A Novel AI-powered Approach for Improving Inclusion and Participation of Unpaid Caregivers in a Digital Carer Support Community

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Abstract. Unpaid carers provide support to individuals who cannot manage independently due to disability, age, illness, mental health conditions, or addiction [1]. They often face significant challenges balancing their caregiving duties while managing their own well-being. In 2021/22, the value of unpaid care across the UK was estimated at £184 billion annually, surpassing the NHS budget for all four nations [2]. Mobilise Care Limited, a digital carer support organisation, empowers carers through the Mobilise Digital Carer Support System (MDCSS) — a platform comprising two main tools: the Carer's Assessment Tool and the Mobilise Assistant Chat. While Carer's Assessment Tool delivers personalised support through guided phone conversations and follow-up via SMS or WhatsApp, Mobilise Assistant Chat offers AI-driven responses to carers' digital queries. This research introduces the Enhanced Carer Digital Support System (E-CDSS) — an upgrade to the existing MDCSS — which integrates peer-generated community knowledge from a growing carers network into its digital infrastructure to improve inclusion and participation of carers in the digital carer support community.. Using supervised machine learning [3] and Retrieval-Augmented Generation (RAG) [4], E-CDSS classifies and embeds helpful community discussions with 93% accuracy, enriching the knowledge base behind both Carer Assessment Tool and Mobilise Assistant Chat. Preliminary findings suggest increased carer satisfaction, reinforcing the role of digital innovation in reducing social isolation and enhancing accessibility, inclusion, and quality of support within the carer community.

Keywords: Personalised AI, Unpaid Carers, Community Engagement, Assistive Technology, Digital health innovation

1 Introduction

Unpaid carers (caregivers) in the UK provide unpaid support to a family member, partner, or friend who is unable to manage independently due to illness, disability, mental health conditions, old age, or addiction [1]. These carers face

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significant challenges in balancing their caregiving responsibilities with their own well-being and daily life. With an estimated 5.7 million unpaid carers across the UK [5], they represent the backbone of informal care provision. In 2021/22, the economic value of their contribution was estimated at £184 billion—surpassing the combined NHS budget for all four UK nations [2]. This highlights both their vital role in the healthcare system and the urgent need for innovative support mechanisms.

The Mobilise Carer Digital Support System (MCDSS), developed through collaboration between Mobilise, London Metropolitan University, and UK Research and Innovation, delivers personalised information and support by leveraging individual carer profiles and responding to real-time needs. The Mobilise Carer Digital Support System (MCDSS) comprises two core components: the Carer's Assessment Tool, which assesses carers' needs through guided phone conversations and delivers tailored support plans via SMS or WhatsApp; and the Mobilise Assistant Chat, which responds to carers' digital queries. While both tools are built on Mobilise's central knowledge base, they often fall short in offering practical insights drawn from lived experiences, fostering emotional engagement, and facilitating two-way discussion on applying caregiving strategies. Online Health Communities (OHCs) allow carers and others in similar situations to connect, exchange information, share experiences, and provide mutual emotional support [6]. Recognising the value of such peer-driven support, this study focuses on the Mobilise Community—a growing digital platform with around 9,500 registered carers—where members discuss day-to-day care-related issues. This research presents a novel enhancement to MCDS: extracting and embedding useful community-generated threads into the system's knowledge base to improve the personalisation, contextual relevance, and emotional resonance of its responses. By integrating peer insights into both the Carer's Assessment Tool and Mobilise Assistant Chat, E-CDSS improves inclusion, accessibility, and the quality of informational support, while fostering stronger community engagement. Preliminary findings indicate increased user satisfaction and extended support reach, demonstrating strong potential for innovation in digital health.

To contextualise this work, Section 2 of this paper reviews the related work and background, discussing existing research on unpaid carers and digital health tools. Section 3 presents the methodology, detailing the AI-powered tools and community integration approach used. Section 4 provides a quantitative and qualitative analysis of the results, including model performance and user feedback. Section 5 discusses the implications of the findings and the impact on carer's engagement and well-being. Finally, section 6 concludes the paper, offering suggestions for future work and further innovations in carer support systems.

2 Related Work

Unpaid carers play a vital role in healthcare systems, yet they often remain under-supported and face significant emotional, financial, and social burdens [2]. Digital interventions have emerged as promising tools to alleviate these pressures,

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particularly through Online Health Communities (OHCs), which enable carers to exchange information and receive emotional support. Participation in OHCs has been associated with reduced isolation and improved mental well-being [6]. These platforms foster peer support and shared lived experiences, empowering carers to manage complex caregiving challenges more effectively. However, OHCs also present limitations: community-generated content is typically siloed within the platform and can be difficult to search or surface in response to specific needs. These challenges limit the accessibility and broader utility of valuable peer knowledge outside the immediate community environment. In parallel, artificial intelligence (AI) is increasingly used in digital health to provide personalised and scalable support. Generative models such as GPT have been deployed for mental health support and education, demonstrating high engagement and perceived usefulness [7], [8]. Recent research indicates that integrating peer-generated content into AI systems can enhance the contextual richness and empathy of responses. For instance, Sharma et al. (2022) developed an AI-in-the-loop agent that provided real-time feedback to peer supporters in mental health conversations, leading to a 19.6% increase in conversational empathy [9]. Similarly, Lee et al. (2024) found that responses generated by large language models were consistently rated as more empathetic than human-written responses across various life scenarios [10]. Retrieval-Augmented Generation (RAG) [4] has emerged as a promising architecture that combines structured language models with unstructured, real-world data. It enables systems to retrieve relevant contextual documents (e.g., community discussions) and use them to ground model outputs. This approach has shown strong performance in domains requiring factual accuracy and contextual reasoning, however, its application in caregiving contexts remains limited. Machine learning has also been utilized to identify factors contributing to burnout and emotional exhaustion among healthcare providers, which are pertinent to understanding carers' stress levels [11]. However, few systems integrate these capabilities into live support tools, and there is minimal research on how community-generated knowledge can be dynamically filtered, stored, and reused to inform AI-driven responses for carer support Despite growing interest in both community-based health interventions and AI-powered support tools, there is a lack of integrated systems that combine peer-generated knowledge with RAG models to deliver personalised, contextually aware assistance to unpaid carers. Furthermore, empirical evaluation of such systems in real-world care settings remains scarce.

3 Methodology

MCDSS (Fig. 1) uses RAG [4] approach, which uses the OpenAI GPT-4o API. The system retrieves data stored in a vector database to generate contextualised responses tailored to the carers' needs. In the latest feature enhancement, community threads (collection of posts and comments) were collected from the Mobilise Community platform using API. These internal discussions on caregiving topics were initially classified using a semi-supervised model [12]. with labels

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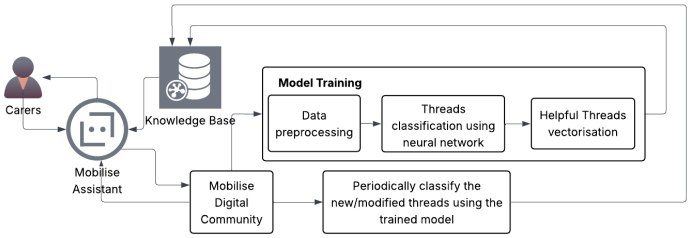

Fig. 1: Conceptual design

from the Mobilise Carer Support Team, who rated threads on a five-level Likert scale from "Very Helpful" to "Not Helpful." The dataset of 1709 threads was then binarised into "Helpful" and "Unhelpful" for model training. Subsequently, a supervised neural network with two layers (256 and 16 neurons) adopted for improved performance [3], incorporating textual features and metadata such as likes and comments. The final pipeline integrates helpful threads into the RAG [4] system by vectorising and storing them in the vector database, enabling the tool to provide carers with both core content and peer-generated community discussions. This entire process is automated to update regularly, ensuring the tool reflects evolving community insights, which are crucial for addressing niche, practical concerns and reinforcing the platform's role in fostering connected, responsive support.

4 Quantitative and Qualitative Results

The model reached 93% accuracy after 70 training epochs (Fig. 2), demonstrating strong generalisability and effective capture of linguistic and contextual features indicating helpfulness in caregiving content.

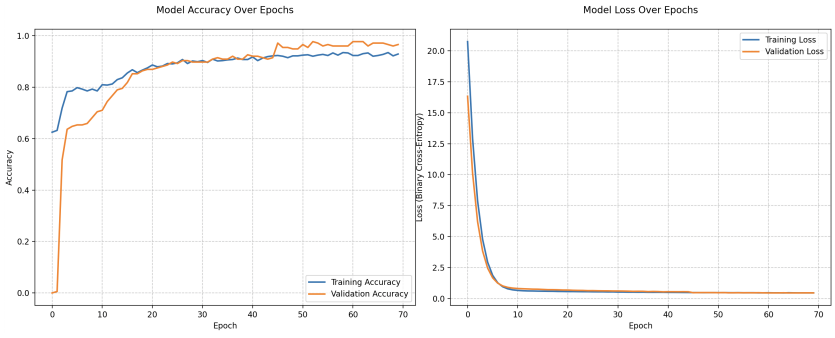

Fig. 2: Training and validation accuracy and loss curves

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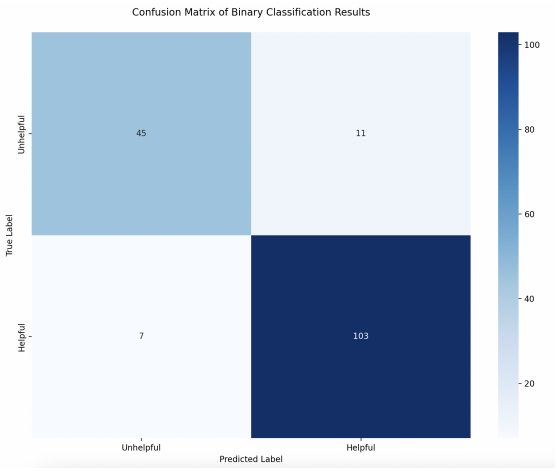
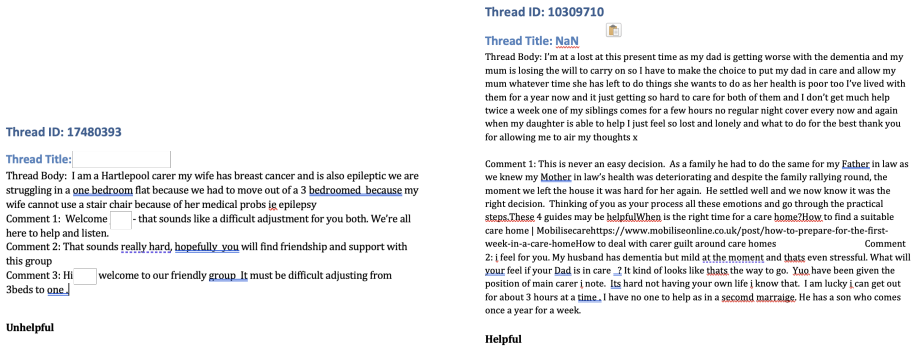


Fig. 3: Confusion matrix of the model

Fig. 2 shows a steady decline in training and validation loss, indicating effective convergence without overfitting. The close alignment of the curves supports the model's robustness and reliability.



(a) Unhelpful (b) Helpful

Fig. 4: Threads predicted as Unhelpful and Helpful

The confusion matrix (Fig. 3) shows the model correctly classified 45 helpful and 103 unhelpful posts, with 7 helpful and 11 unhelpful misclassifications, demonstrating balanced performance and high precision in identifying unhelpful content to maintain a reliable knowledge base. Fig. 4 provides qualitative examples: Fig. 4a depicts an unhelpful thread lacking actionable support, while

Fig. 4b shows a helpful thread offering emotional and practical advice relevant to carers. These illustrate the model's real-world classification effectiveness.

No	Question (user query)	Answer from Assistant's staging environment	Is it helpful, relevant, and coherent	Are you happy with the empathy	Comment
23	How can I get Mum to drink more	Encouraging someone to drink more can be challenging, especially if they're resistant. Here are a few suggestions: Offer a variety of drinks: Try different types of beverages like tea, coffee, squash, or banana milkshake. Sometimes, a change in taste can stimulate the desire to drink. Make it fun: You could try making tasty ice lollies to get extra fluids in. This can be especially helpful during warmer days. Use soups and porridges: These are easy to consume and can be a good way to slip both calories and extra fluid into the diet. Use hydration aids: Some carers have found products like jelly drops helpful. These are jelly sweets that help with hydration. Try a gentle approach: Instead of insisting, leave the drink within their reach and let them decide when to drink. Remember, it's important to respect their autonomy and not to force them to drink if they don't want to. For more tips and shared experiences from other carers, you can check out this discussion on the Mobilise community.	Yes, yes, yes	Yes	Includes a brilliant community link but doesn't include a link to our great piece of content. Has it swapped one for the other? I like the wording "For more tips and shared experiences from other carers, you can check out this discussion on the Mobilise community". If it could also specifically mention the topic that would be even better. E.g. "for more tips on getting your mum to drink more, you can check out...."

Fig. 5: Feedback from carer support expert

Feedback from carer support experts (Fig. 5) confirmed the system's practical value, noting improvements in content relevance, workflow efficiency, and user engagement. These results validate the AI classification's effectiveness and support its integration into the Mobilise platform, enhancing personalisation, engagement, and scalable intelligent support.

5 Discussions and Impacts

This study shows that integrating AI-powered community knowledge into MCDSS positively affects carers and key stakeholders. As shown in Fig. 6, referrals to relevant community threads have increased engagement, enhancing carers' sense of inclusion and support.

The feature also benefits carer support staff by streamlining workflows, providing quicker access to relevant content, aiding empathetic responses, and summarising queries. This reduces time for personalised support, improves communication quality, and eases staff onboarding. For local authorities, the system offers better responsiveness through aggregated insights, aiding policy and support planning.

From an organisational perspective, Mobilise gains strategic advantages such as higher user retention, improved service delivery, and operational scalability. The centralised knowledge base aids staff training, content creation, and decision-making. Data-driven metrics also help Mobilise demonstrate its impact to funders and partners, strengthening its leadership in digital carer support.

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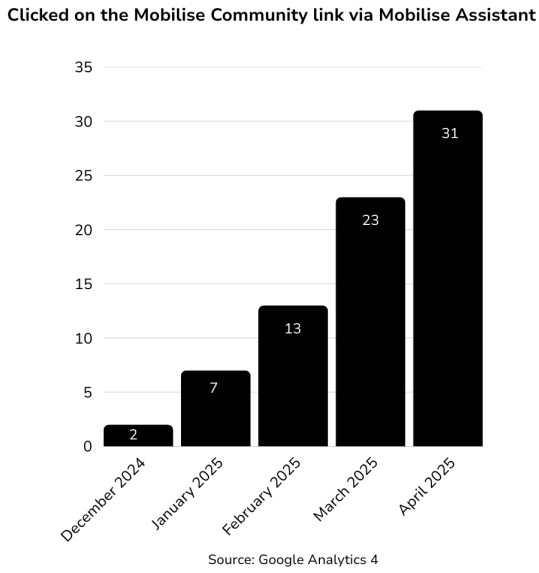

Fig. 6: User engagement

Integrating peer-generated knowledge into AI systems is a promising advance in digital health. By grounding AI responses in real-life experiences, the system enhances relevance, trust, and engagement. This approach has potential applications in mental health, chronic illness management, and other OHCs where lived experience is crucial.

6 Conclusion and Future Work

This research presents a novel AI-powered approach that integrates personalised support with community-derived knowledge to enhance digital assistance for unpaid carers. By classifying and embedding helpful peer-generated content from a digital caregiving community into the Mobilise Carer Digital Support System (MCDSS), the system delivers richer and more contextually relevant responses. This integration enhances not only informational accuracy but also fosters inclusion, empathy, and a sense of shared experience among carers. Quantitative evaluation showed strong model performance, with 93% accuracy in classifying helpful versus unhelpful posts, robust convergence, and balanced classification as reflected in the confusion matrix. Qualitative testing with carer support experts and carers across diverse real-world scenarios revealed increased satisfaction, improved problem-solving, and stronger community engagement. The solution also

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benefits Mobilise staff and stakeholders by reducing response time, supporting onboarding, and generating actionable insights from user behaviour.

These findings confirm the viability and value of combining machine learning with lived experience to enhance digital care platforms. Future work will focus on scaling the system to support broader populations, refining engagement techniques, and expanding multilingual and culturally sensitive features to promote inclusion across diverse carer communities.

Intellectual Property Statement

All proprietary systems and methods described in this paper, including the Mobilise Carer Digital Support System (MCDSS), Carer's Assessment Tool, and Mobilise Assistant Chat, are the intellectual property of Mobilise Care Limited. © Mobilise Care Limited 2025. All rights reserved.

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