what the reports contained. Results indicated that the most useful feature for improving SSR use was the Feedback button. The use of structured reports did not increase when pathologists or residents worked with two or three implementation strategies compared to situations where they used just one or none. Both techniques indicate that some report categories still face ongoing challenges. Even though the piloting stage achieved success, the elements in the evaluative implementation strategy kept encountering problems which may explain why their use was still inadequate [22]. The previous studies [19, 20] showed problems, but we were unable to solve them because of financial and time constraints [22]. All three tumor types reported improved outcomes in almost all laboratories, hinting that good measurement methods can lead to meaningful changes. Removing particular challenges faced by client groups is needed for SSR to improve at the national level. The research found that a digital pathology innovation could be effectively put into use everywhere across the country. The findings provide experts with useful techniques and approaches to use in comparable studies. Studies in the past [19, 38, 39] agree with this study because both groups report the same challenges with temples and speed limitations for SSRs reporting. According to the pathologists, an integrated method would be the preferred approach to including implementation components. As pathology labs move towards using all digital tools, IT should help build digital pathology systems that are simple to use. With help from such programs, pathologists can complete SSRs much faster, cutting the time it takes them to write biopsy reports. Supporting the process of pathologists may benefit from making eLearning and audit & feedback reports available for everyone involved. As a result, (inter)national professional organizations now have the chance to adopt these approaches [40]. We created our detailed plan for implementation by looking at findings from earlier studies and by first trying out our approach on a small scale [19, 20, 22]. We were able to examine six components of implementation strategy with the scientific evaluation framework. Because of organizational and technical difficulties, we could not test all promising design aspects and this formed a key limitation for our work. Variant testing errors may be responsible for the differences in SSR reception by distinct tumor types. SRRLDS would perform better if there were standardized templates for SSR in wide use. Group members from pathology worked together to make the SSR template at the beginning of the project and this became the baseline for further improvements in the last part of the post-introduction phase. Standard governance processes for SSR development and improvement can be evaluated after the fact, as regions and countries applying SSR frequently meet the same problems [41, 42, 43]. Custom programs for the SSR template were not written since, technically, the system could not communicate with external data systems. Local technical challenges were still poorly managed despite the presence of website liaison staff together with existing channels for communication. In labs moving to digital pathology, specialized workers are needed who know pathology and information technology to assist pathologists with the new system.

CONCLUSION

The introduction of SSR for pathology results of gastrointestinal and urological cancers was successful thanks to a variety of digital tools that pathologists could easily use to help SSR gain more acceptance in the country. According to earlier findings, implementing SSR still encounters regular barriers from subgroups performing gynecological oncology or reporting biopsies. As SSR is applied widely in clinical pathology, resolving existing SSR advisory difficulties becomes necessary. Now is the perfect time for pathologists, pathology associations, cancer registries, IT specialists and patient organizations to work together and make the most of pathologists using SSR.

Even though pathology is the worldwide leader in SSR, it is slow to catch up with new digital tools in the industry. During the next few years, attempting to improve oncological diagnostic workflows will require all stakeholders to cooperate with each other. The use of structured data in pipelines covering all areas of oncological diagnostics will help provide better treatment approaches.

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