A CASE STUDY IN DIGITAL HEALTH TRANSFORMATION

Morocco's Decentralized Cause-of-Death Reporting System

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EXECUTIVE SUMMARY

The Kingdom of Morocco has successfully developed and implemented a web-based application called "Statistiques de mortalité au Maroc" to strengthen the registration of causes of death. Initiated in 2015-2016 as part of efforts supported by Bloomberg Philanthropies' Data for Health Initiative, the system was developed by the Ministry of Health and Social Protection (MSPS) with support from its internal information technology (IT) team. Previously, death registration was limited to a single computer at the central level, where staff could only enter data without the ability to track records, verify data quality or code causes of death—making the process inefficient and prone to error. In contrast, the new decentralized system has significantly improved the coverage and quality of mortality data. By 2021, coverage rates increased from approximately 30% to 45%, and the proportion of ill-defined causes decreased from over 35% to around 28%. The system now processes approximately 85,000 death certificates annually—more than double the previous volume of 40,000-44,000 certificates. The cloud-hosted platform enables decentralized data entry, quality control, automated cause-of-death coding through integration with the international Iris software and comprehensive statistical analysis capabilities.

BACKGROUND AND RATIONALE

Prior to the implementation of the current system, Morocco faced several significant challenges in its cause-of-death data collection process. The previous application operated as a mono-post system, limited only to data entry at the central level, with no capability for data tracking, quality control or cause-of-death coding. The system lacked error verification mechanisms for data entry, making data management extremely difficult. The system offered no way to follow up on individual death certificates or monitor data quality, contributing to delays in preparing annual statistical reports.

These limitations resulted in low coverage of mortality data (around 30%) and poor-quality information, with ill-defined causes of death exceeding 35%. The centralized data entry created bottlenecks and processing delays, which the MSPS identified as a major challenge. The solution was to decentralize data entry and develop a more comprehensive web-based platform. A key technical challenge was ensuring interoperability with the Iris automated cause-of-death coding software, which required careful consideration during system design and frequent checks during development.

DIGITAL SOLUTION OVERVIEW

The "Statistiques de mortalité au Maroc" platform is a web-based application with the following key features and architecture.

CORE ARCHITECTURE

- Web-based application hosted in the MSPS cloud infrastructure
- Developed with support from the Division of Information Technology and Methods, MSPS
- Structured around multiple modules with role-based access control
- Nightly automatic backups of the database and server image

SYSTEM COMPONENTS

1. Authentication and user profile module
2. Death certificate management module
3. Coding module with Iris software integration
4. Statistics and dynamic dashboard module
5. Data validation, audit and quality control modules

USER ACCESS LEVELS

The system implements seven distinct user profiles:

1. Data entry accounts
2. Visualization accounts by level (hospital, regional and provincial)
3. Coder accounts
4. First-level administrator accounts (user, batch and coder management)
5. Second-level administrator accounts (data cleaning)
6. Third-level administrator accounts (reference parameter management)
7. Superior administrator accounts (monitoring, supervision and validation)

KEY FUNCTIONALITIES

- **Data Entry:** Four-step structured entry process for death certificates
- **Data Validation:** Mandatory fields, duplicate prevention and cross-variable validations
- **Cause-of-Death Coding:** Integration with Iris international automated coding software
- **Quality Control:** Includes anomaly detection, data cleaning module and integration with the World Health Organization's CoDEdit tool. A key feature of the system is its use for continuous monitoring of data quality. As data quality problems are identified, monitoring and support teams (suivi et accompagnement) visit the regions to review data quality issues with local users and provide training or retraining as required.
- **Analytics:** Dynamic dashboards for monitoring data entry and analyzing mortality statistics
- **Document Management:** Capability to download digital copies and scanned certificates
- **Audit Trail:** Full traceability of all system actions and modifications

SECURITY FEATURES

- Professional accounts with login/password authentication
- VPN access for coders to secure cause of death information
- Cloud hosting with security standards
- Complete audit trail of all system actions

OPERATIONAL WORKFLOW

Death certificates are entered into the system at hospitals and Communal Health Bureaus (BCHs, which are administered by the Ministry of Interior). The data follows a validation process before being coded using the Iris software. The coded data is then available for statistical analysis and reporting, with comprehensive quality control mechanisms at each stage.

TRAINING AND ADOPTION

The implementation of the system required continuous training efforts to ensure proper adoption throughout Morocco.

- Training sessions on system use are conducted regularly in regions and provinces
- Designated focal points have been established at all levels (regional, provincial, hospitals and BCHs)
- Training is provided whenever new users join the system
- Three WhatsApp groups were created for different user categories (i.e., coders, regional focal points and administrators) to facilitate communication and support

The system has been designed with a gradual implementation approach, allowing for progressive adoption and continuous improvement. This approach has facilitated acceptance among users at various levels of the health system. Ongoing training and support structures have enabled successful decentralization of the data entry process.

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Figure 1: A representation of the Moratlity Statistics of Morocco dashboard in French

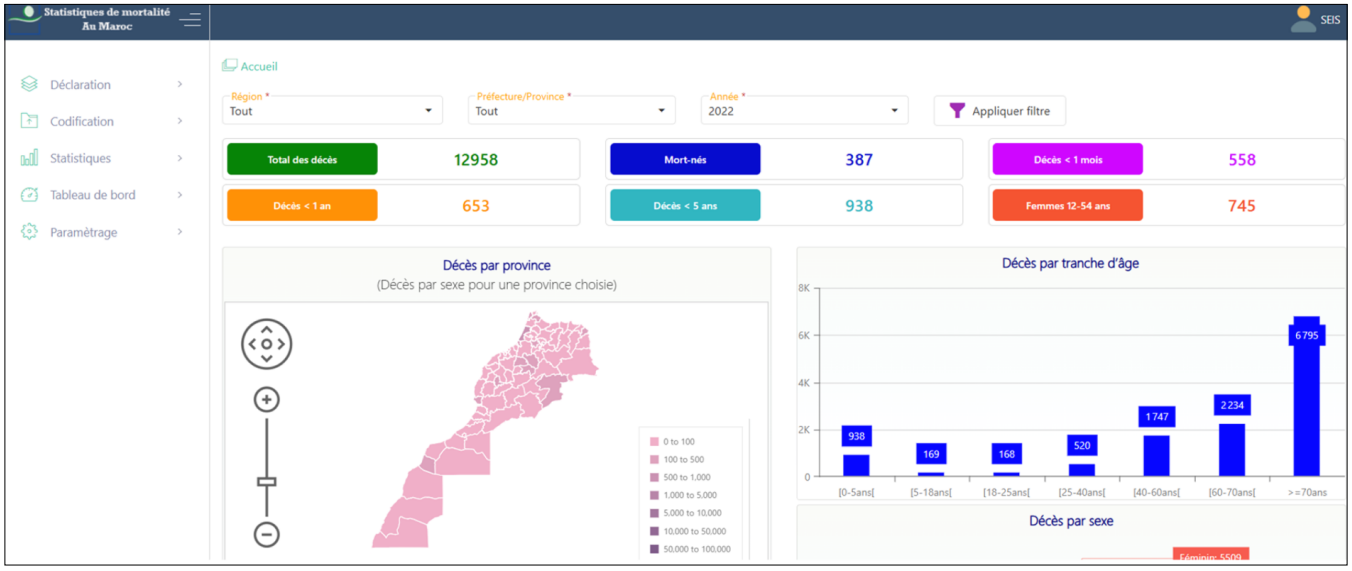
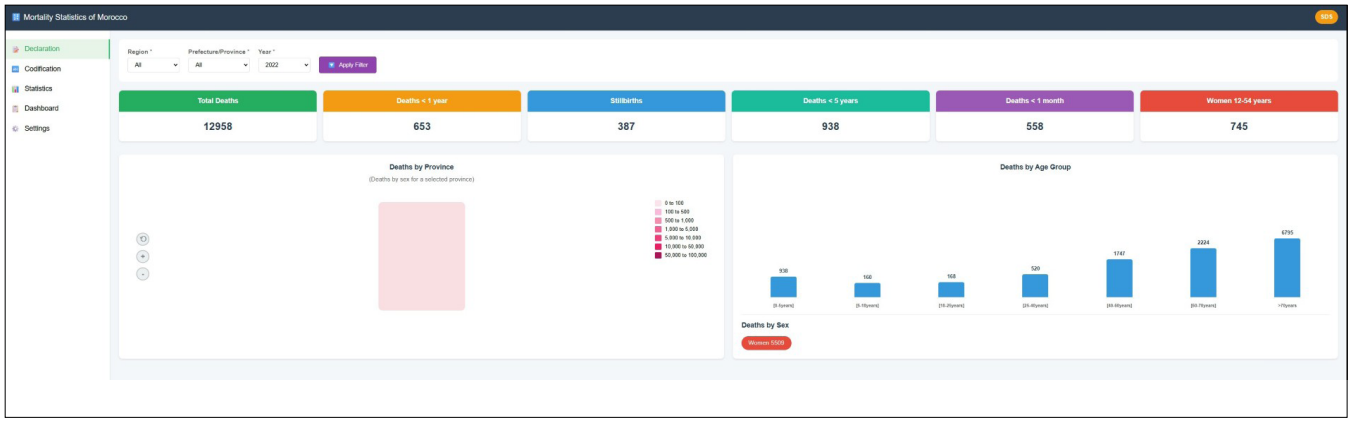


Figure 2: A representatin of the Moratility Statistics of Morocco dashboard in English



IMPACT ANALYSIS

The implementation of the decentralized system has shown measurable improvements in several key areas.

COVERAGE IMPROVEMENT

Before implementation: Coverage of cause-of-death data was approximately 30%

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After implementation (2021 data)**:** Coverage increased to 45%, representing a 15 percentage point improvement

DATA VOLUME

Previous system: 40,000-44,000 death certificates processed annually

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Current system: Approximately 85,000 death certificates processed annually—more than double the previous volume

DATA QUALITY

Before implementation: Ill-defined causes exceeded 35%

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After implementation: Ill-defined causes reduced to around 28% overall and for deaths occurring in health facilities, only 19% have ill-defined underlying causes of deaths

- The proportion of ill-defined causes is significantly higher for community deaths, as Morocco does not have a system of family physicians to complete death certificates
- The system provides better data validation, control and traceability

SYSTEM RELIABILITY

- The cloud-hosted system maintains 24/7 availability
- No incidents of unavailability have been reported since deployment
- Redundancy mechanisms ensure continuous operation even if a server fails

OPERATIONAL EFFICIENCY

- Decentralized data entry at regional, provincial and local levels
- Real-time data availability in the central database
- Enhanced monitoring capabilities through dynamic dashboards

While still being improved, the platform has significantly enhanced the capabilities for mortality data collection, quality control, analysis and reporting in Morocco, addressing the critical challenges that existed in the previous system.

FUTURE INTEGRATION AND EXPANSION

The Ministry of Health and Social Protection (MSPS) has planned several initiatives to further enhance the system.

INTEGRATION WITH HOSPITAL INFORMATION SYSTEMS

- The MSPS is developing hospital-wide information systems throughout Morocco, which will include a dedicated module for death certificates.
- Physicians will be able to directly enter cause-of-death information, which will be automatically transferred to the mortality platform—eliminating duplicate data entry.
- Technical meetings have begun to establish the necessary data exchange mechanisms required for this integration.

INTEGRATION WITH COMMUNAL HEALTH BUREAUS

- Communal Health Bureaus (BCHs) are implementing their own information management systems.
- Death certificate data will be a significant component of these systems.
- Electronic data transfer is planned between these systems and the MSPS platform, which will further reduce manual data entry and improve coverage.

INTEROPERABILITY STANDARDS

- API (Application Programming Interfaces) are planned for data exchange.
- The system follows standard data exchange protocols.

FUTURE ICD-11 IMPLEMENTATION

- The system is designed to be adaptable to future International Classification of Diseases 11th Revision (ICD-11) implementation; it will require configuring it for ICD-11 standards.
- Iris for ICD-11 can be inserted into the platform.
- The transition will be dependent on the availability of an ICD-11-compatible version of Iris software.

NO PLANS FOR BIRTH REGISTRATION

- The MSPS clarified that it does not have plans to extend the system to birth registration as this responsibility belongs to the Ministry of Interior in Morocco.
- The MSPS system will remain focused on cause-of-death information.

The integration plans emphasize continued improvement of the mortality data system through integration with other health information systems, rather than expanding to other vital events. This approach aims to further enhance data quality and coverage by capturing information directly at the point of care.

CONCLUSION AND RECOMMENDATIONS

Morocco's decentralized approach to the reporting and processing of cause of death data demonstrates several success factors that could benefit other countries.

1. **Incremental development:** Start small and continuously improve the system based on user feedback and emerging needs.	2. **Local capacity building:** Maintain an in-house development team that ensures sustainability and responsive system evolution.	3. **Integration with international standards:** Incorporate tools like Iris cause-of-death coding software.	4. **Decentralized implementation:** Empower regional and local facilities to participate in data entry while maintaining central quality control.	5. **Continuous training and support:** Ensure ongoing capacity building as new users join the system.

The Ministry of Health and Social Protection recommends a gradual approach for other countries considering the implementation of similar systems. A dedicated local team responsible for system maintenance and ongoing development is crucial for sustainability—ensuring the system can be continuously updated to meet emerging needs without relying on external contractors.

This case study demonstrates how a country can leverage internal technical expertise to develop sophisticated health information systems that significantly improve vital statistics while maintaining cost efficiency and sustainability. Abdelilah El Marnissi, Director of the Division of Planning and Studies, Directorate of Planning and Financial Resources, MSPS, along with Deputy Director Jamila El Mendili emphasized that one of the main reasons for using local IT expertise was to ensure system security.

This approach also significantly reduced development costs and avoided dependency on foreign companies and their software—mitigating risks such as bankruptcy, version changes or software retirement. This strategic decision has proven essential for the system's long-term viability.