

# A “Sludge Audit” for Health System Colorectal Cancer Screening Services

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Screening for colorectal cancer (CRC) is broadly recognized as effective in reducing disease-related mortality.<sup>1</sup> The US Preventive Services Task Force, American Cancer Society, and US Multi-Society Task Force on Colorectal Cancer recommend regular screening for average-risk individuals aged 45 to 75 years (Table).<sup>2-4</sup> Even so, approximately 1 in 3 Americans fails to receive up-to-date screening, and substantial disparities in screening exist.<sup>1</sup> For example, only 55% of people with low income and less than half of people living in rural areas in the United States received on-time screening in 2019.<sup>5,6</sup> To date, efforts to improve the implementation of CRC screening have largely focused on enhancing patient demand for screening or promoting clinician referrals for screening.<sup>7-9</sup> Factors within the health system itself (eg, governance and regulatory structure, policies and procedures, technological infrastructure, resource allocation, communication, quality control processes, setting, culture) are infrequent targets for intervention despite evidence of their role in decreasing health care organization capacity for and patient access to CRC screening.<sup>10,11</sup>

Many health system barriers to CRC screening can be described as “sludge.” Sludge is a behavioral economics concept that describes frictions or administrative burdens that make it difficult for people to attain what they want or need.<sup>12</sup> Unnecessary or repetitive paperwork, complicated administrative processes, and long wait times are common sources of sludge. The relevant frictions and burdens might well be excessive and unjust; they might be understood as time taxes. Within health care organizations, there is evidence that clinicians themselves must deal with sludge when referring patients to CRC screening and that patients face significant sludge throughout the screening experience. Cumbersome electronic health record (EHR) navigation, gaps in referral procedures, complicated instructional materials, and long wait times for screening are some examples.<sup>11,13-15</sup> Low-value CRC screening (inconsistent with evidence-based recommendations, resulting in no net benefit or possibly harm)<sup>16</sup> (Table<sup>2-4</sup>) can also be considered sludge because it decreases capacity and resources available for high-value screening.

Sludge audits, understood as systematic steps to identify and quantify existing levels of sludge, have proven instrumental to

## ABSTRACT

**OBJECTIVES:** “Sludge,” or the frictions or administrative burdens that make it difficult for people to attain what they want or need, is an unexplored health care delivery factor that may contribute to deficiencies in colorectal cancer (CRC) screening. We piloted a method to identify and quantify sludge in a southeastern US health system’s delivery of CRC screening services.

**STUDY DESIGN:** Mixed methods sludge audit.

**METHODS:** We collected and analyzed quantitative (insurance claims, electronic health record, and administrative files) and qualitative (stakeholder interviews and process observations) data associated with CRC screening for instances of sludge. Because they contribute to sludge and reduce system capacity for high-value screening, we also evaluated low-value CRC screening processes.

**RESULTS:** Although specific results were likely amplified by effects of the COVID-19 pandemic, the sludge audit revealed important areas for improvement. A 60.4% screening rate was observed. Approximately half of screening orders were not completed. The following categories of sludge were identified: communication, time, technology, administrative tasks, paperwork, and low-value care. For example, wait times for screening colonoscopy were substantial, duplicate orders were common, and some results were not accessible in the electronic health record. Of completed screenings, 32% were low-value and 38% were associated with low-value preoperative testing. There was evidence of a differential negative impact of sludge to vulnerable patients.

**CONCLUSIONS:** Our sludge audit method identified and quantified multiple instances of sludge in a health system’s CRC screening processes. Sludge audits can help organizations to systematically evaluate and reduce sludge for more effective and equitable CRC screening.

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increasing access to important services and opportunities in non–health care settings.<sup>17,18</sup> For instance, auditing sludge in the process of enrolling children in the National School Lunch Program informed the transition to modified enrollment procedures (“direct certification”), which has helped millions of children to obtain access to subsidized school meals.<sup>12</sup> Large impacts from sludge audits and sludge reduction have been described in the college application process, occupational licensing, and enrollment in public insurance programs.<sup>17-19</sup> The Department of Homeland Security has followed a sludge audit, which it has made public, to reduce 20 million hours in annual paperwork burdens.<sup>20</sup> We are not aware of published examples of sludge audits in the health care setting, but we hypothesize that the identification and quantification of sludge in the delivery of clinical preventive services will facilitate targeted process improvement and increased access to and capacity for preventive services delivery. For that reason, we piloted a method to identify and quantify sludge within a large health system’s CRC screening delivery process through the administration of a proof-of-concept sludge audit.

## METHODS

This mixed methods sludge audit took place within a southeastern US health system in 2021 and 2022. This health system includes 47 primary care practices, performs colonoscopy procedures in 6 hospitals and 1 office-based endoscopy suite, and contracts with a large national laboratory services provider. The audit involved the collection of quantitative and qualitative data focused on standard CRC screening metrics and sludge (paperwork, technology, communication, administrative tasks, time, and low-value care in the CRC screening process). For the purpose of this study, the CRC screening process was defined as the events and time spanning from the opportunity for referral to screening (eg, primary care visit) to the receipt of screening results by clinicians and patients. The health system’s institutional review board determined that this project is a quality improvement initiative that does not meet the definition of human subjects research as outlined in 45 CFR 46.102(d) and therefore does not require institutional review board oversight or approval.

### CRC Screening Metrics

We used EHR and internal administrative data obtained in spring 2022 to assess several CRC screening metrics. The overall screening rate was calculated using National Quality Forum (No. of patients

## TAKEAWAY POINTS

Sludge is a behavioral economics concept that describes frictions or administrative burdens that make it difficult for people to attain what they want or need. To reduce sludge, organizations need a method for identifying sludge. Our mixed methods sludge audit identified multiple categories of sludge in a health system’s delivery of colorectal cancer (CRC) screening services: communication, time, technology, administrative tasks, paperwork, and low-value care. Findings suggest the following:

- ▶ Sludge is an organization-level barrier to achieving target CRC screening rates.
- ▶ The differential impact of sludge may perpetuate CRC screening inequities.
- ▶ Sludge audits may inform interventions to improve health care delivery.

**TABLE.** High- and Low-Value Colorectal Cancer Screening Definition and Details<sup>2-4,a</sup>

Appropriateness classification	Definition	Details
High value	Consistent with professional guidelines; associated with net clinical benefit	In average-risk patients aged 45 to 75 years, 1 of the following: Colonoscopy (every 10 years) or CT colonography or flexible sigmoidoscopy (every 5 years) or Stool-based test (every 1 to 3 years)
Low value	Inconsistent with professional guidelines; associated with waste, harm, and no clinical benefit	Screening in patients <45 years or >85 years or More frequently than: Colonoscopy (every 10 years) or CT colonography or flexible sigmoidoscopy (every 5 years) or Stool-based test (every 1 to 3 years)

<sup>a</sup>Because this study occurred shortly after the US Preventive Services Task Force updated its recommendation to begin screening for colorectal cancer at age 45 years (2021), we used age 50 years for the study analysis.

aged 51-75 years during the measurement year who had 1 or more screenings for CRC /No. of patients aged 51-75 years during the measurement year) and Healthcare Effectiveness Data and Information Set (HEDIS) (No. of patients aged 51-75 years during the measurement year who had 1 or more screenings for CRC /No. of patients aged 51-75 years during the measurement year who had at least 1 medical visit during the measurement year) approaches.<sup>21</sup> We compared the screening rate to the target of 80% of eligible individuals established by the National Colorectal Cancer Roundtable.<sup>22</sup>

We also compared the number of CRC screening tests ordered with the number completed within 12 months for 4 modalities: colonoscopy, CT colonography, flexible sigmoidoscopy, and stool-based tests (ie, fecal immunochemical test [FIT], guaiac-based fecal occult blood test [gFOBT], and multitargeted stool DNA). To assess potential missed opportunities for screening, we documented the number of patients who had a primary care visit in the previous year but were not up to date on CRC screening, the number of screening referrals that were not completed within 12 months, and the volume of positive

stool-based tests that were not followed up by colonoscopy within 12 months, as is recommended by the US Multi-Society Task Force.<sup>23</sup>

## Sludge

To identify and quantify sludge (frictions or administrative burdens experienced by clinicians or patients), we analyzed EHR data, internal administrative records, and research assistant observational field notes for the following categories, as informed by previous sludge audits in sectors other than health care<sup>12,17,18</sup>:

- 1. Time.** Median wait time between colonoscopy referral and scheduling during the past 12 months; median wait time between colonoscopy referral and procedure during the past 12 months.
- 2. Paperwork.** Number of insurance preauthorization forms completed for CRC screening in the previous 12 months.
- 3. Communication.** Median number of patient interactions with health system throughout the screening process; number of patients in the CRC screening queue who have received more than 3 missed calls for colonoscopy scheduling.
- 4. Technology.** Number of mouse clicks required for clinicians to order CRC screening in the EHR as observed by a trained research assistant.
- 5. Other administrative tasks.** Number of duplicate referrals for screening colonoscopy received in the past 12 months; “no-show” rate for colonoscopy during the previous 12 months.
- 6. Low-value care.** Number of low-value CRC screenings; low-value CRC screenings stratified by classification; number of low-value periprocedural tests associated with CRC screening. For the low-value care analyses, we extracted insurance claims associated with CRC screening and periprocedural testing prior to CRC screening using the Virginia All-Payer Claims Database (APCD; www.vhi.org), which collects medical and pharmaceutical claims for more than 7 million Virginians insured by traditional Medicare, Medicare Advantage, Medicaid, dual (Medicare-Medicaid), and commercial payers. The Milliman Medinsight Health Waste Calculator, proprietary algorithm-driven software, was used to classify APCD claims as *guideline concordant* or *low-value* as described in previous research.<sup>24-26</sup> Briefly, CRC screening was classified as low value if it took place in average-risk patients younger than 50 years or older than 85 years, or more frequently than once in 10 years (colonoscopy), 5 years (CT colonography or flexible sigmoidoscopy), 3 years (FIT-DNA), or 1 year (FIT/gFOBT) (Table<sup>2-4</sup>). Of note, age 50 years was used as the minimum age for screening because the USPSTF’s newer recommendation of age 45 years was published during the analysis period. Patients who were symptomatic or had a history of gastrointestinal cancer, polyps, or other indications for more frequent screening were excluded by the Health Waste Calculator. Periprocedural testing (laboratory, electrocardiogram, chest x-ray) associated with CRC screening was classified as low value if the patient met criteria for minimal risk from anesthesia and the CRC screening test (American Society of Anesthesiologists category 1 or 2).

We also invited 12 key stakeholders (a convenience sample of clinicians [ $n = 4$ ], staff members [ $n = 3$ ], and administrators [ $n = 5$ ] involved in the health system’s CRC screening process) to participate in 30-minute semistructured interviews focused on the health system’s CRC screening process. As a quality improvement project, informed consent was not required, but the objectives of the project were described to each stakeholder, who provided verbal agreement to participate. From interview transcripts, 2 trained research team members coded examples of the 5 categories of sludge highlighted earlier, in addition to other emerging themes. Coding agreement between the 2 researchers was approximately 88% on first pass. Differences were resolved via discussion with a third team member. Data were integrated for analysis and interpretation by the research team and compiled into a sludge audit summary report.

## RESULTS

The sludge audit summary is shown in the [Figure](#). This health system’s CRC screening rate was 60% (per NQF methodology), with 85% of screenings conducted via colonoscopy. The screening rate was 64% for Medicare, 59% for commercial, and 42% for Medicaid patients. A total of 1814 (32%) CRC screening tests were classified as low value, with the most common reason being that the patient was not yet due for screening. Of screening tests ordered for EHR-denoted Black or African American patients, 39% were low value vs 32% or less for all other races.

Our audit revealed multilevel sludge in the CRC screening process ([Figure](#)). In the stakeholder interviews, *time* and *communication* were the most frequently described categories of sludge (38 and 32 mentions, respectively), followed by *technology* (24), *other administrative tasks* (16), and *paperwork* (13). The median wait time between colonoscopy referral and procedure exceeded 6 months (*time*), but some patients did not receive the procedure after 12 months (*time*). Others were asked to attend multiple visits prior to a screening colonoscopy (*other administrative tasks*), sometimes making long commutes to do so (*time*). The median wait time between colonoscopy referral and scheduling exceeded 6 weeks (*time*); during this period, numerous patients received multiple missed calls for scheduling (*communication*), and some were asked to complete duplicative forms (*paperwork*). The process of ordering a screening colonoscopy required clinicians to make a median of 17 mouse clicks in the EHR (*technology*). Sludge related to clinicians’ receipt of screening results was consistently described (eg, inability to access results of screenings conducted outside of the health system, stool-based test results not viewable in the EHR) (*technology*).

One stakeholder summarized the sludge experienced by some patients in the CRC screening process: “It seems like patients are being asked to do way too much. First, they wait several weeks to hear from us, then we want them to come for a separate [preoperative] visit, and then we want them to come pick up their [colonoscopy] prep, and then finally have the procedure itself, which, by the way, isn’t very pleasant. And this doesn’t include all the phone calls and

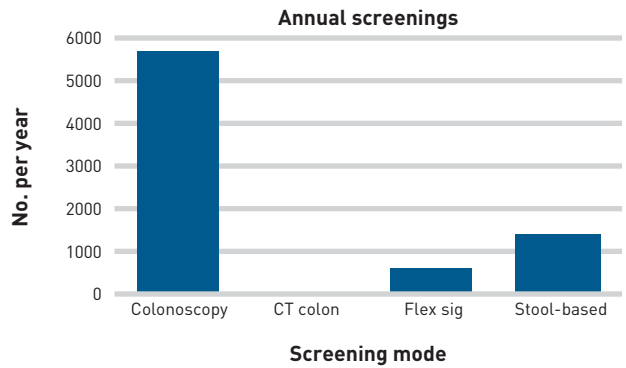
**FIGURE.** Sludge Audit Summary: Key Findings From a Health System CRC Screening Sludge Audit

**SCREENING SNAPSHOT**

<b>Overall screening rate</b>	<b>60.4%</b> (NQF)/ <b>51.3%</b> (HEDIS)
<b>Screenings completed</b>	6679 (50% completion rate)

**POTENTIAL MISSED OPPORTUNITIES**

Screenings ordered but not completed within 1 year	6738
Patients who had PCP visits and are not up-to-date on CRC screening	64,520
Positive stool tests not followed up by colonoscopy within 1 year, n (%)	728 (52%)



**SLUDGE:** excessive or unjust administrative tasks incurred by patients and health care team members

Type of sludge	Examples from quantitative data	Examples from qualitative data
Time	Wait time for colonoscopy scheduling: <b>48 days</b> Wait time between referral and colonoscopy: <b>221 days</b>	Primary care staff receipt of messages regarding wait time or prep/stool-based test instructions; billing staff spending hours "on hold" with insurance companies; patients' lengthy repeated commutes for 1 screening test
Paperwork	Number of insurance preauthorization forms: <b>3900</b>	Repetitive intake forms; duplicate/triplicate in-procedure notes; miscoding/recoding • "Depending on the patient, they may have to fill out essentially the same intake form 3 different times." (staff member)
Communication	Number of touch points with patients throughout screening process: <b>7</b> Patients in colonoscopy scheduling queue who have received > 3 missed scheduling phone calls: <b>787</b>	Referrals back to ordering clinicians for order clarification; conflicting FIT instruction sheets; excessive fax-only forms; patients unable to recall test results (anesthesia or other causes); high call volume from patients wishing to reschedule colonoscopy; high call volume from patients confused about charge for adenoma removal during screening colonoscopy
Technology	EHR clicks required to order screening: <b>14-30</b>	Instructions/results not viewable via patient portal; barriers to accessing data for tracking screening rates, processes, and outcomes; lack of interoperability between EHRs; inability to access screening results
Other administrative tasks	Duplicate orders/referrals: <b>1950</b> Colonoscopy no-show rate: <b>27%</b> Patients charged out-of-pocket \$ for screening: <b>1202 (18%)</b>	Separate preprocedure process required prior to colonoscopy; FIT tests lost in mail, with results never received; inconsistent insurance requirements and procedures
Low-value care	Screenings that were not guideline concordant: <b>1814 (32%)</b> • Duplicate test performed: <b>490 (27%)</b> • Patient not due for screening: <b>889 (49%)</b> • Patient aged > 85 years: <b>363 (20%)</b> • Patient aged < 50 years*: <b>73 (4%)</b> Low-value preoperative tests prior to screening colonoscopy: <b>2537 (38%)</b>	Receipt of screening referrals from multiple specialties; low-risk patients undergoing blood tests, electrocardiogram, and an extra preoperative process prior to colonoscopy; early follow-up for diagnostic surveillance colonoscopy • "There's no chance that we are screening people who don't need to be screened. As hard as it is to get patients to do it, I can't imagine any of our docs sending someone who doesn't need it." (administrator) • "We have a bunch of systems in place to prevent unnecessary screenings." (physician)

**POPULATION**

- Screening rate in Medicaid patients: **42%** (vs **59%** in commercial, **64%** in Medicare, and **60%** overall)
- Higher rate of low-value screenings in Black/African American patients (**39%** vs **32%** overall)
- Lower rate of stool-based test uptake in rural primary care clinics (**< 1%** vs **6%** overall)
- Sludge in the screening process was related to disparities in care:
  - ▶ "There are many confusing steps and I am concerned about, [for] people who have limited knowledge of health care or have a lot of other barriers to care, how our process is another one of those barriers. So, I worry about how it creates disparities, actually." (administrator)

CRC, colorectal cancer; EHR, electronic health record; FIT, fecal immunochemical test; flex sig, flexible sigmoidoscopy; HEDIS, Healthcare Effectiveness Data and Information Set; NQF, National Quality Forum; PCP, primary care provider.

\*Age 50 years was used because the US Preventive Services Task Force's recommendation to begin screening at age 45 years was published during the analysis period.

## METHODS

messages involved in setting all this up. I really think about our patients who live a couple of hours away. It's not a surprise that they drop out of the process or do it once but never again" (staff member).

Another described sludge related to insurance coverage and some of its impacts: "I am aware that the Affordable Care Act made certain screenings available at no charge to patients, which sounds good and right. However, the reality of operationalizing that isn't as pretty at all. I can't tell you how many patients we get complaints from when they were charged for a [stool-based test] that their insurance doesn't cover or a colonoscopy after positive [stool-based test]. One physician told me that patients complain about this weekly" (staff member).

Two additional themes emerged in the stakeholder interviews. The first was concern about disparate impacts of sludge in the CRC screening process: "There are many confusing steps, and I am concerned about, [for] people who have limited knowledge of health care or have a lot of other barriers to care, how our process is another one of those barriers. So, I worry about how it creates disparities, actually" (administrator).

The second was the association of the CRC screening process with negative emotional effects, including frustration, stress, and burnout among health care team members. Several stakeholders described enhanced responsibilities and stress associated with the COVID-19 pandemic and lower tolerance for "burdensome processes" such as those incurred in CRC screening. The increased volume of patients in the CRC screening queue as a result of pandemic has "made the problem feel insurmountable to providers and they just stop dealing with it" (administrator).

## DISCUSSION

Throughout the United States, CRC screening rates remain well below the national target of 80% and demographic disparities are prevalent.<sup>1,22</sup> We performed a proof-of-concept sludge audit of the CRC screening process of a large regional health system with a 60% screening rate and 50% order completion rate. The audit revealed multilevel sludge in the form of communication, time, technology, administrative processes, paperwork, and low-value care. As this sludge was associated with decreased health system capacity for screening, decreased patient access to screening, and disparities in screening, we conceptualize sludge as a novel target for interventions to improve the rate and equity of CRC screening. Because the composition of sludge varies among health care organizations, the sludge audit method can effectively identify and quantify system-specific sludge.

This health system's audit findings are not substantially different from data reported on a national level. We believe that sludge is a ubiquitous problem in complex systems such as health care organizations. Additionally, similar to other health systems throughout the United States, this organization was recovering from shutdowns and delays associated with the COVID-19 pandemic, which caused backlogs, resource shortages, procedural changes, and likely additional

sludge within an already complex process. This system has already initiated a number of measures to reduce this sludge and increase CRC screening rates: multiple administrative reviews to increase the likelihood that high-priority colonoscopies are performed, improvements to the order interface for CRC screening in the EHR, and measures to improve the throughput of colonoscopy referrals and follow-up for abnormal stool-based screening tests.

Interventions to improve CRC screening rates commonly aim to enhance patient demand for or clinician referrals for screening.<sup>7-9,22,27-29</sup> Our findings suggest that health system sludge stands in the way of CRC screening, even for highly motivated patients and clinicians. We posit that, when faced with sludge in the CRC screening delivery process, patients and clinicians are deterred (consciously or not) from initiating or completing screening. Furthermore, increasing demand for screening without addressing existing sludge is likely to further exacerbate capacity challenges faced by many health systems. Care disruptions associated with the COVID-19 pandemic, a national shortage of endoscopists and anesthesiologists, and a reduction in the recommended minimum screening age from 50 to 45 years (introducing up to 20 million more Americans into the screening process) have played a role in screening colonoscopy backlogs and delays reported throughout the United States.<sup>22,30-35</sup> Although increased utilization of stool-based tests over colonoscopy is an important and broadly recommended strategy for improving access to and capacity for CRC screening, our audit identified sludge in the stool-based test process as well (eg, complicated or conflicting instructions, results inaccessible in EHR/patient portal, inconsistent insurance coverage, separate phone calls/messages). Importantly, health system sludge is not necessarily a reflection of the quality of care provided by a particular health care organization or system. Rather, it is likely a result of numerous evolving factors—environment, policy, reimbursement, staffing, and demand fluctuations, to name just a few.

In addition to delayed or deferred screenings, navigating sludge may have other adverse consequences. Not only can sludge impose time taxes, but it might also be associated with frustration, fear, embarrassment, and shame.<sup>12,36</sup> It may increase clinician workload and burnout and negatively influence decision-making.<sup>37,38</sup> Among patients, it may decrease trust in the health care system. Sludge may exacerbate existing disparities in CRC screening. In our health system audit, stakeholders perceived disparate impacts of sludge in the CRC screening process to some members of the population, such as those with poor health literacy or those living in rural areas.

Others have previously highlighted the potentially disproportionate costs of sludge to certain groups and individuals, due at least in part to the concept of cognitive scarcity, understood as limited bandwidth to manage various burdens, including administrative burdens.<sup>17,39</sup> Those who have financial challenges, impaired health status, poor trust in health care, or other obstacles to screening may lack the time, bandwidth, or means to persevere through sludge-laden systems. Although we are unable to assess the causal impact of sludge on adverse outcomes in the current study, we observed evidence of



lower screening rates in underserved populations. Stakeholders also highlighted the impact of a burdensome screening process on clinicians' stress level and sense of well-being. Reducing sludge in the CRC screening delivery process has the potential to narrow the known equity gaps in CRC screening through simplifying the process for patients and health care team members alike.

President Joe Biden's Cancer Moonshot Initiative 2.0 (2022) aims to reduce the cancer death rate by at least 50% over the next 25 years with an enhanced focus on reducing the burden of cancer screening and diagnosis.<sup>40</sup> Given the complexity of health care and concurrent efforts to improve quality, decrease waste, and protect privacy, sludge can inadvertently accumulate and have unintended harmful consequences. Our sludge audit uncovered numerous actionable targets for future efforts to increase CRC screening rates through minimizing associated burden. A variety of approaches to the reduction of sludge have been described by others and may serve as valuable templates. For example, in his work with the White House Office of Information and Regulatory Affairs, one member of our research team (C.R.S.) promoted the identification of paperwork burdens, followed by evaluation of necessity, setting goals for reduction, and public reporting on progress.<sup>12</sup> Soman et al<sup>18</sup> designed a dashboard and series of checklists to reduce sludge. Others have designed creative "nudges" to counter the sludge in an environment.<sup>28,41-43</sup> Building upon common health care quality improvement approaches (Plan-Do-Study-Act cycles,<sup>44</sup> Lean Performance Improvement, Six Sigma<sup>45</sup>) may also be effective. For instance, a sludge audit would be an invaluable starting point for a Plan-Do-Study-Act process or other quality improvement initiatives. Finally, an increasing number of theories, frameworks, and approaches to the deimplementation of low-value health care services have been evaluated and may be applicable.<sup>46-48</sup>

## Limitations

This study had several limitations. First, it took place within a single health system. Sludge audits implemented within other systems may encounter different categories and relative quantities of sludge. Second, data obtained from the EHR were limited to those that were available within the system. For example, if a patient received a CRC screening test at a different health system, that may not have been captured in this health system's EHR. Limitations to any use of insurance claims for analysis of low-value care also exist because clinical nuance is not captured. However, claims data are commonly considered reliable for analysis of low-value care trends in large population sizes. Finally, although our stakeholder interviews provided great insight about sludge in the CRC screening process, we did not represent the important voice of patients themselves.

Further, much more research is needed to describe and quantify sludge in the screening processes of other health systems, to incorporate perspectives of patient stakeholders, and to characterize and specify the association between sludge and adverse outcomes (eg, delayed or deferred screenings, mistrust, disparities). Additionally, improving understanding of how much sludge is too much would

benefit interventions to reduce sludge. Some metrics are well established, such as the 80% screening rate target established by the National Colorectal Cancer Roundtable.<sup>22</sup> We can easily assess that the observed 60% screening rate and the national 65% screening rate are well beneath the 80% target.<sup>1</sup> However, targets for other sludge audit components are less clear. For example, the median wait of longer than 7 months for screening colonoscopy felt too long to the stakeholders we interviewed, but recommendations for an appropriate time frame are lacking. Likewise, the observation that nearly one-third of completed screenings were classified as low value (nonconcordant with guidelines) was surprising to the stakeholders we interviewed and was higher than in some previous studies, but a specific target recommendation is not available. Sludge audits create opportunities for health systems to establish internal performance improvement goals and metrics for evaluation of improvement. Future iterations of the sludge audit should assess costs of operationalizing and implementing the sludge audit method.

## CONCLUSIONS

This pilot health system sludge audit, performed during the COVID-19 pandemic, uncovered multiple opportunities to improve the delivery of CRC screening services. The audit revealed sludge in the categories of communication, paperwork, technology, administrative tasks, time, and low-value care; suggested disparate impacts of sludge to disadvantaged populations; and highlighted frustrations of CRC screening process sludge to health care team members. Reducing sludge may facilitate postpandemic recovery of missed screenings. Next steps include further characterizing the consequences of sludge in the CRC screening process; expanding sludge audits to include additional stakeholders (ie, patients), varied health systems, and other health care services; and determining the cost-effectiveness of sludge audits for improving delivery of CRC screening. ■

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**Authorship Information:** Concept and design (MSR, KAD, SHP, BLC, CRS, JWE); acquisition of data (MSR, MCF, JAR); analysis and interpretation of data (MCF, JSS, KAD, SHP, GCD, CRS, JWE); drafting of the manuscript (MSR, JSS, BLC, JWE); critical revision of the manuscript for important intellectual content (MCF, JSS, KAD, SHP, GCD, JAR, BLC, CRS, JWE); statistical analysis (MSR, GCD); provision of patients or study materials (MSR); obtaining funding (MSR); administrative, technical, or logistic support (JAR, JWE); and supervision (MSR, SHP, JWE).

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