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Navigating Complexity: A Hybrid Project Management Approach In The Healthcare Industry

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Abstract

This paper compared the Agile and Waterfall approaches to project management in healthcare. The study responds to the need to meet stringent regulatory compliance while being flexible in light of swift digital transformations in the sector. On the basis of actual hospital and medical technology case studies, the paper concluded that Waterfall works best for highly regulated, stable projects, whereas Agile is suitable for fast-evolving, innovative projects. The paper also put forward a new hybrid model, the Adaptive Compliance Agile Waterfall (ACAW) model, that incorporates the best of both. The approach enables healthcare organisations to maintain compliance and react swiftly to emerging problems, facilitating safer and more successful project outcomes.

Keywords: Agile, Waterfall, healthcare management, hybrid project management, ACAW framework

Introduction

Effective project management is indispensable in the modern healthcare landscape, where the convergence of rapid technological advancements, stringent regulatory requirements, and rising patient expectations has intensified operational complexities. Healthcare organizations today must not only deliver innovative, patient-centered solutions but also ensure rigorous compliance with local and international standards. In this environment, selecting the appropriate project management methodology becomes a critical strategic decision.

Two main approaches, Waterfall and Agile, offer contrasting methodologies.Waterfall is a linear, sequential, step-by-step method characterised by extensive upfront planning and strict adherence to a schedule. It is ideal for projects demanding precision, thorough documentation, and regulatory compliance, such as manufacturing medical devices or implementing large-scale electronic health record (EHR) systems. In contrast, Agile uses short cycles called "sprints," enabling teams to adjust plans based on continuous feedback and evolving requirements. This makes Agile highly suitable for dynamic projects, such as telemedicine platforms or digital patient engagement solutions, where frequent changes are common. Despite increasing

real-world experimentation, there's a lack of practical guidance on combining these methodologies to meet the sector's dual needs for compliance and adaptability.

Our research addresses this gap, recognising the unique complexities of healthcare, where organisations must simultaneously deliver innovative and strictly regulated care. This paper expands on previous reviews by including in-depth case studies from Indian and global hospitals, as well as medical technology companies. It critically assesses the benefits and drawbacks of both approaches as observed in actual healthcare projects. Additionally, it introduces the Adaptive Compliance Agile Waterfall (ACAW) Framework, a new hybrid strategy designed to maximise innovation and compliance within the healthcare environment.

Methodology of the Research

- Examined several actual healthcare projects of hospitals & medical technology companies using Agile and Waterfall approaches.
- Recorded project objectives, regulatory requirements, and procedures for each approach used.
- Contrast the strengths & limitations of Agile and Waterfall across cases.
- Derived the Adaptive Compliance Agile Waterfall (ACAW) hybrid framework from findings.
- Employed case study analysis without experimental formulas or tools.

Overview of the Approach

Waterfall Approach

The Waterfall methodology, a traditional and sequential approach to project management, progresses through distinct project stages. These stages typically include requirements gathering, system design, implementation, verification/testing, deployment, and maintenance, each logically following the last in a linear, downward flow resembling a waterfall. This model operates on the assumption that all requirements can be fully detailed at the outset, and that changes in later phases will be costly and disruptive.

In the medical field, the Waterfall method is particularly common in projects where accuracy, traceability, and compliance are critical, such as in the development of medical devices, electronic health records (EHR) systems, and infrastructure upgrades. Its emphasis on comprehensive upfront documentation and clearly defined milestones offers transparency to stakeholders and demonstrates adherence to regulatory standards. However, its inherent inflexibility can pose challenges when dealing with evolving requirements or unexpected complexities, which are often encountered in dynamic healthcare environments.

Agile Approach

In contrast, the Agile methodology offers an iterative and incremental approach to project management, prioritising adaptability and continuous improvement. Projects are broken down into manageable iterations, known as "sprints," each culminating in a functional deliverable for stakeholder review and testing. This iterative process fosters frequent feedback, flexible planning, and collaborative problem-solving.

Agile's flexibility makes it particularly well-suited for healthcare projects where user requirements, technological advancements, or regulatory landscapes can change rapidly. Examples include the development of telemedicine platforms, patient engagement applications, and integrated IT systems across disciplines. Agile encourages the active participation of end-users, clinicians, and administrators throughout the project lifecycle, leading to rapid adaptation and enhanced stakeholder satisfaction. However, Agile's high responsiveness necessitates strong communication and a culture open to change—elements that can be challenging to maintain in traditionally structured or highly regulated healthcare environments.

Waterfall Project Management In Healthcare - Case Studies

Case Study 1: Atlantic Health System - Epic EHR Deployment

Atlantic Health System (AHS), a New Jersey non-profit health organisation, upgraded its Epic Electronic Health Record (EHR) system, a platform that consolidates patient records, scheduling, documentation, billing, and speciality practices for various healthcare organisations. This upgrade utilised the traditional Waterfall project management methodology, known for its sequential approach.

The project started with thorough requirements gathering, planning, risk assessment, and budgeting, focusing on usability, compliance, and patient safety. System design and build involved technical and clinical stakeholders to create customised workflows and infrastructure. Extensive real-world testing with stakeholder involvement ensured effective system integration. User acceptance was ensured via training, change management, and regular communication. The phased rollout began in February 2018, seamlessly integrating without disrupting operations. Post-launch, continuous support and optimisation maintained performance and satisfaction.

This disciplined methodology offered significant benefits, enhancing patient safety through accurate, real-time data. It also ensured compliance with HIPAA and Meaningful Use regulations, facilitated efficient change management to reduce resistance, and minimised risks by identifying issues early.

Case Study 2: Philips Medical Imaging Device Development

Philips, a medical imaging leader, uses the Waterfall method for developing diagnostic equipment (MRI, CT, X-ray machines). This linear approach suits medical device development due to strict regulations, documentation needs, and execution quality.

The process starts with thorough requirements gathering and analysis, documenting clinical, technical, and regulatory needs to meet standards like FDA 21 CFR Part 820 and ISO 13485, alongside evolving healthcare provider needs. This is followed by a system design phase, where multidisciplinary engineers and clinicians collaborate on hardware schematics, software architectures, and interface designs, ensuring inherent regulatory compliance and built-in quality.

Implementation, following approved designs, involves creating embedded software, electronics, and mechanics, allowing no major changes to avoid rework and ensure regulatory compliance. The Verification & Validation phase rigorously tests prototypes in simulated clinical settings, using documented plans, to confirm safety, performance, and interoperability. After clearance, Philips manufactures, trains clinicians/technicians, and launches products post-regulatory approval. Post-market monitoring ensures device reliability and safety. Philips adopts the Waterfall methodology to deliver compliant, high-quality medical imaging products promptly and efficiently. This disciplined approach mitigates risks and ensures regulatory clearance, fostering innovation that ultimately enhances patient care and clinician trust worldwide.

Case Study 3: Waterfall Implementation of Emergency Physician Scheduling

A medium-sized academic emergency department implemented the Waterfall project management technique to improve operational efficiency and patient care. The formal, sequential process began with a clear problem definition, addressing ED crowding and extended patient wait times. Stakeholders set specific goals to decrease door-to-doctor time (DDOC) and reduce the number of patients leaving without being seen (LWBS).

An overlapping "waterfall" calendar was implemented for patient triage and case management, ensuring sustainable coverage. Post-implementation, DDOC decreased from 65.1 to 35 minutes, LWBS rates from 1.12% to 0.92%, and patient elopement from 3.96% to 1.95%. Staff reported improved workflow, patient continuity, and satisfaction, despite a slight increase in sign-outs due to higher volume. Door-to-disposition time increased, but not significantly.

The Waterfall method offers structured discipline, enabling controlled change management, preventing confusion, and fostering data-driven improvement. Its rigorous documentation and phase-by-phase reviews enhance compliance and guarantee consistent performance. This approach demonstrates how sequential project management leads to measurable clinical improvements and continuous healthcare advancements, even in operational projects like physician scheduling.

Agile Project Management In Healthcare - Case Studies

Case Study 1: Agile Transformation at Apollo Hospitals

Apollo Hospitals has embraced Agile principles in its healthcare delivery systems more and more, mainly transitioning from linear, fixed models of service to an iterative, dynamic, and customer-centric methodology. This change is facilitated by the "Personology" system that follows each patient's health process and continually adjusts care protocols by means of technology and feedback. This closely aligns with Agile methodologies that focus on user (in this case, patient) requirements, flexibility, and incremental building.

At its core is the adoption of end-to-end digital health platforms like Apollo 24/7, an "agile digital front door" to healthcare. It offers seamless access to electronic health records (EHRs), lab reports, teleconsultations, prescriptions, and appointment scheduling, creating a digital journey that constantly evolves based on patient input and system efficiency. Tele-ICU, command centres, and remote monitoring systems are also used for coordinating care, facilitating real-time information exchange among clinicians and permitting clinical protocol and operational decision updates within brief time cycles, analogous to Agile sprints and daily stand-ups.

Operational and clinical staff work in perpetual short-cycle feedback loops, refreshing protocols with patient outcomes, AI-based clinical learnings, and piloting programs like hospital-at-home. The quick scaling of services is a manifestation of an Agile approach to healthcare in which product increments are constantly added, prototyped, and optimised. Likewise, similar to Agile's sprint retrospectives, Apollo's platform allows for a culture of iterative review and improvement by users.

The investment in such Agile practices at Apollo pays rich dividends. It results in accelerated service innovation, more advanced personalised diagnostics through digital tools, more effective crisis management, like during the COVID-19 pandemic, and more patient satisfaction through seamless, digitally enhanced experiences. The overall tale of Apollo illustrates how Agile values-flexibility, teamwork, feedback, and iteration succeed even in high-complexity, high-risk settings like healthcare.

Case Study 2: Agile Practices at Manipal Hospitals

One of the best examples of agile deployment is the nurse handover project that was crafted in collaboration with Google Cloud. The team implemented an MVP (Minimum Viable Product) strategy, first tested at one hospital, involving frontline input before rollout expansion. This roll-out in stages, with more than 5,000 nurses utilising it every day, demonstrates Agile's sprint-based, iterative method.

Manipal's ICT-facilitated changes find their origins in cross-functional project management: products such as the nurse handoff AI solution or IBM Watson installations are conceptualised and run jointly by clinical leaders, IT, & operations groups. This brings about accountability & co-ownership, really quite in the spirit of Agile Scrum's multi-disciplinary team ethos.

While making the pilot deployments, the team received a few rounds of feedback sessions-over eight with the nursing staff-to improve the clinical handoff template. This intense cycle of feedback is Scrum's focus on user feedback & refinement in iterations.

Manipal uses data & cloud technologies to provide operational agility. The nurse handoff solution uses Google Cloud's Vertex AI (Gemini), Cloud Run, & Cloud Healthcare API along with analytics platforms such

as Looker, facilitating real-time updates & performance tracking. Their e-pharmacy system also minimised order processing time significantly through the use of AI & simplified processes.

Manipal initiated Lean Six Sigma–based process workshops through the "Ekta" initiative. Lean-out teams used a rigorously structured approach to nursing handovers & discharge processes, shortening handover times by ~35–64%, & cutting discharge times in half in most hospitals-glorious examples of iteration and continuous improvement.

Case Study 3: Agile Implementation in a Bengaluru Hospital (IIHMR Bangalore Project)

The project titled "Application of Scrum Framework & Low Code No Code Platform for Development & Implementation of Inpatient Electronic Visitor Management System" was carried out by IIHMR Bangalore in collaboration with a small hospital in Bengaluru. The target was to improve the slow, paper-based visitor pass system utilised by the inpatient department (IPD) by replacing it with a more effective & safer electronic system.

To accomplish that, the team used the Scrum Agile framework and completed the project within five sprints in two months. The team had a Product Owner, three developers and a Scrum Master, and it was cross-functional. Hospital administrative officers, security officers and nurses would participate in review and sprint planning meetings, and in so doing, the solution would meet the operational needs of the real world.

Zoho Creator's low-code platform was utilised to build the app, as well as SQL databases and live dashboards. This involved an interweave of process mapping and requirements gathering, followed by iterative live pilot development, testing. Already, the pilot environment has allowed 55 digital passes to be issued within 10 days.

The interaction of the last system included digital guest interaction cards using QR, automated screening, and live tracking functionalities. It enhanced the security of hospitals greatly, minimised the administrative workload, and simplified visitor management. The final deployment was carried out to train staff who would facilitate interaction-free adoption.

This case shows how a small, resource-limited hospital manages to adopt a sufficiently effective digital solution with the Agile approach. Scrum's iterative, user-centred process led to fast development, continuous improvement and exposure by the users.

Results and Discussion

Table 1

A Comparative Analysis: Agile vs. Waterfall Project Management in Healthcare

Aspect	Agile Methodology	Waterfall Methodology
Process & Planning	Iterative, incremental sprints with planning, executing, & retrospection; continuous reassessment & realignment based on feedback.	Linear, sequential stages with severe change control; planning initially with finishing each stage before progressing.
Project Nature & Suitability	Dynamic, innovation-led projects to fit changing care models, digital solutions, and accelerated IT innovation.	Structured, compliance-led projects with hard requirements such as medical devices, infrastructure upgrades, and extensive EHR deployments.
Scope & Flexibility	Growing scope, changing dynamically through ongoing feedback; highly responsive to regulatory or clinical change.	Fixed scope set in advance; rigid to changes after planning, with expensive and disruptive late changes.
Stakeholder Involvement & Team Structure	Regular interaction of clinicians, administrators, end-users in cross-functional, decentralised teams (product owners, scrum masters, developers, clinicians).	Limited stakeholder input mainly in planning and validation; team organisation is centralised in functional silos by the PMO.
Technologies, Tools & Testing	Modern integrated tools (Zoho Creator, Apollo 24/7, AI platforms, telehealth, cloud APIs); continuous integrated testing with early defect correction.	Traditional systems (Epic EHR, V&V test environments, ERP, MS Project); testing postponed until after build, delaying defect fixes.
Risk Management	Proactive, adaptive risk identification and mitigation are continually	Early on, preventive risk management was applied to the initial project stages, restraining

	ongoing throughout the project life cycle through continuous learning.	responsiveness to arising risks later.
Time-to-Market & Scalability	Accelerated delivery through early functional increments (MVPs), to achieve faster value realisation; excellent scalability through iterative refinement and hospital-wide rollouts after validation.	Slower release since the final product comes out only after phased completion in entirety; scalability is restricted once deployed, with the entire redeployment.
Documentation & Regulatory Fit	Flexible, light documentation specific to sprint; accommodates soft regulatory regimes but could necessitate hybrid models where strict compliance is necessary (FDA, HIPAA).	Heavy, intense documentation guaranteeing complete traceability and compliance; well-suited to heavily regulated settings such as medical devices.
Cultural Fit in Healthcare	Best suited for patient-driven, innovation-oriented environments, emphasising flexibility and incorporation of technology.	Best fit for mission-critical systems prioritising stability, predictability, and thorough documentation.

The Waterfall model excels in large, compliance-heavy, infrastructure-oriented projects where precision, regulation, & stability are paramount (e.g., Philips' imaging systems). Conversely, the Agile model thrives in dynamic environments requiring flexibility, patient personalisation, & technology-driven transformation, as seen with Apollo & Manipal Hospitals.

Healthcare organisations are increasingly embracing hybrid models, utilising the framework of Waterfall for core systems & the flexibility of Agile for digital innovations & patient-facing tools.

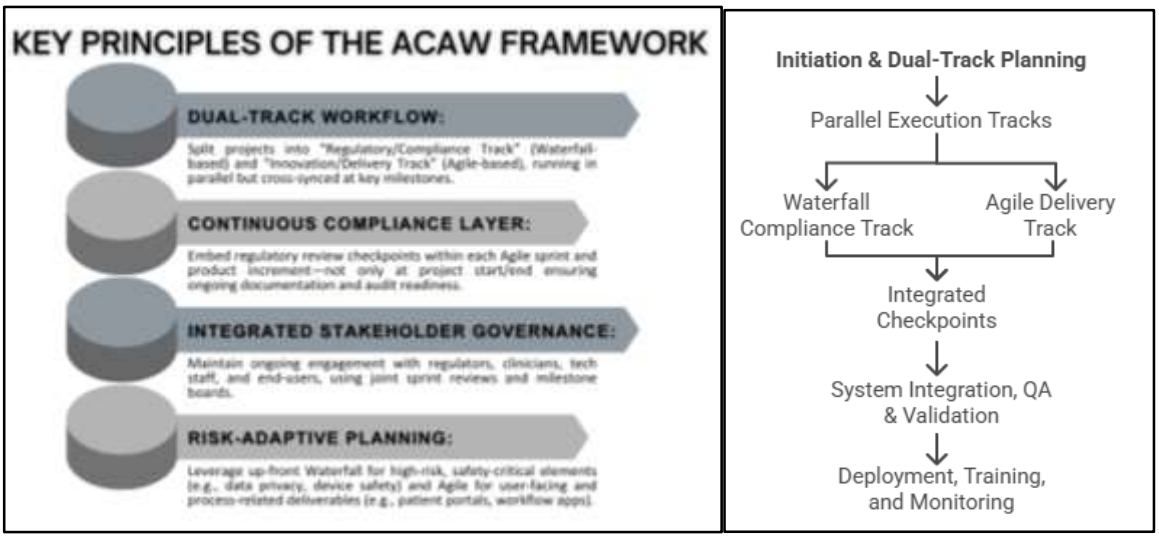
Choosing the Right Approach

A hybrid project management model, combining Agile and Waterfall, can be effectively applied in the complex healthcare industry, as case studies suggest.

- Strict regulatory compliance & documentation (Waterfall favoured)
- Agility to accommodate technology transformation & changing patient or operational requirements (favouring Agile)

A hybrid model blends Waterfall & Agile to tackle the unique challenges of complex healthcare projects, optimising both compliance & adaptability.

Adaptive Compliance Agile Waterfall (ACAW) Framework



1. Initiation & Dual-Track Planning

- Define critical governance objectives, master milestones, compliance, and deliverables.
- Determine which project parts require Waterfall (controlled) vs. Agile (high iteration, fast feedback).
- Form a composite project governance group.

2. Parallel Execution Tracks

- *Waterfall Compliance Track:* Documentation of requirements, System and infrastructure design, Core compliance processes, Data and risk assessment, Milestone sign-offs
- *Agile Delivery Track:* Product feature and user story backlog, Recurring sprint iterations with functional releases that take two to four weeks, Ongoing user and stakeholder input, Ongoing adjustment to comments and compliance changes

3. Integrated Checkpoints: For Agile, integrate "compliance champions" at sprint ends to assess risk, update documentation, and consider regulatory impacts. Instead of bulk handling, use "compliance stories" in the backlog..

4. System Integration, QA & Validation (Hybrid)

- System-level black box testing.
- Collaborate with compliance auditors and clinicians for UAT and regulatory validation.
- Validate technical documentation and processes for regulatory submission readiness.

5. Deployment, Training, and Monitoring: Ongoing staff training, compliance feedback, and quality monitoring. Continuous improvement cycles integrate compliance and innovation.

Conclusion

Both Agile and Waterfall methodologies benefit healthcare. Waterfall's detailed planning suits projects needing stability and compliance, while Agile excels in adaptable, collaborative, and continuously improving projects. Increasing healthcare complexity demands both stable processes and innovation. This paper revealed that a hybrid approach, such as the ACAW Framework, is often the most practical choice. By merging Waterfall's control and documentation with Agile's flexibility, healthcare organisations are able to manage high

compliance requirements without losing ground in responding to patient demands and technology trends. In the future, this hybrid approach to project management is likely to be the norm for healthcare, enabling organisations to innovate safely and effectively.

References

1. Apollo Hospitals. (n.d.). The Apollo story: Milestones. Apollo Hospitals. https://www.apollohospitals.com/company-overview/the-apollo-story#milestones
2. Dissanayake, D. M., Weerakkody, V., & El-Haddadeh, R. (2024). Project management in healthcare: An examination of critical success factors and challenges. Heliyon, 10(1), e11450. https://doi.org/10.1016/j.heliyon.2024.e11450
3. Fister, A. S., VanStan, J. A., & Wong, J. S. (2019). Use of Agile project methodology in health care IT: A systematic review. Journal of Healthcare Informatics Research, 3(2), 180–200. https://doi.org/10.1007/s41666-019-00044-z
4. Google Cloud. (2024, March 6). How Manipal Hospitals sped up nurse handoffs across 37 hospitals with Google Cloud AI. Google Cloud Blog. https://cloud.google.com/blog/topics/customers/how-manipal-hospitals-sped-up-nurse-handoffs-across-37-hospitals
5. Jain, D., Ramesh, S., & Mutt, R. (2024). Implementation of Agile methods in hospital systems using Scrum: A case study. JAMA Network Open. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC11131107/
6. Kaiser, S., & Prasad, P. V. (2023). Healthcare project management: A systematic literature review on methodologies and challenges. International Journal of Medical Informatics, 169, 104854. https://doi.org/10.1016/j.ijmedinf.2023.104854
7. Kerzner, H. (2023). Project management: A systems approach to planning, scheduling, and controlling (14th ed.). Wiley.
8. McCormack, B., & O'Sullivan, M. (2022). Agile methodology in health care: Enhancing patient-centered care and project outcomes. Journal of Nursing Management, 30(7), 1685–1693. https://doi.org/10.1111/jonm.13614
9. Project Management Institute. (2021). Pulse of the profession® 2021: Beyond agility. https://www.pmi.org/learning/library/pulse-of-the-profession-2021
10. Shinde, D. V., & Rathi, M. (2024). Application of Scrum framework and Low Code/No Code platform for development and implementation of In-patient electronic visitor management system to optimise hospital operations. ResearchGate. https://www.researchgate.net/publication/379132191
11. Spiegelman, L., Jen, M., Matonis, D., Gibney, R., Saadat, S., Sakaria, S., Wray, A., & Toohey, S. (2021). The effects of implementing a "Waterfall" emergency physician attending schedule. Western Journal of Emergency Medicine, 22(4), 882–889. https://doi.org/10.5811/westjem.2021.2.50249
12. TechCircle. (2024, April 9). Manipal Hospitals teams up with Google Cloud to streamline healthcare services. https://www.techcircle.in/2025/04/09/manipal-hospitals-teams-up-with-google-cloud-to-streamline-healthcare-services
13. Waly, A., & Sabri, W. (2024). Comparative analysis of Agile and Waterfall project management in healthcare: Benefits and limitations. International Journal of Healthcare Management, 17(1), 23–31. https://doi.org/10.1080/20479700.2024.1747268