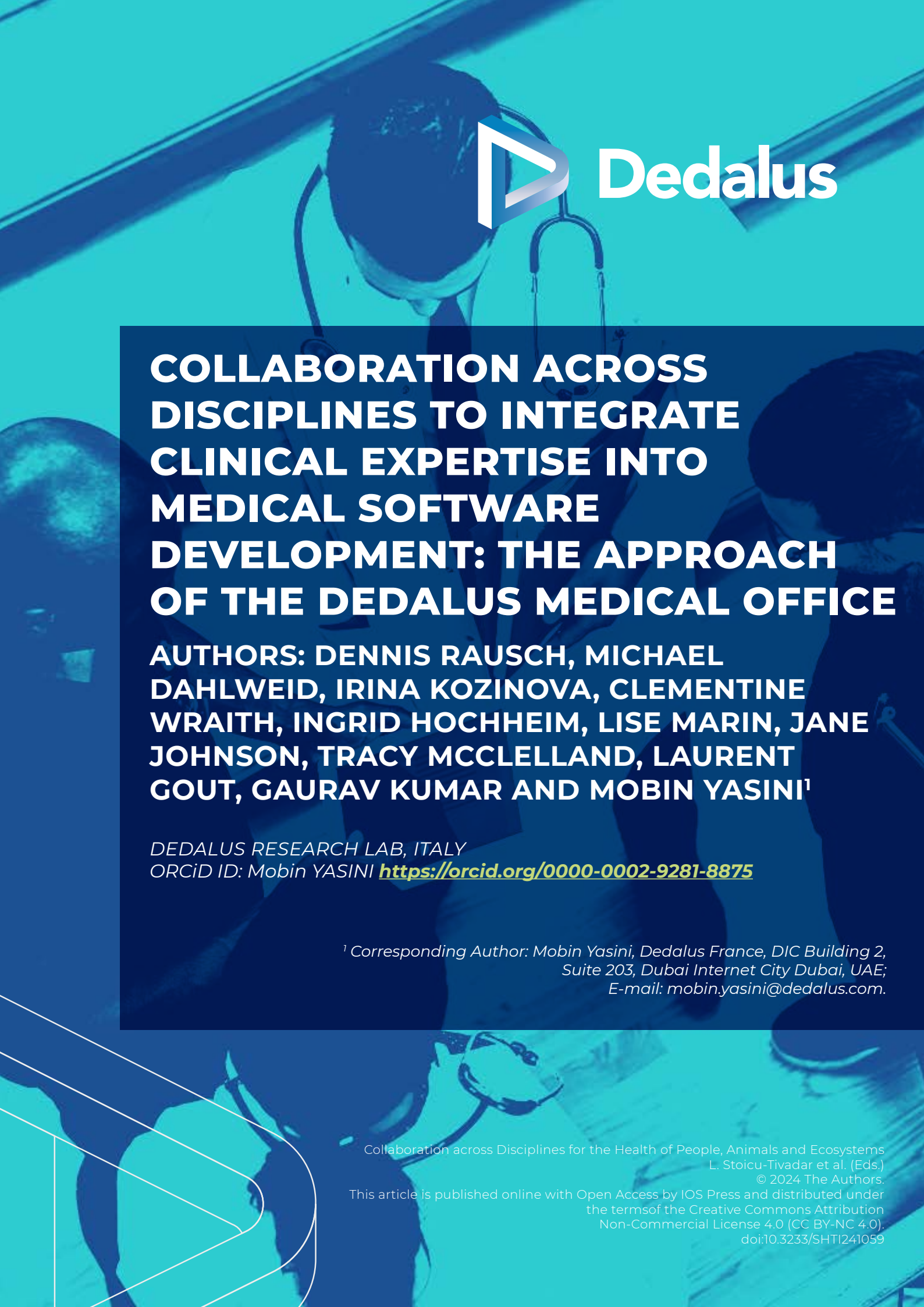

COLLABORATION ACROSS DISCIPLINES TO INTEGRATE CLINICAL EXPERTISE INTO MEDICAL SOFTWARE DEVELOPMENT: THE APPROACH OF THE DEDALUS MEDICAL OFFICE

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Collaboration across Disciplines for the Health of People, Animals and Ecosystems
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Abstract

Medical informatics is a multidisciplinary field combining clinical and technical expertise. Addressing the challenge of aligning software design with clinicians' real-world needs, Dedalus established the Medical Office, a dedicated department designed to integrate clinical expertise directly into the software development process, in 2022. This paper details the approach and impact of the Medical Office.
An international team of 15 healthcare professionals with experience in medical informatics was assembled. The team employed a multifaceted approach, incorporating global communication sessions and a ticketing system to track and analyze service requests. Over two years, 398 tickets were received, categorized into nine areas: clinical content curation, medical terminologies, clinical safety, clinical evaluation, design support, clinical UX, research & publication, real-world medical cases, and pre-sales support. The average duration of ticket resolution decreased over time, attributed to process finetuning and the formation of a relevant expert group.
A preliminary satisfaction survey indicated positive feedback from technical teams. The collaborative model improved software design, usability, and clinical safety, demonstrating the value of clinician involvement. While preliminary results are promising, ongoing evaluation and adaptation are essential. The study emphasizes the importance of interdisciplinary collaboration in medical informatics and the benefits of clinician involvement in healthcare technology development. Future studies should explore this model's long-term impacts and scalability in other organizations and healthcare systems.

Keywords

Medical Informatics, **Interdisciplinary Communication**, **Human - Computer Interaction**

1. Introduction

Medical informatics is an inherently multidisciplinary field, blending the expertise of clinical and technical disciplines to enhance healthcare delivery. The field requires contributions and collaboration across diverse domains, including clinical medicine, computer science, data science, healthcare management, human-computer interaction, and regulatory affairs, to create comprehensive solutions that improve healthcare delivery and patient outcomes [1,2]. There is a challenge to ensure that software specifications and design meet the real-world needs of clinicians and earn their trust [3]. One of the solutions to this challenge is the involvement of healthcare professionals in developing software solutions [4].

Lack of time has been long expressed as a key barrier for healthcare professionals to be involved in the research and development of new digital health products [5]. Dedalus, a clinical software solutions manufacturer, established the Medical Office in 2022, including dedicated full-time clinicians, a unique department integrating clinical expertise into software design and development processes. The Medical Office is structured as a cross-functional department that liaises between clinical professionals and software developers, ensuring that the software products align with clinical practice and standards. Since its creation, the Medical Office has demonstrably improved clinical software designs, enhancing usability and clinical safety. The main aim of this study is to present our approach to creating the Medical Office, showcasing the volume and categories of requirements received since its inception and highlighting its impact on the development process.

2. Method

A team of 15 healthcare professionals (including physicians and nurses) from various countries, including Germany, France, UK, India, Italy, UAE, Belgium, and Australia, with diverse healthcare backgrounds and experience was assembled under the leadership of the Chief Medical Officer. All team members also possess expertise and experience in one or more fields of medical informatics. A multifaceted approach was employed to integrate this clinical expertise into developing clinical software.

Communication and presentation sessions were conducted globally, ensuring that internal collaborators across various countries were well-versed in the functionalities and benefits of the Medical Office services.

A ticketing system was implemented to track activities within the Medical Office and facilitate ongoing improvement. This system allows for detailed analysis of service requests. These tickets were then analyzed to identify the subject category to which they belonged. A new subject category was added whenever a ticket could not be included in a category already created. Therefore, the categories of tickets found in the requests were enumerated incrementally as they were received. A clear definition was assigned to each category of subject to avoid ambiguity. Each ticket could be classified into one or more categories. By analyzing ticket data, the team identified areas with a greater requirement for clinical expertise. The fine-tuning of the processes involved regular reviews of workflows, identifying bottlenecks, and implementing iterative improvements based on feedback from both clinical and development teams. For each ticket, the time taken to solve it was recorded to determine the average duration of resolution and its evolution over time. Additionally, a simple 5-star rating satisfaction survey (simplified Likert scale) was conducted after finishing each request to gather immediate feedback from requesters.

3. Results

We have received 398 tickets during two years of exercise activity. The ticket subjects were classified into nine categories. These categories, their definitions, along with the frequency and average resolution time (ART) of each category, are described in Table 1.

Table 1. Categories of requests submitted to the Medical Office, together with their definitions, data frequency, and average resolution time (ART).

Requested service category	Definition	Frequency (%)	ART (days)
Design support	Design support involves participating in R&D meetings and systematic software reviews to align new and existing products with clinical best practices. This includes defining requirements, conducting research, providing insights, and maintaining a library of clinical design recommendations.	44 (10)	19
Clinical UX	Clinical UX focuses on understanding clinical requirements to avoid design errors and ensure intuitive user experiences. It involves mapping user journeys, understanding interactions between patients, clinicians, and software, and conducting feedback sessions to refine the design.	50 (11)	14
Scientific Research and Publication	This involves supporting design teams by identifying relevant scientific literature to inform design decisions. The Medical Office also conducts and publishes its own studies in medical informatics, contributing to evidence-based software design.	14 (3)	120
Clinical Content Curation	Clinical content curation involves creating standardized forms, charts, assessments, and other content based on medical evidence. This content is standardized and interoperable across different software products using SNOMED CT and LOINC terminologies.	132 (30)	21
Managing Medical Language and Terminologies	This entails defining and standardizing medical terms, translating natural language, and addressing semantic differences to ensure precise communication, consistent data, and improved understanding.	56 (13)	7
Real-World Medical Cases	This involves collecting case reports, dummy patient documents, and workflows to create realistic scenarios for demonstrations and mockups. These cases help design teams improve the relevance and usability of the software.	16 (4)	10
Clinical Safety Assurance	Clinical safety assurance focuses on ensuring product safety through risk management, clinical evaluation, and vigilance. This includes supporting validation approaches, clinical study designs, and compliance with Medical Device Directive (MDD) and Medical Device Regulation (MDR) processes.	46 (10)	15
Clinical Evaluation	Managing the clinical evaluation aspect of medical device manufacturing according to European MDR. This involves contributing to regulatory policies and decisions to ensure product safety and compliance.	48 (11)	21
Pre-Sales Support	Pre-sales support enhances sales presentations by providing clinical expertise and understanding of medical terminology, workflows, and clinical needs. This helps effectively communicate software benefits, address pain points, and build trust with potential clients.	38 (9)	4

Fine-tuning allowed each resolved ticket to contribute to a more extensive database of clinical insights, which was used to inform future software updates and refinements. For example, tickets related to clinical content curation led to the development of a standardized content library integrated into multiple products, increasing content creation efficiency across teams.

The average duration of ticket resolution over two years is shown in Figure 1.
The satisfaction survey results showed an overall average rating of 4.6 out of 5.

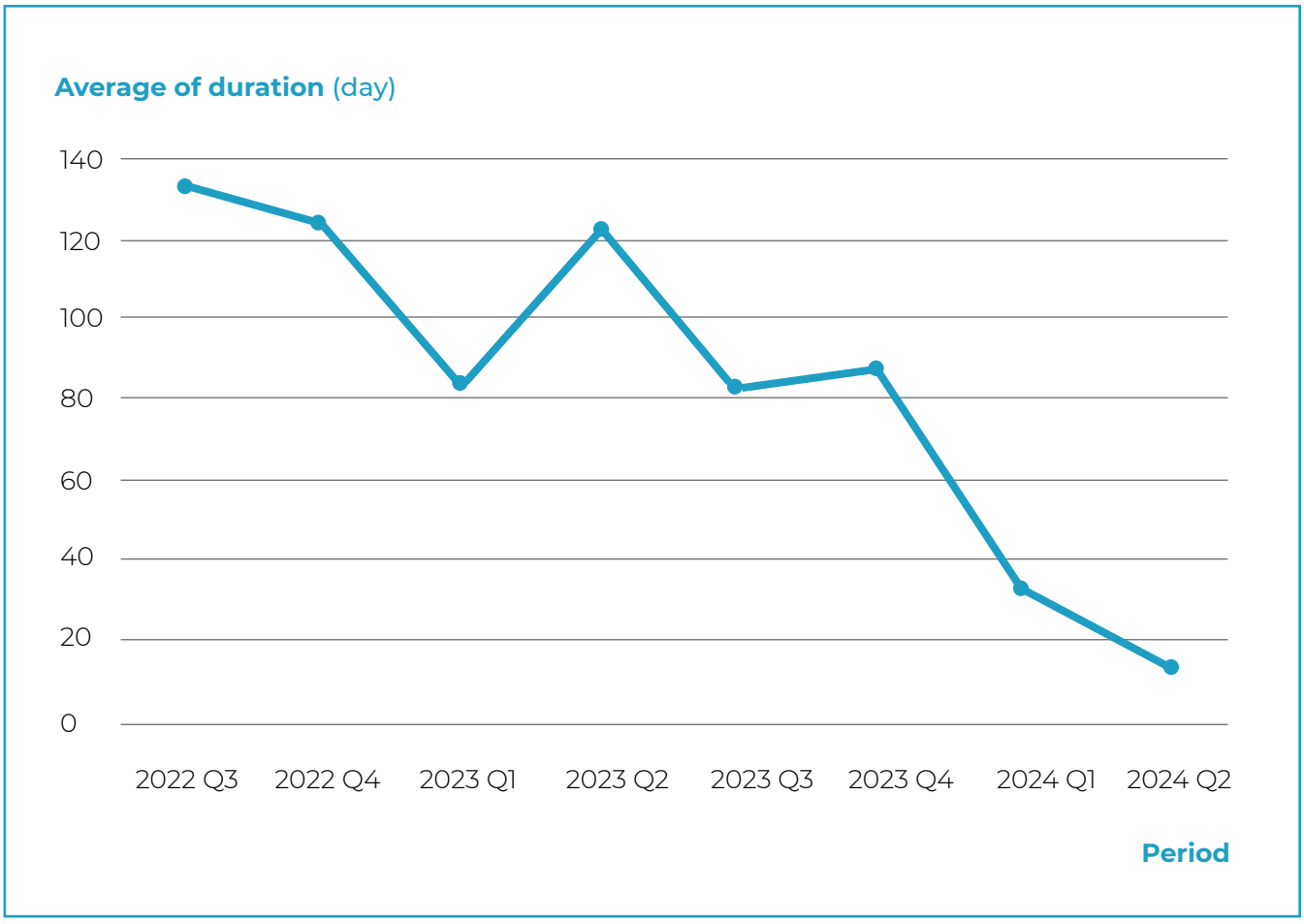

Figure 1. The average duration of ticket resolution for each quarter during two years of exercise.

4. Discussion

This study outlines the creation and operation of the Dedalus Medical Office. Over two years, hundreds of requests were analyzed to understand needs and guide future resources. The Documentation of responses helps inform other teams, with some leading to published papers. The preliminary satisfaction survey indicated positive feedback from technical teams, underscoring the value of this collaborative model.

Among the requests received, the most frequent were related to clinical content curation. This is because clinical content specification cannot be done without clinical expertise. Requests related to medical language and terminologies were also frequent, as standardizing our software is essential for improving interoperability. Clinical safety and clinical evaluation were also common requests, highlighting the importance of ensuring the software is safe and effective. Various requests led the Medical Office to conduct and publish studies that support evidence-based software design [6–9].

The average duration of ticket resolution has generally decreased over time. This improvement results from fine-tuning the process and accelerating outcomes achieved by assembling a group of relevant experts.

Our findings reinforce the importance of interdisciplinary collaboration in medical informatics, which aligns with the previous studies that emphasize the benefits of involving clinicians in developing healthcare technology and software [4,10,11]. Integrating clinical insights has improved various aspects of the software, including user experience, efficiency, and clinical safety. By embedding clinical experts within production teams, offering helpdesk support, and conducting systematic research, the Medical Office has successfully bridged the gap between clinical needs and technical solutions.

One of the key strengths of this approach is its ability to address real-world clinical needs and workflows, thereby earning the trust and satisfaction of end-users.

The findings of this study are based on a limited sample size and a relatively small team of 15 healthcare professionals, which may not capture the full diversity of potential issues. The 5-star satisfaction survey is a simple measure that does not capture the reasons behind satisfaction or dissatisfaction.

5. Conclusions

The Medical Office model demonstrates the importance of continuous clinical input in the development process, ensuring that the final product is functional and meets the high standards required in healthcare settings.

While the initial results are promising, ongoing evaluation and adaptation will be crucial to maintaining and expanding these benefits.

Future studies should explore this model's long-term impacts and potential scalability to other organizations and healthcare systems.

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