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Review Article

Modernizing Mandatory Disease Reporting in Radiology

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Abstract

Mandatory disease reporting by radiologists is a critical yet inefficient component of public health infrastructure. Current manual, disruptive, and unidirectional processes create a significant administrative burden for clinicians and deliver data that is often delayed and fragmented for public health agencies. This manuscript examines these workflow inefficiencies through a business process analysis, which identified key pain points including context switching, manual data entry, and a fundamental lack of systems integration. To address this, we propose a modernized framework based on the adoption of structured SNOMED CT AU coding, HL7® FHIR® standards, and API-driven interoperability. The proposed model automates reporting through event-driven triggers within radiologists' existing systems, ensuring timely and accurate data transfer. Furthermore, it introduces a critical bi-directional feedback loop, providing clinicians with confirmation and valuable outcome data. The implementation of this integrated framework can transform mandatory reporting from a bureaucratic task into a seamless byproduct of care delivery. This promotes a collaborative partnership between clinical care and public health, ultimately enhancing the timeliness, efficiency, and overall efficacy of population health surveillance.

Keywords: Public Health Surveillance, Health Data Interoperability, HL7 FHIR, SNOMED CT, Radiology Informatics, Health Information Exchange, Process Automation, Notifiable Disease Reporting.

1. INTRODUCTION

The diagnostic imaging suite is a vital frontline for identifying public health threats, from communicable diseases like tuberculosis to cancer and non-accidental trauma. The mandatory reporting of these findings is a legal requirement designed to trigger essential public health intervention. Despite its critical importance, the reporting mechanism remains anchored in legacy practices, often relying on fax, phone, or standalone web portals that operate entirely outside of clinical workflows [1, 2]. This fundamental disconnect creates significant friction, resulting in reporting delays, data incompleteness, and a lack of situational awareness for both the reporting radiologist and the public health agency [3]. This analysis examines the inefficiencies of the current workflow and proposes an integrated, standards-based framework designed to automate data exchange, enhance timeliness, and foster a collaborative partnership between radiology and public health through effective bi-directional communication.

2. In-Depth Analysis of Current Workflow Inefficiencies: A Business Process Perspective

A thorough examination of the mandatory reporting workflow, from the moment of diagnosis to final confirmation, reveals a process riddled with friction points. These inefficiencies not only burden highly skilled clinical staff but also directly compromise the speed, accuracy, and completeness of public health data. The following analysis breaks down this workflow from a business process improvement standpoint.

2.1 The Context Switch and Cognitive Load Burden

The most significant inefficiency is the forced context switching imposed on the radiologist. The primary workflow is a focused, diagnostic loop within the Picture Archiving and Communication System (PACS):

1. Retrieve study.
2. Interpret images.
3. Dictate findings using specialized speech-to-text software.
4. Finalize report within the Radiology Information System (RIS).

The intrusion of a mandatory reporting task breaks this flow state. The radiologist must:

- Pause their diagnostic reading queue.
- Identify the correct reporting pathway (e.g., Is this a cancer case? A communicable disease?).

- Navigate away from the PACS/RIS environment to a separate system (a web browser, a fax machine, a paper form).
- Recall the specific patient details and findings from memory.

From a Business Analysis perspective, this is a classic case of a high-value knowledge worker being tasked with low-value, administrative work. The cognitive load of switching contexts increases the risk of error in both the reporting task and the subsequent diagnostic reads, impacting overall radiology department throughput. This type of cognitive burden and its detrimental effect on diagnostic performance is well-documented in other high-focus medical disciplines such as pathology [6].

2.2 Manual Data Re-entry and The High Cost of Redundancy

The separation between diagnostic tools (PACS/RIS) and reporting systems creates profound data redundancy. The Business Analyst would identify the following data flow failures:

- **Source of Truth vs. Manual Transcription:** The RIS contains a full, accurate digital record of the patient (Demographics, MRN, Accession Number, Referring Physician) and the structured report. The reporting process ignores this digital source, forcing the radiologist or their staff to become a human API, manually re-keying this data into a separate portal. This introduces a significant risk of transcription errors (e.g., misspelled names, incorrect DOB, transposed MRNs) that can render a report useless for data linkage and follow-up. The immense financial and time burden of such manual administrative tasks on clinical practices has been quantitatively demonstrated, with billions spent annually on similar quality reporting activities [5].
- **Loss of Data Fidelity:** The rich, structured data of the original report is often lost. The radiologist's precise diagnostic language must be condensed into the limited fields of a web form or a fax sheet, stripping away nuance and context critical for public health triage.

2.3 The "Black Box" of Unidirectional Reporting

The current process is almost entirely unidirectional. The radiologist sends data into a void with no integrated feedback mechanism. This creates several problems a BA would seek to quantify:

- **Lack of Confirmation:** There is no automated, system-generated proof of successful submission. The radiologist operates on faith, creating potential medico-legal anxiety. "Did the fax go through? Did the web portal submit correctly?" This often leads to time-consuming manual follow-up calls to health departments to verify receipt.
- **No Closed Feedback Loop:** The radiologist receives no information on the outcome of their report. They cannot see if their data contributed to identifying a cluster, if a case was confirmed, or what the public health response was. This disconnects the clinician from the public health mission, making reporting feel like a bureaucratic checkbox rather than a meaningful clinical action. This lack of visibility is a major demotivator and a key reason for reporting fatigue. Research on data sharing between health agencies indicates that trust and perceived value are critical factors for successful exchange, elements that are absent in a unidirectional model [10].

2.4 The Critical Integration Gap Between Diagnosis and Reporting Tools

The core failure is a fundamental lack of systems integration. The PACS/RIS and the public health reporting system operate as isolated silos.

- **No Event-Driven Triggers:** There is no automated link between the act of signing a report containing a "reportable" code and the initiation of the reporting process. The trigger is entirely human: the radiologist must remember the mandate and initiate the separate process themselves. This reliance on human memory leads to inevitable missed reports.
- **API Absence:** Modern API-based integration is non-existent. Data cannot flow seamlessly between systems because no standardized interface (like a FHIR API) has been implemented to facilitate it. The Business Analyst would document that data transfer is achieved through the least efficient methods: manual human effort or outdated electronic methods like fax that cannot carry structured data.

2.5 Process Variability and Compliance Risk

A BA would find that reporting processes are rarely standardized, even within a single institution. One radiologist might have a saved fax cover sheet template, another might rely on a administrative assistant to handle the web portal, and a third might use a different browser bookmark. This high degree of process variation makes training difficult, audits challenging, and creates significant compliance risk. It is impossible to ensure consistent and complete reporting when the process is not standardized, measured, or integrated into the primary clinical workflow.

3. A Proposed Framework: Standardized, Automated, and Bi-Directional Exchange

The deficiencies of the current workflow can be addressed through a deliberate modernization strategy centred on interoperability, automation, and collaboration. The proposed framework leverages existing health data standards to create a seamless, event-driven data pipeline that eliminates redundancy and fosters a continuous feedback loop.

3.1 Foundation: The Imperative of Standardized Terminology

The critical enabler for automation is the consistent mapping of clinical concepts to a shared, universal terminology. This does not necessitate the abandonment of nuanced free-text reporting but rather its enhancement through a structured, coded layer.

- **Leveraging SNOMED CT AU:** The Australian release of SNOMED CT (Systematized Nomenclature of Medicine -- Clinical Terms) provides the comprehensive clinical vocabulary required for this task. The objective is to map key diagnostic findings within the radiology report to their precise SNOMED CT AU codes. For instance, the free-text phrase "suspicious lung nodule, likely malignant" would be mapped to the concept [SNOMED CT AU: 254583000 | Lung nodule suspicious for malignancy].
- **Structured Data Capture:** This mapping can be achieved through integrated clinical terminology services within the Radiology Information System (RIS), allowing for the automated or semi-automated encoding of findings as the report is finalised. This process creates a machine-readable data layer alongside the human-readable narrative, transforming the report into an interoperable asset for secondary use. The adoption of structured, coded reporting, while a shift in practice, has been successfully implemented in parallel diagnostic fields like pathology, leading to significant gains in data completeness and utility [7].

3.2 Automation: Event-Driven Triggers for Seamless Reporting

With a standardized, coded data layer in place, the reporting process can be automated through event-driven triggers within the clinical workflow.

- **Integration Layer:** An integration layer (e.g., an integration engine or FHIR server) is configured to monitor the RIS for finalized reports containing specific SNOMED CT AU codes that trigger a mandatory reporting obligation.
- **FHIR-Based Action:** Upon detection of a reportable code, the system automatically generates a FHIR Diagnostic Report resource. This resource bundles the coded findings, patient demographics, provider details, and study information into a standardized, interoperable package.
- **API-Driven Transmission:** This FHIR resource is then instantly transmitted to the public health agency's surveillance platform via a secure HL7® FHIR API. This entire process occurs without any manual intervention from the radiologist, effectively removing the duplication of effort and the potential for transcription errors. The technical feasibility of such event-driven triggers is proven through their widespread use in clinical data research networks, where coded data within EHRs automatically identifies patient cohorts for studies [11]. Furthermore, the HL7 FHIR standard is specifically designed to enable this type of interoperable, API-based data exchange within clinical workflows [9].

3.3 Timeliness: Enabling Frequent and Continuous Data Flow

The API-driven model facilitates a near-real-time flow of information, a stark contrast to the batched, delayed nature of manual reporting.

- **From Periodic to Continuous:** Public health agencies transition from receiving data in daily or weekly batches (e.g., from faxes or uploaded files) to receiving individual reports within minutes of finalization. This continuous data stream is the bedrock of modern syndromic surveillance.
- **Proactive Surveillance:** With data arriving frequently and in a structured format, analytics platforms can immediately parse, aggregate, and correlate findings. This allows for the proactive detection of anomalies—such as an unusual cluster of pneumonia cases across a metropolitan area—well before traditional confirmation pathways (like lab results) would trigger an alert.

3.4 Bi-Directional Feedback: Closing the Loop with Clinicians

A truly effective system must close the feedback loop, transforming a one-way data extraction into a two-way collaborative partnership. This is achieved through bi-directional FHIR APIs.

- **Acknowledgement of Receipt:** Immediately upon successful ingestion of the FHIR Diagnostic Report, the public health system should send back a FHIR Communication resource to the RIS. This provides the radiologist with instant, auditable confirmation that their legal obligation has been fulfilled, eliminating uncertainty and reducing administrative overhead.
- **Outcome and Informational Feedback:** More importantly, this channel can be used for meaningful clinical and public health feedback. With appropriate privacy safeguards, the system could later send updates back to the originating organization, such as:
  - **Diagnostic Confirmation:** A subsequent message containing the patient's confirmed diagnosis (e.g., lab-confirmed tuberculosis) based on the radiology report, closing the clinical loop for the radiologist.
  - **Population Health Impact:** Aggregated, anonymized data showing the radiologist, or their department, how their reporting contributed to public health. For example: "Your reports contributed to the identification of 5 cases of pertussis in the [Area] school district, triggering a vaccination clinic."

This bi-directional exchange validates the radiologist's effort, integrates them into the public health mission, and provides valuable data that enhances their own clinical understanding of disease outcomes. Closing

this feedback loop is consistently identified as a key requirement for advancing EHR-based public health surveillance, as it fosters the collaborative partnership necessary for a sustainable system [4].

4. Impact and Benefits: A Dual Value Proposition for Clinicians and Public Health

The implementation of a standards-based, automated, and bi-directional reporting framework delivers a powerful dual value proposition, addressing the core pain points of radiologists while simultaneously transforming the capabilities of public health agencies.

4.1 Value for the Radiologist and Clinical Practice

- **Elimination of Administrative Burden:** By automating the reporting trigger, the proposal directly removes the disruptive, manual tasks of data re-entry and switching between systems. This allows radiologists to remain focused on high-value diagnostic work, improving both job satisfaction and departmental throughput.
- **Reduced Medico-Legal Risk:** Automated, digitally-verified submission provides an auditable trail that the mandatory obligation was fulfilled, mitigating the anxiety and potential liability associated with unconfirmed faxes or portal submissions.
- **Enhanced Clinical Insight:** The bi-directional feedback loop closes a critical gap in patient care. Receiving diagnostic confirmations and outcomes (e.g., a lab result matching their radiological suspicion) provides valuable learning and reinforces the clinical relevance of their reporting work.
- **Connection to Public Health Impact:** Feedback on how their data contributed to community health interventions (e.g., outbreak identification) transforms reporting from a bureaucratic task into a meaningful part of their professional practice, fostering a sense of contribution and engagement.

4.2 Value for the Public Health Agency

- **Significant Improvement in Data Timeliness and Completeness:** Automated, event-driven reporting reduces the time from diagnosis to data availability from days or weeks to minutes. This near-real-time data flow is the critical foundation for effective proactive surveillance and early warning systems.
- **Dramatic Enhancement in Data Quality and Actionability:** Data received as structured FHIR resources with coded SNOMED CT AU concepts is immediately computable. This eliminates the resource-intensive manual data cleaning and coding currently required from free-text or paper-based reports, freeing up analysts for higher-value tasks. Automated data flows with standardized terminology directly address the primary electronic data quality challenges faced by public health agencies, which have historically limited the use of this data for proactive surveillance [8].
- **Foundation for Advanced Analytics:** High-fidelity, standardized data streams enable sophisticated correlation with other data sources (e.g., lab results, pharmacy prescriptions). This allows public health agencies to move from simple case counting to complex predictive modelling and trend analysis, identifying subtle anomalies that would otherwise go unnoticed. The use of EHR data, when structured and timely, has the proven potential to transform public health surveillance, moving it from a reactive to a proactive state [4].
- **Strengthened Collaboration with Clinical Partners:** The bi-directional exchange fosters a cooperative relationship with frontline providers. By offering valuable feedback, public health agencies become a source of insight rather than just a destination for data, encouraging more consistent and engaged reporting from clinicians.

5. CONCLUSION

The existing paradigm for mandatory disease reporting in radiology is fundamentally misaligned with modern clinical workflows and the data needs of public health. It is a process characterized by manual, unidirectional data extraction that imposes a significant administrative burden on highly skilled clinicians and delivers information that is often delayed and fragmented. This analysis has detailed these critical inefficiencies, from workflow disruption and data redundancy to the profound lack of feedback for the reporting radiologist.

Conversely, the proposed framework—built upon the pillars of standardized clinical terminology (SNOMED CT AU), automated FHIR-based data exchange, and bi-directional communication—presents a transformative opportunity. This model moves beyond mere process improvement to redefine the very nature of public health reporting. It transitions from a disruptive obligation to a seamless byproduct of care delivery, ensuring data flows to public health agencies in near real-time, ready for advanced analytical use. Simultaneously, it closes the feedback loop, providing radiologists with confirmation, clinical context, and a visible connection to the public health outcomes their reporting supports.

Ultimately, adopting this integrated approach is not merely a technical upgrade but a strategic imperative. It fosters a collaborative partnership between clinical care and public health, creating a more responsive, intelligent, and equitable surveillance system capable of truly protecting population health.

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