

A Framework for Identifying and Addressing Bottlenecks in Government Administrative Approval Processes

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Abstract: Many government offices in Sri Lanka now handle files through digital workflow systems, yet the record of how files move is rarely used to study delay. This paper presents a simple and reusable framework for identifying and addressing bottlenecks in government administrative approval processes. The framework was developed and tested on one six-stage file approval process carried out in five government offices. Because system event logs were not available, a structured questionnaire was used: Subject Officers copied the stage-by-stage dates from files they had personally closed, giving 150 file records (30 per office). A bottleneck was defined as a waiting time above the stage mean plus one standard deviation, and the data were analyzed using Python. Delay and bottleneck rates rose with the approval level required, from 6.9% for files needing Assistant Director approval to 52.0% for files needing Secretary approval. Stage-level bottleneck rates were highest at the Director (14.0%) and Additional Secretary (14.5%) stages, and office-level rates ranged from 20.0% to 40.0% although all offices followed the same process. The most common reported cause of delay was that no specific reason was known. Officers identified the slowest stage correctly for only 42.0% of files and rarely noticed delay higher in the approval chain. A dashboard and an officer portal built on the framework obtained a mean System Usability Scale score of 80.2, and an expert reviewer judged the framework reasonable and practical for identifying delays.

Keywords: Administrative Delay; Bottleneck Identification; Dashboard; File Approval Process; Framework; Sri Lanka.

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I. INTRODUCTION

Government offices in Sri Lanka still run largely on files. A citizen's application or an internal administrative matter is opened as a file and passed from one officer to the next until an officer with the authority to decide signs it off. Over the past decade, many departments have started to move this process onto digital workflow systems, supported by programmes led by the Information and Communication Technology Agency of Sri Lanka (ICTA) [1]. A side effect of this shift is a detailed trail of how files actually move: who handled a file, when, and for how long. In most offices, however, this trail is used only for accountability, for example when a member of the public complains that an application has been sitting for months. It is rarely used to ask a more basic question: where in the process do files usually get stuck, and why?

Digitalization does not by itself remove delay. A post-ICT deployment study of 29 Sri Lankan ministries and departments found that most public service functions had not reached an efficient level of performance [2]. The process mining literature offers a way to locate delay by measuring

waiting time at each stage of a process using timestamped event logs [3]. However, such logs were not available in the offices studied here, and most Sri Lankan studies examine a single institution rather than comparing offices that carry out the same process. As a result, there is little evidence on which stage of a specific approval process causes delay, or on whether the pattern is common across offices or specific to one.

This paper addresses that gap. Its aim is to develop a simple and practical framework for identifying and addressing bottlenecks in government administrative approval processes, using data collected directly from officers. The paper makes four contributions: (i) a seven-step framework that turns dated file records into stage-level measures of delay; (ii) a questionnaire-based method for collecting stage-level timing data where system logs are unavailable; (iii) an empirical comparison of one approval process across five government offices; and (iv) a dashboard and an officer portal prototype, evaluated for correctness and usability. The study is guided by two research questions. RQ1: At which stages of the selected file approval process do the longest delays occur, across the offices studied? RQ2:

What factors contribute to delays at the identified stages? The remainder of the paper reviews related work, describes the proposed framework and prototype, reports and discusses the results, and concludes with recommendations and future work.

II. RELATED WORKS

Classical bureaucratic theory explains why files move slowly in government offices. Weber described bureaucracy as a rational-legal form of organization built on fixed jurisdictions, a hierarchy of offices, written records and rule-governed procedure [4]. These features make an organization predictable and accountable, but they also create multiple steps, approvals and waiting periods. Public administration research calls the resulting burden red tape. Kaufman argued that red tape seldom comes from the malice of individual officials; rules are added over time for good reasons, and their accumulation makes the whole system less efficient [5]. Bozeman defined red tape as a rule or procedure that stays in force although it no longer serves its original purpose [6]. Administrative delay is seen as one visible effect of ineffective rules, but the two terms are not the same [7]. Pandey and Bretschneider added that public organizations tend to show more administrative delay than private ones, and that this delay shapes their interest in new information technologies [8]. Following this literature, the present study does not judge whether the governing rules are functional. It takes them as given and asks where, within them, time is lost.

The e-government literature looks at how administrations move from paper to digital operation. The best-known account is the four-stage model of Layne and Lee: cataloguing, transaction, vertical integration and horizontal integration [9]. For this study, the value of the model is that it shows how digitalization can change the way a bureaucratic process is carried out without removing the approval steps that cause delay. Introducing a workflow system mainly moves an office to the transaction stage. It does not automatically connect levels or departments, and it does not by itself provide the process-level information needed to locate delay.

The analytical logic for finding delay comes from process mining. It uses the event log of an information system, which records who performed each activity, on which case and when, to show how a process really runs and where waiting time builds up [3]. Workflow mining showed that process models can be reconstructed directly from workflow event logs [10]. Bottleneck detection then computes a measure such as average waiting time for each stage and flags the stages where it is highest [11]. The approach has been used in hospital billing, where a single registration step caused a large share of the delay [12], and in software development, where delays were traced mainly to handovers between team members [13]. Across these settings, a small number of stages, rather than the process as a whole, usually account for most of the accumulated delay. Findings must also be shown in a form that people can act on. Dashboards, which trace back to the French *tableau de bord* [14] and later became part of business intelligence, help staff notice patterns

and decide faster. A study of a government agency found that a business intelligence dashboard supported quicker and more accurate decisions, especially when users could filter the data [15].

Sri Lanka's digital government efforts began with the National Computer Policy of 1983 and the ICT Act of 2003 [16]. The e-Sri Lanka programme led by ICTA [1] and later infrastructure programmes such as the Lanka Government Network [2] were built to connect institutions and move services online. Implementation has nevertheless varied. Alahakoon and Jehan found scale inefficiency in many digitalized departments [2]. Fowsar reported that citizens in Divisional Secretariat areas of the Ampara District faced security concerns, unequal access to devices and difficulty using e-services [17]. Madhuwanthi and Muthulingam described how passport application in the Department of Immigration and Emigration moved from a decentralized paper-based process to a fully digital one that reduced long waiting times and rejections [18]. That case is one of the few in which a specific administrative process was examined across its full approval path.

Three gaps follow from this review. First, process-level detail is missing: most Sri Lankan studies deal with national policy, infrastructure or the overall performance of an institution, and few examine a specific approval process step by step. Second, cross-office comparison within the same process is rare, so it remains unclear whether a pattern of delay belongs to the process or to local conditions in one office. Third, no simple method exists for analyzing stage-level delay when researchers cannot access complete system-generated event logs. This paper addresses the three gaps by collecting structured, stage-level information from officers in several offices that carry out the same process.

III. PROPOSED WORK

➤ Study Setting and Data Collection

The study focuses on one type of file approval process that is carried out in broadly the same way in several government offices under the same circulars and Establishments Code provisions. A file is opened and handled by the Subject Officer and then passes through the supervising and approving officers before the required action is completed. In the offices studied, the chain has six stages in order: Subject Officer, Assistant Director, Director, Director General, Additional Secretary and Secretary (Figure 1). Not every file needs sign-off at every level. The required approval level depends on the nature and importance of the matter and decides how far along the chain the file travels. After sign-off the file returns down the chain to the Subject Officer, and each officer writes the dates of receipt and return on the file.

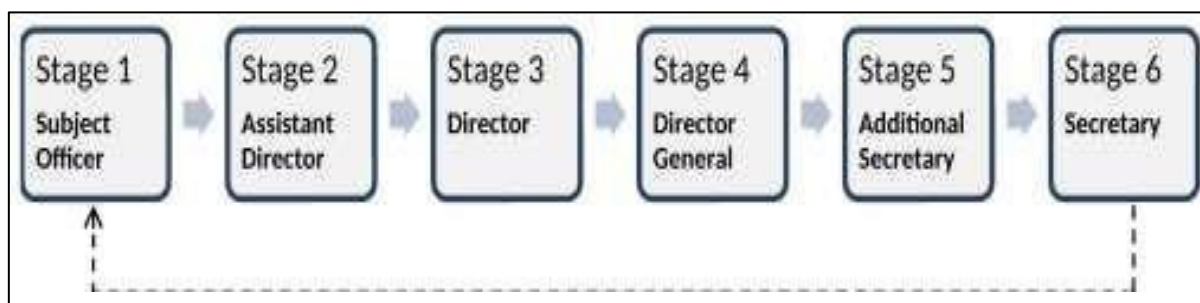


Fig 1 The Six-Stage File Approval Chain

Five offices were selected purposively because each carries out the same category of approval process and access to officers was achievable within the study period. To protect their identity they are called Office A to Office E. The population consists of Subject Officers, who open and compile a file and remain responsible for it until it is closed. Because every officer who acts on a file dates and endorses it, the Subject Officer can read the dates recorded by all officers once the file is closed. Officers at higher levels said they had no time to complete a questionnaire, so asking only Subject Officers was the most realistic way to obtain full stage-by-stage timing. Each officer completed the questionnaire once for each of several files he or she had personally closed. The target of 25 to 30 records per office was met, giving 150 file records, 30 from each office. The unit of analysis is the file, not the officer.

Data were collected with a structured questionnaire built in Google Forms and organized in three sections. The file context section records the office, the file category (for example financial, administrative, procurement, personnel, policy, planning or regulatory), the priority (High, Medium or Low), the required approval level and the date the file was opened. The stage-by-stage movement section records the dates on which the file was received and returned at each stage, from the Assistant Director to the Secretary, and the date it was closed. The delay factors section asks which stage took longest in the officer's view, the cause of the delay (officer unavailability, high workload, awaiting clarification, awaiting input from another department, return for correction, or other), whether the delay was typical or unusual for that type of file, and any comments. Officers were told not to record names or file reference numbers. Verbal permission was obtained from the head of each office, participation was voluntary, and responses were used only in aggregate.

➤ Proposed Framework

The framework is a seven-step method that turns dated file records into stagelevel measures of delay, flags bottlenecks with a fixed rule, links the flagged stages to the causes reported by officers, and presents the results in a form that supports action (Figure 2). Step 1 defines the approval chain, its stages and the rule that sets the required level for each file. Step 2 collects the dated stage records of closed files. Step 3 measures waiting time, processing time and total duration. Step 4 sets a threshold for each stage. Step 5 flags bottlenecks. Step 6 compares results by approval level, office, stage and priority and links flagged stages to reported causes. Step 7 addresses the bottlenecks through a dashboard,

reminders and cause-based recommendations. The framework needs three inputs (a defined approval chain, the dated stage records of closed files and the reported cause of delay) and produces four outputs (stage thresholds, bottleneck flags, comparisons across offices and stages, and recommendations linked to causes). Because the inputs are dates that officers can read from a file, another office can reuse the framework without specialized software. Applying it to a different process requires a new stage chain and new thresholds calculated from that office's own data.

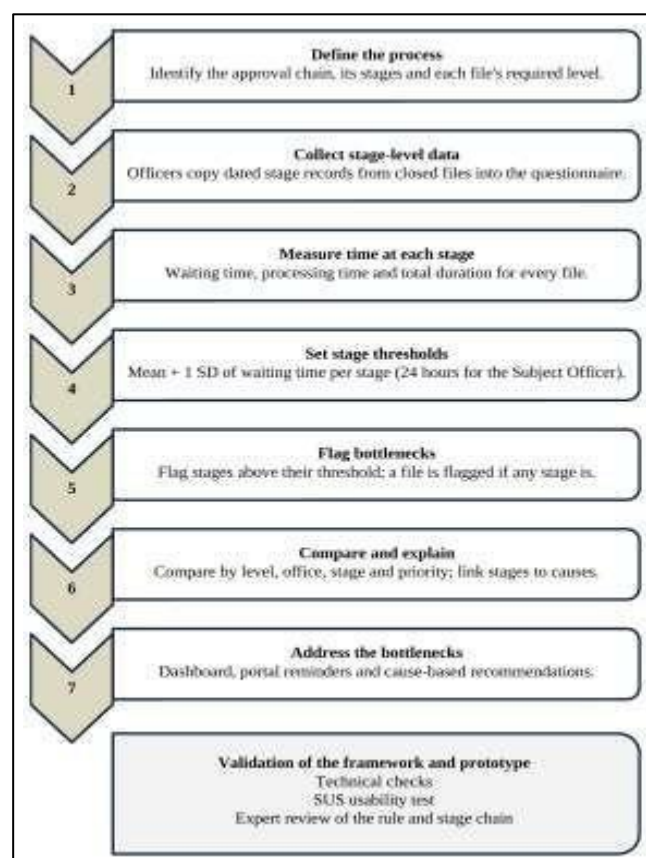


Fig 2 The Proposed Framework for Identifying and Addressing Bottlenecks in Government Administrative Approval Processes

• Time Measurement

Two measures were computed at every stage a file passed through. Waiting time is the time between a stage receiving the file and an officer starting work on it. Processing time is the time an officer actually spent working on it. Officers recorded calendar dates, not exact times, so

durations were calculated in working days, excluding Saturdays, Sundays and public holidays, and converted to hours by multiplying by 24. A period shorter than one working day was recorded as zero, and a period extending into the next working day was counted as one full working day. The data were cleaned and analyzed in Python, mainly with the pandas library.

- **Bottleneck Rule**

A bottleneck is defined separately for each stage, so that each stage is compared with its own normal speed rather than with one fixed number. For stage s , the threshold T_s is the mean waiting time plus one standard deviation of the waiting times observed at that stage (Eq. 1), where μ_s and σ_s are that mean and standard deviation. A stage is flagged for file f when its waiting time $w_{f,s}$ exceeds T_s (Eq. 2). A file is a bottleneck file when at least one of its stages is flagged.

$$T_s = \mu_s + \sigma_s \quad (1)$$

$$w_{f,s} > T_s \quad (2)$$

The Subject Officer stage has no waiting stage before it in the data, so a fixed limit of 24 hours (one working day) was used for it. A flag marks a stage as slower than usual for that stage. It does not show that the delay is unjustified, so the framework does not judge the rules behind the process.

- **Grouping and Cause Analysis**

After flagging, files were grouped in four ways: by required approval level, by office, by priority (to check whether High priority files were processed faster), and by individual stage (waiting time, processing time and bottleneck rate). The cause reported by officers was compared with the stage that the data showed was actually slowest, so that what officers believed could be compared with what the data showed.

- **Prototype Development**

Two prototype components implement Step 7. The first is a self-contained dashboard built with HTML, JavaScript and the Chart.js library. It shows duration and bottleneck rate by approval level, office, priority and stage, the causes of delay reported by officers, and a comparison between the stage officers believed was slowest and the stage the data showed. It also lets a user inspect any individual file record, and it runs in a web browser without installation. The second is an officer portal built with Python, Streamlit and a local SQLite database, using only free open-source software.

Officers log in with their office, role and a personal identification number (PIN), add a file when it reaches their desk, and see its waiting time, which is calculated only in working hours (8:15 a.m. to 4:15 p.m., Monday to Friday, excluding public holidays). A reminder appears once a file exceeds the threshold for that stage. A supervisor view lists pending files across offices and officers, and a recommendations view shows, for each flagged stage, the most common reported cause and a matching low-cost action. For example, if officer unavailability is the main cause, the suggestion is to designate a backup officer, and if missing documents are the main cause, to add a checklist before submission. The portal is a research prototype for a controlled setting, not a production system.

- **Evaluation Design**

Three checks were used. Technical validation tested the duration calculations in two ways: for all 150 records, the sum of the stage-by-stage waiting and processing times was compared with the total duration computed independently from the opening and closing dates, and ten records chosen at random were recalculated by hand from the raw dates. Usability was measured with the System Usability Scale (SUS), a ten-item, five-point agreement scale [19], given to 15 officers and supervisors after they used the dashboard and the portal. A score above 68 is taken as above-average usability. Respondents were also asked whether the bottleneck rule matched their experience. Finally, an Assistant Director (ICT) with experience of government administrative processes reviewed the stage chain and the bottleneck rule.

IV. RESULT AND DISCUSSION

The 150 files passed through 733 recorded processing steps. The number of steps varies because files needing more senior approval pass through more stages. Using the rule in Section 3.2.2, 39 of the 150 files (26.0%) were bottleneck files. By priority, 51 files were marked High, 55 Medium and 29 Low, and 15 had no priority marked.

- **Where Delay Builds Up (RQ1)**

Table 1 shows that files needing a higher approval level took longer. Files needing only Assistant Director approval took 1.62 working days on average, and files needing Secretary approval took 3.12. The bottleneck rate rose from 6.9% to 52.0% over the same range. This pattern was expected, since a higher required level means the file must pass through more stages.

Table 1 Average Duration and Bottleneck Rate by Required Approval Level

Required level	Files	Avg. duration (days)	Bottleneck rate
Assistant Director	29	1.62	6.9%
Director	39	1.79	17.9%
Director General	27	2.44	29.6%
Additional Secretary	30	2.77	30.0%
Secretary	25	3.12	52.0%

All five offices carry out the same process, yet their bottleneck rates differed widely (Table 2). Office A had the highest rate (40.0%) and Office D the lowest (20.0%). Average duration was similar across offices, between 2.10

and 2.37 working days, so some offices had far more seriously delayed files than others even though files took a similar time on average.

Table 2 Average Duration and Bottleneck Rate by Office

Office	Files	Avg. duration (days)	Bottleneck rate
Office A	30	2.37	40.0%
Office B	30	2.27	23.3%
Office C	30	2.37	23.3%
Office D	30	2.37	20.0%
Office E	30	2.10	23.3%

Table 3 gives the result for each stage separately. Bottlenecks were not evenly distributed. The Director stage (14.0%) and the Additional Secretary stage (14.5%) had

higher rates than the Assistant Director (6.0%), Director General (6.1%) and Secretary (8.0%) stages.

Table 3 Average Waiting Time, threshold and Bottleneck Rate by Stage

Stage	Avg. waiting time (hours)	Threshold (hours)	Bottleneck rate
Assistant Director	1.44	7.16	6.0%
Director	3.37	11.75	14.0%
Director General	1.46	7.24	6.1%
Additional Secretary	3.49	12.03	14.5%
Secretary	1.92	8.57	8.0%

The study also checked whether High priority files were processed faster. They were not. High priority files took 2.27 working days on average and Medium priority files 2.36, both with a bottleneck rate of 25.5%. Low priority files had a rate of 27.6% and an average of 2.14 days, and files with no priority marked had 26.7% and 2.40 days. Marking a file High priority therefore did not clearly reduce processing time or bottlenecks.

➤ Perceived Causes of Delay (RQ2)

Table 4 shows the causes reported by officers. The most common answer, given for 52 of the 150 files, was that no specific reason was known. The second most common cause was that the file was returned for correction or re-submission (28 files). High workload was reported least often (14 files). Officers described the delay as typical for that type of file in 95 cases, unusual in 27 and were not sure in 28, so most officers regarded delay as a normal part of the process.

Table 4 Reported Causes of Delay Across all 150 Files

Reported cause	Number of files
No specific reason known	52
File was returned for correction or re-submission	28
Officer was on leave or unavailable	22
Awaiting clarification or documents from the applicant	17
Awaiting input from another department	17
File was queued behind other files (high workload)	14

Table 5 compares the stage that the data showed was actually slowest for each file with the stage the officer named. Overall, officers named the true slowest stage correctly for 63 of 150 files (42.0%). The gap widens higher up the approval chain. When the Subject Officer's own initial processing was

slowest, officers were right in 31 of 46 cases (about 67%). When the Director General stage was slowest they were right in only 2 of 19 cases, and when the Additional Secretary or Secretary stage was slowest they were never right (0 of 9 and 0 of 4).

Table 5 The Stage the Data Showed was Slowest, Compared with how Often the Officer Named it Correctly

Stage	Times it was the real slowest stage	Times the officer named it correctly
Subject Officer	46	31
Assistant Director	42	18
Director	30	12
Director General	19	2
Additional Secretary	9	0
Secretary	4	0

➤ Discussion

- **RQ1.** The answer has two parts. At the file level, delay and bottleneck rate rise with the required approval level (Table 1). A file needing Secretary approval passes through six stages, and even a small chance of delay at each stage accumulates as stages are added. At the stage level, bottlenecks are not spread equally: the Director and Additional Secretary stages stand out (Table 3). Both the length of the chain and delay at particular stages therefore appear to contribute to overall delay. This differs somewhat from the hospital billing and software development studies, where one step or one handover explained much of the delay [12], [13]. Here two stages stand out, but no single stage dominates.

The office results add a further point. All five offices follow the same process under the same rules, yet bottleneck rates range from 20.0% to 40.0% while mean duration is almost the same. Delay therefore seems to depend on staffing, workload and local working practices as well as on the process itself, which agrees with the view that administrative delay is shaped by factors specific to each organization [8]. The priority result is also notable. The priority marking exists as part of the process, but it does not appear to work as intended, which fits Bozeman's description of a procedure that stays in place without serving its purpose [6].

- **RQ2.** That officers most often gave no specific reason suggests that most delay in this process is not tracked or explained by anyone, even informally. Where a cause was known, return of the file for correction was the most common, followed by officer unavailability. High workload is often assumed to be the main cause of government delay, yet officers reported it least often.
- **Visibility of delay.** Table 5 is one of the clearest findings. Officers were fairly good at noticing delay at their own desk but almost never identified delay further up the chain. Government offices already hold the information needed to see delay, in the dates written on each file, but it is rarely brought together and viewed as a whole. Without a shared tool such as the dashboard, delay away from an officer's own desk stays largely invisible.
- **Implications.** Three practical points follow. First, efforts to reduce delay should look at the length and structure of the approval chain and at the two stages with the highest rates, not only at individual officers. Second, since the largest reported cause was that no reason was known, recording even a brief reason for delay at each stage would turn an invisible problem into a visible one. Third, since bottleneck rates varied widely between offices carrying out an identical process, each office would benefit from seeing its own figures compared with the others, which the dashboard was built to do.

➤ Prototype and Framework Evaluation

Both technical checks confirmed the duration calculations. The stage-by-stage totals matched the independently computed total duration for all 150 records, and all ten hand-recalculated records matched the analysis script exactly. The SUS was completed by 15 respondents

(five Subject Officers, four Assistant Directors, three Directors and three in other roles). The mean score was 80.2 out of 100 (standard deviation 10.7, range 67.5 to 100.0), which is above the benchmark of 68 [19] and indicates good usability. Asked whether the way the prototype identifies a bottleneck matches how delay happens in their experience, 7 respondents said it matched well, 6 said it matched partly and needed small adjustments, and 2 were not sure. None said it did not match. The most common suggestions were better search and filtering, alerts when action is needed, and report export. The portal already includes a basic pending-file reminder, which supports the view that alerts are useful.

The expert reviewer considered the mean-plus-one-standard-deviation rule reasonable and practical for identifying files that are delayed more than usual. The reviewer also confirmed that the six-stage chain generally reflects how files move in the offices studied, while noting that the actual path may vary with the type and urgency of a file. Overall, the reviewer judged the framework suitable for identifying potential bottlenecks, understanding the areas that need attention and supporting actions to reduce delay.

V. CONCLUSION

This paper presented a simple, reusable framework for identifying and addressing bottlenecks in a government file approval process when system event logs are not available. Applied to 150 files from five offices carrying out the same six-stage process, the framework showed that delay grows with the approval level required, that the Director and Additional Secretary stages have the highest stage-level bottleneck rates (14.0% and 14.5%), and that bottleneck rates vary widely between offices (20.0% to 40.0%) although the process and rules are the same. The largest single reported cause of delay was that no reason was known (52 of 150 files), and officers identified the true slowest stage for only 42.0% of files, seldom noticing delay higher up the chain. Together, the results suggest that both the length of the approval chain and delay at particular stages contribute to overall delay, and that much of it is invisible to the people involved. The dashboard and officer portal that make this information visible were technically correct and reached a mean SUS score of 80.2, and an expert reviewer judged the framework reasonable.

Practical recommendations follow from the findings: record a short reason for delay at each stage; use a shared tool so that delay away from an officer's own desk becomes visible; review the approval levels required for different file types and the workload and practices at the Director and Additional Secretary stages; check whether priority marking is used and acted on as intended; arrange a backup officer for each stage where possible; and use low-cost open-source tools for continuing monitoring.

The study has limitations. Data came only from Subject Officers and from dates recorded on paper files, so the findings depend on the accuracy of those records. Only dates were recorded, not times, so short waits within a working day cannot be separated. Five offices and 150 files are enough to

compare offices and stages, but not to generalize to all government offices in Sri Lanka, and the usability evaluation involved only 15 respondents. Future work may adapt the approval chain to different file types and levels of urgency, as the expert reviewer suggested; apply the framework to other approval processes; introduce lightweight digital time-stamping at each stage; connect the portal's reminders to email or SMS; run a larger and longer usability evaluation; and study the causes of delay in more depth through interviews.

➤ *Conflict of Interest*

- None declared.

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