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RESEARCH

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Looking at human healthcare to improve agricultural service delivery: The case of online chatgroups

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Abstract

This study analyses the opportunities and pitfalls of using chatgroups for plant health systems. It also examines the conditions for strengthening chatroom functions and considers the possibility of replicating reported successes in healthcare settings to plant health systems. We use mixed qualitative methods, which include stakeholder surveys and observation of chatgroup activity interactions in Ghana, Kenya, Uganda and Sri Lanka. Our findings show that there is evidence of the benefits of chatgroups to human health which can be replicated in plant health. Replication should, however, not be a 'copy and paste' approach. This is due to the general lack of evidence-based guidelines and lessons learned to move beyond the initial adoption success of communication applications. Also, in practice, plant doctor chatgroups are generally much larger than groups in healthcare settings and it remains to be seen whether increasing chatroom activity could benefit specific plant health objectives; or whether it would lead to increased labour costs, and/or diminish the participation of plant doctors.

One Health impact statement

The article is relevant in a One Health context as it demonstrates that there is a lot to learn between sectors about interventions and approaches. The work used literature from human health interventions to shed light on how a similar intervention in plant health functioned and could be improved. It shows that if actors in the plant health sector had engaged early on with actors in the human health sector, they may have avoided pitfalls in the ways that chatgroups can be used to support plant health management. It is expected that human, animal and plant health sectors would benefit from the knowledge and recommendations in this article to establish new online chatgroups that can support transformative change.

Keywords: WhatsApp, Telegram, human healthcare, crop health, extension, plant clinics

Introduction

Each year millions of farmers suffer from crop and livestock losses due to a variety of pests and diseases (Savary *et al*., 2012; Sharma *et al*., 2017). Low yields and ailing livestock diminish the food security, income and overall health of farmers (Strange and Scott, 2005; Savary and Willocquet, 2020). Given that crops provide income for farmers, as well as both food for people and feed for livestock, it is important to ensure that they remain in good health. This therefore demands effective plant health management (Danielsen and Matsiko, 2016).

The plant clinic approach is a novel way of supporting plant health management in countries where it has been established (Srivastava, 2013; Majuga *et al*., 2018; Tambo *et al*., 2020; Rambauli *et al*., 2021). The approach hinges on trained plant doctors diagnosing and providing evidence-based management options for crop pests and diseases from samples of afflicted crops, brought by farmers to plant clinics. Apart from increased crop yields and household incomes for those attending plant clinics (Silvestri *et al*., 2019; Tambo *et al*., 2020), plant clinics also have the potential to support farmers' own health, as plant doctors also provide advice to farmers on the safe use of pesticides and post-harvest crop management to reduce mycotoxin levels (Danielsen *et al*., 2020). Given these benefits, efforts have been made to increase the reach of the approach via the use of digital applications, especially those that are informally facilitated and self-organized. This is because evidence shows that the use of digital technologies has the potential to enhance and complement

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traditional agricultural extension service provision (Danielsen and Matsiko, 2016; Munthali *et al*., 2018; Tambo *et al*., 2019; Toepfer *et al*., 2019; Coggins *et al*., 2022; Porciello *et al*., 2022).

Furthermore, evidence from human health shows that since the first studies on the use of chatrooms in health care (Shah and Bhatt, 2013; Wani *et al*., 2013), online chatgroup usage has been found to have many benefits (De Benedictis *et al*., 2019; Weaver *et al*., 2022). Given the positive experiences from human healthcare and the need to reach farmers at scale, several plant health clinic networks in different countries have adopted the use of online chatgroups. Despite this, the real and perceived opportunities and pitfalls of the use of online chatgroups for plant health systems have not been extensively researched. This study therefore seeks to meet this gap by examining and clarifying the opportunities and pitfalls of the use of online chatgroups for plant health systems, by using insights from chatgroup usage in human healthcare settings.

STATEMENT ON HOW THE RESEARCH INVOLVED DIFFERENT DISCIPLINES

The research involved social scientists, data scientists and biophysical scientists involved in supporting plant clinic network chatgroups to extract insights and learning from the plant clinic networks established under the Plantwise program.

Methods

A mix of qualitative methods were used to meet the objectives of the study. This included a literature review, observing interactions in online chatgroups and stakeholder surveys.

LITERATURE REVIEW

The literature review focused on the health sector and was limited to papers that included ‘WhatsApp’ or ‘Telegram’ in both the title and the abstract and were published in English, after 2015. The search was carried out using the PubMed search engine of the MEDLINE medical database. Since the analysis was interested in the general and broad use of WhatsApp across the healthcare sector, the results were not limited to any specific topic, ranging across a variety of medical practices and themes in both rural and urban contexts. The search yielded 144 unique articles – a combination of letters of concern, commentaries by editors, literature reviews, reports and case studies. There were no papers reporting on the use of the Telegram application, meaning all findings were confined to experiences using WhatsApp. Saturation guided the quantity and quality of information gathered and the reading of sources was halted once redundancy was reached. Three articles published prior to 2015 were included due to their overall significance to the study. Once a study was included in the literature review, we searched within it for specific information including a description of the levels of interaction/activity levels within chatgroups and among chatgroup members, the management of the group as well as the contents being shared and the rules guiding chatgroup participation. We also searched for information on the incentives and deterrents for participating in the chatgroup as well as any reported benefits and challenges.

It should be noted that not all related literature on WhatsApp adoption in healthcare is part of the PubMed database. Overall usage of WhatsApp in the medical sector is probably under-represented by the few case studies that make it into the peer-reviewed literature that this report has synthesized. Out of the 51 documents analysed, only 30 explicitly mention the term ‘chat’; the rest did not clarify what they referred to when implying ‘WhatsApp use’. In addition, the research has not investigated developments from 2020 onwards, following the COVID-19 pandemic that will surely produce new insights towards successful online facilitation and guidance of virtual online communities. Considering that all literature assessed in this study was published no later than the start of 2020, there is a wealth of potentially new information still to be looked at.

OBSERVATION OF THE INTERACTIONS IN ONLINE CHATGROUPS

We conducted observations of the interactions within online chatgroups using online plant clinic networks from Ghana, Kenya, Uganda and Sri Lanka. Specifically, we analysed Telegram plant clinic chatgroup activity between 2017 and 2020 for four countries (see Table 1 for details on group sizes). The Telegram data for all study countries was downloaded by using the ‘export Telegram data’ function as machine readable.json format. The .json file was then converted to .csv file using R studio computer programme using packages ‘tidyverse’ and ‘jsonlite’. The downloaded .csv file was used to derive descriptive statistics, including the changing participation and intensity of exchanges as well as participation of individuals and different categories of participants. Telegram group sizes differed by country, ranging from around 45 in Sri Lanka to 250 in Kenya (Table 1).

STAKEHOLDER SURVEYS AND KEY INFORMANT INTERVIEWS

Finally, we conducted stakeholder surveys, key informant interviews and focus group discussions in Ghana, Uganda and Sri Lanka to substantiate the descriptive statistics from the Telegram data (Table 1). The survey gathered insights into how platform actors experienced interaction in the chatgroups, factors hampering or enabling chatgroup members’ interaction and information on the general use and perceived value of the platforms in organizational activities. Data was analysed using thematic analysis.

To ensure that the data we collected adhered to ethical standards, several actions were taken. Respondents for the stakeholder surveys, key informant interviews and participants in focus group discussions were informed about the objective of the study and were given the option to consent to participating in the interview or discussion. They were also informed that they could opt out at any point in the study even after an interview or group discussion had started. For the Telegram data, a message was sent to all groups to inform them that a research study was underway that would analyse the group chat history and interactions. The groups were also informed that a ‘bot’, which collects data, was going to be added to the group, and were sent a message on what the ‘PlantwiseBot’ would do – i.e. monitoring the chatgroup and tracking topics and information shared, to look at trends for the research, with information collected likely to be used to also provide back-end support for the group.

Results and discussions

The benefits and challenges of the use of chatrooms in human health have been documented in the literature. The benefits include but are not limited to facilitating efficient communication between health professionals, and linking different departments within hospitals, hospitals with other hospitals, and rural specialists with urban specialists (Henry *et al*., 2016; Masoni and Guelfi, 2020; Weaver *et al*., 2022). This has resulted in improved decision making (Coleman and O’Connor, 2019; Salam *et al*., 2021) and patient care (Johnston *et al*., 2015; Salam *et al*., 2021), as well as advancing learning and skills development (Salam *et al*., 2021). The challenges range from confidentiality concerns, to a lack of sufficient guidance and technical challenges. This section provides specific insights on how both the benefits and challenges from the use of chatrooms in healthcare settings can be applied to plant health settings.

Table 1. Data sources and sample sizes.

Data source	Country	Group size	Note
Telegram data	Ghana	230	Sri Lanka had at the time of the study 10 local level groups and no national group. Each group had on average 45.1 members.
	Kenya	250	
	Uganda	118	
	Sri Lanka	45.1	
Data source	**Country**	**Sample size**	**Actors' samples/interviewed**
Stakeholder surveys***	Ghana*	55	Chatgroup members
	Uganda	40	
	Sri Lanka	40	
Focus group discussions***	Ghana**	19	Extension staff, NGO staff, smallholder farmers
	Uganda	8	
	Sri Lanka	8	
Key informant interviews***	Ghana**	11	Extension services, research and university representatives
	Uganda	15	
	Sri Lanka	15	

*See Munthali (2021a) for details on surveys, focus group discussions and key informant interviews.
**This represents 23.9% of chatgroup members in Ghana.
***No stakeholder surveys, focus group discussions or key informant interviews were conducted in Kenya.

CHATGROUP INTERACTIONS AMONG HEALTHCARE WORKERS AND PLANT DOCTORS

Participation over time

Studies from separate hospitals in the UK, where WhatsApp chatgroups have been adopted highlight how online participation of group members varies with time (Johnston *et al*., 2015; Raiman *et al*., 2017). High volumes of messages are observed soon after establishing the chatgroup, but these gradually decrease over time (Raiman *et al*., 2017). Day-to-day fluctuations in posting activity are also noted, with surges in the number of posted messages correlating with visits by supervisors (Raiman *et al*., 2017). There were also reports of community health workers creating informal chatgroups in parallel to official ones (Henry *et al*., 2016).

From the Telegram data from the countries with online plant clinic groups, we observe that there was a total of 43,081 interactions by the end of 2019. Of these messages, approximately 4% (or 1699 interactions) were 'service' interactions, such as setting up a new group or inviting members, with Kenya being the earliest adopter and most active Telegram user. Figure 1 shows the fluctuations in number of messages sent (both text and media) and the number of members participating (i.e. active members).

As observed in healthcare settings, there were fluctuations in posting activity observed in all the four countries under study. We observed specifically a decline in the number of participants and posts in groups after an initial peak. An exception was in Ghana, where there was an additional peak in 2019, which correlated with a series of plant health training sessions delivered via the chatgroup.

Levels of activity amongst chatgroup members

In general, posting behaviour has been observed to vary among health professionals. The interactions and discussions within healthcare chatgroups have been observed to have varying numbers of active participants, depending on the content or topics discussed (Henry *et al*., 2016; Mazzuoccolo *et al*., 2019; Woods *et al*., 2019). Higher levels of active participation were reported among younger members (20–39 years old) and those with less professional experience (less than 10 years' experience) (Johnston *et al*., 2015; Chan and Leung, 2018; De Benedictis *et al*., 2019).

Similar variations in participation have been observed with plant clinic networks. Figure 1 further shows that between 2017 and 2019, the proportions of participants remaining relatively silent in the plant clinic chatgroups were 37–48% in Kenya, 50–52% in Ghana and 35–58% in Uganda. In Sri Lanka, participation was more variable across years and groups – though it rarely fell below contributions from 30% of participants in any particular year. In Ghana, during the plant doctor training series in 2019, participation increased with only 22% of chatgroup participants being silent members. Furthermore, surveys conducted in Ghana show that differences in participation in plant clinic chatgroups in the country were attributable to the topics being discussed, as well as dependent on hierarchy – with junior members more reluctant to post in groups that also included senior staff (Munthali *et al*., 2021b).

General research in online social network analysis shows that periods of membership growth may be marked by decreases or stagnation in information exchanged, and vice versa (Rossetti *et al*., 2017). In addition, short periods of increased online interactions are often separated by longer periods of silence or less activity (Rybski *et al*., 2012). Documented participation fluctuations across healthcare chatgroups, as well as across plant clinic online chatgroups supporting plant health systems, are thus in line with general social networking literature. That being said, there is need to conduct assessments to determine the reasons why plant clinic online members remain silent for long stretches of time, and thus develop strategies to promote more active participation. This is key as generally it has been shown that user discussion facilitates the uptake of digital agricultural services (Porciello *et al*., 2022).

Another observation from all the plant clinic chatgroups is that interactions within chatgroups often revolved around several central figures; either diagnostic experts, experienced extension agents or chatgroup facilitators. This agrees with the findings from Hashemi and Chahooki (2019), who demonstrate the overall importance of

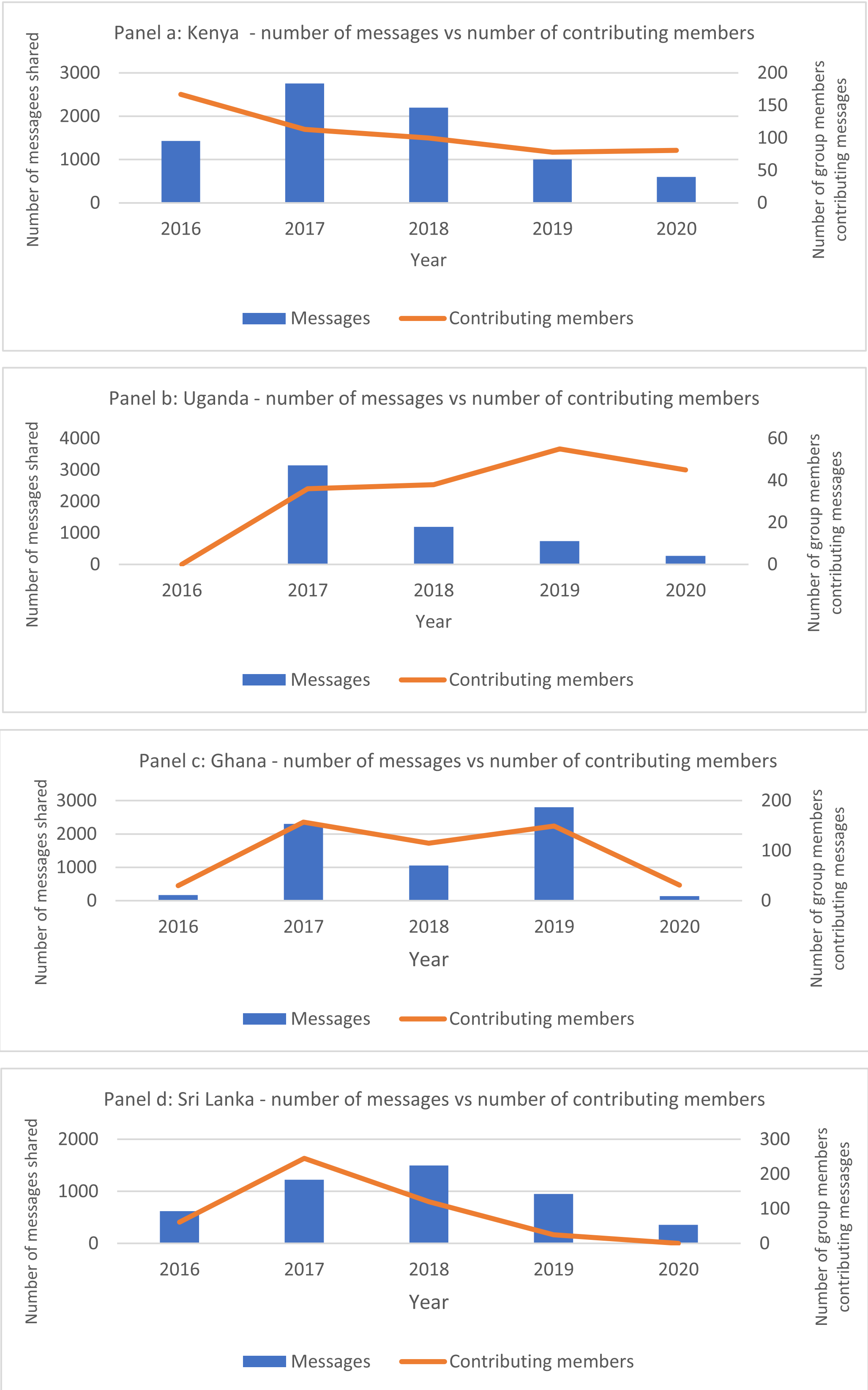

Figure 1. Number of messages shared on groups and contributing users – all plant clinic network chatgroups (2016 to 2020). Source: Author compilation based on Telegram chatgroup interactions.

administrators or pro-active members for a successful professional chatgroup. We also find that smaller chatgroups in Africa were noted to encourage greater participation, with plant doctors stating that small chatgroups helped shy members to connect and reach out to others. In Uganda, Ghana and Kenya, smaller plant clinic online groups, that usually represent a particular geography (district, province etc.) or training cohort, operate alongside a national group. In Sri Lanka, there are only nine provincial groups and no national groups. All these groups are official, but observations were made that smaller groups were more homogenous in terms of members, less formal with more social exchanges and focused on logistics. In contrast the larger, national groups were more heterogenous, allowing access to broader expertise, but more formal and focused on knowledge exchange including addressing queries. This agrees with insights from healthcare settings with Pahwa *et al*. (2018) showing that small groups encourage greater interaction; and Zhang *et al*. (2013) who showed that large chatgroups may be less efficient with active participation declining as the group size increases.

Chatgroup content

The content of shared messages across chatgroups in healthcare settings varies according to context, ranging from clinical questions and information and instructions, to discussions of administrative tasks and procedures (Gulacti *et al*., 2016) and at times socialization (Arunagiri and Anbalagan, 2016). The plant clinic chatgroups were initially set up to support plant doctors to operate new tablets. However, plant doctors and their supervisors soon started to use the groups to share diagnostic and advisory experiences and access diagnostic/advisory support from plant health experts. Plant doctors in Ghana noted that non-work-related content was discouraged on nationwide groups but was more common in smaller groups (Munthali *et al*., 2021b), and this was not discouraged. This might be because it is known that balancing institutional goals and social interactions within chatgroups is key for their continued success (Pimmer *et al*., 2017) and is sometimes desired by users (Patel *et al*., 2010).

Across some healthcare chatgroups, the sharing of media content, such as images, made up a third of total posts (Henry *et al*., 2016). Pathologists sent approximately six images (Bennani and Sekal, 2019) – and surgeons up to 78 images – per single case (Boulos *et al*., 2016). The sharing of pictures by plant doctors is also key across plant clinic chatgroups, since the images help platform users to diagnose and identify pests and diseases. In the four plant clinic study countries, media posts comprised between 15% and 33% of posts in the most active years. However, the quality of the images affected diagnostic support and participant engagement.

Rules guiding chatgroups and participation

Across the reviewed healthcare literature there were remarkably few cases reporting on explicitly defined rules established to increase or govern online participation. In cases in which rules are mentioned, they focus on pre-admission induction (Henry *et al*., 2016; Pimmer *et al*., 2017), criteria for removal from a chatgroup (Dorwal *et al*., 2016), duration for which clinical data can be visible on the chatgroups, guidelines for raising new queries and message sharing, archiving of chat messages and practices to ensure patient confidentiality (Johnston *et al*., 2015; Dorwal *et al.,* 2016; Mazzuoccolo *et al*., 2019). Furthermore, in some case, due to low bandwidth and/or expensive data packages the sharing of text messages, rather than images, was encouraged (Arroz *et al*., 2019).

Similarly in plant health settings, rules and/or guidance were not explicitly articulated. Stakeholders interviewed in plant clinic chatgroups, stated that the only rule clearly articulated is related to guidance discouraging social chatter in national-level chatgroups. Other areas that require guidance such as sharing of data-costly media or conduct of chatgroup administrators/facilitators is not available in any of the countries under study. The latter is also an area that is lacking in healthcare settings (Dorwal *et al*., 2016; Henry *et al*., 2016; Pimmer *et al.,* 2017; Kauta *et al*., 2020). But it is an important area as our study found that active plant clinic chatgroup administrators were observed to improve the functioning of institutional chatgroups, ensuring timely responses to queries and follow-up and reinforcing group norms. In Ghana and Uganda, it was observed that if active administrators left the chatgroup, there were noticeable decreases in overall interactions.

Incentives and deterrents to participation

Understanding how online participation is incentivized is crucial in maintaining smooth running of a chatgroup. Teo *et al*. (2017) noted that online participation is driven mainly by the need to receive approval and acceptance from group members. Sullivan and Koh (2019) identified enjoyment and feelings of being useful as the main enablers of participation in chatgroups. There are, however, many factors that determine if participation is beneficial to a member. Several studies show that among healthcare workers, the perceived benefits of chatgroups, is highest among those who are actively engaged with others (Woods *et al*., 2019), who have used the app for over 12 months, and receive responses to their queries in less than 15 min (Ganasegeran *et al*., 2017). In the case of plant clinics, Munthali *et al*. (2021b) as well as insights from stakeholder surveys indicate that benefits are perceived as being present or high where chatgroup activities provide practical information for problem solving or when information is shared about emerging plant health threats. In addition, stakeholders surveyed from Ghana, Uganda and Sri Lanka stated that a quick response from plant health diagnostic experts to queries raised as well as evidence-based technical responses is highly incentivising for group members. Meanwhile complexity, frequent changes to the system used for interactions, and distress and anxiety associated with the use of such platforms, were found to be the major inhibitors of participation in chatgroups in healthcare settings (Sullivan and Koh, 2019). Similar sentiments were echoed by plant health key informants in Ghana and Sri Lanka.

Reported benefits of chatgroups in healthcare and in plant health contexts

Numerous evidence exists of the benefits of the use of chatgroups in healthcare settings (Table 2). These range from simplifying and improving interactions across vertical chains of communication, especially in the management and mobilisation of specialists and multidisciplinary teams to supporting resource management during a health crisis or emergency (Table 2).

In plant clinics, supporting diagnostics is a key function of chatgroups, which facilitate vertical exchanges between plant doctors and sources of expertise, including national plant health experts. Similarly, health practitioners in rural clinics receive advice from experts in urban centres (Williams and Kovarik, 2018). In the plant health chatgroups it was observed that although the number of requests for diagnostic support decreased over time, the quality improved. In addition, it was also reported that the proportion of cases where conflicting or incorrect diagnoses were given also declined. In addition, as in healthcare settings, the sharing of images across plant doctor chatgroups was critical in identifying and diagnosing pests and diseases. Since pathogens, at times, are indistinguishable from the human eye, the use of an externally attachable microscope for smartphones – as reportedly used in healthcare (Bennani and Sekal, 2019) – could aid plant doctors in taking quality pictures with high detail. The sharing of uncommon symptoms in plant clinic chatgroups was also observed to contribute to early detection and rapid response systems by raising awareness that a potential outbreak is on the way and rapidly sharing information on the correct identification of the pest and on how to manage the problem.

Table 2. Reported benefits of chatgroups in healthcare settings.

Reported benefits in healthcare	**Citation**
Improved decision making in diagnosis and treatment	
Improved communication (generally)	Johnston *et al*. (2015)
	Gulacti *et al*. (2016)
	Gould and Nilforooshan (2016)
	Ganasegeran *et al*. (2017)
	Williams and Kovarik (2018)
	Mazzuoccolo *et al*. (2019)
	Othman and Menon (2019)
	Woods *et al*. (2019)
Improvements in discussing ambiguous and challenging cases of complex pathologies	Johnston *et al*. (2015)
	Graziano *et al*. (2016, 2017)
Lower incidences of incorrect diagnoses	Johnston *et al*. (2015)
	Ganasegeran *et al*. (2017)
	Othman and Menon (2019)
	Woods *et al*. (2019)
Helps in distinguishing and prioritising the admission of urgent cases	Martinez *et al*. (2018)
	Williams and Kovarik (2018)
	Othman and Menon (2019)
	Kauta *et al*. (2020)
Aids with swift intra-department handovers, and timely commencement of treatment	Choudhari (2014)
	Astarcioglu *et al*. (2015)
Aids with avoiding complications to health	Astarcioglu *et al*. (2015)
	Graziano *et al*. (2015)
	Mars and Scott (2017)
	Alanzi *et al*. (2018)
	Williams and Kovarik (2018)
	Hogan *et al*. (2019)
	Othman and Menon (2019)
	Woods *et al*. (2019)
Improved communication and team cohesion	
Improved team dynamics, cohesion and connectedness, hierarchy breakdown	Gulacti *et al*. (2016)
	Pimmer *et al*. (2017)
	Othman and Menon (2019)
Tighter-knit teams	Gulacti *et al*. (2016)
	Othman and Menon (2019)
Strengthened interpersonal relationships among peers and colleagues	Gould and Nilforooshan (2016)
	Dorwal *et al*. (2016)
	Bennani and Sekal (2019)
Enhanced teamwork, boosting overall efficiency and workflow	De Benedictis *et al*. (2019)
	Martin *et al*. (2019)
For younger practitioners, access to advice of senior practitioners	Johnston *et al*. (2015)
	Gould and Nilforooshan (2016)
	Graziano *et al*. (2016)
Improved wellbeing of health workers, increased networking	Johnston *et al*. (2015)
	Kordowicz (2018)
	Murphy (2019)
Social support to patients	Cheung *et al*. (2015)
	Boulos *et al*. (2016)
	Yu and Caramelli (2018)
	Woods *et al*. (2019)
Chatgroups as learning platforms	
Continuous medical learning and training	Graziano *et al*. (2016)
	Williams and Kovarik (2018)
	Othman and Menon (2019)
	Woods *et al*. (2019)
	Johnston *et al*. (2015)
	Henry *et al*. (2016)
	Ganasegeran *et al*. (2017)
Cost-effective removal of geographical barriers	
Mobile support for healthcare specialists working in remote areas	Henry *et al*. (2016)
	Coleman and O'Connor (2019)
	Hogan *et al*. (2019)
Provision of healthcare across low- and middle-income countries to remote areas from urban-based specialists	Astarcioglu *et al*. (2015)
	Henry *et al*. (2016)
	Giordano *et al*. (2017)
	Williams and Kovarik (2018)
	Woods *et al*. (2019)
	Mazzuoccolo *et al*. (2019)
	Hogan *et al*. (2019)
	Kauta *et al*. (2020)
Cost saving for hospitals and patients, aids in resource management	Martinez *et al*. (2018)
	De Benedictis *et al*. (2019)
Support with resource management during an emergency	Shah and Kaushik (2015)
	Boulos *et al*. (2016)
	Henry *et al*. (2016)
	Basu *et al*. (2017)
	Woods *et al*. (2019)
	Arroz *et al*. (2019)

Source: Author compilation based on review of the literature.

In terms of improved communication and team cohesion, as with healthcare settings, plant clinic experiences show that being surrounded by colleagues and experts online both encouraged plant doctors in their work and supported them in their day-to-day field activities, with immediate access to expert opinions. In terms of using chatgroups as learning platforms, again, similar observations as those in healthcare settings (Table 2) were noted, with plant doctor chatgroups used for training and capacity building. Specifically in Ghana, key informants stated that plant doctors use the groups to deliver mini-lectures, plant health diagnosis and use them for management. Members of chatgroups reacting to the queries and activities of others and participating in discussions also serves as a form of horizontal and vertical information exchange and knowledge co-creation among the advisory staff, supporting their overall learning and capacity building (Adolwa *et al*., 2017; Landini, 2021). Knowledge created is, however, not necessarily knowledge used, as for example in a healthcare case, where participants acknowledged the online exchanges were very beneficial, but they had never put into practice any of the advice they received (Woods *et al*., 2019). This is contrary to plant clinic experiences, where most plant doctors interviewed stated that most knowledge shared in chatgroups, is used in practice.

Finally, chatgroups in healthcare settings have been reported to aid with cost-effective removal of geographical barriers (for example reducing costs associated with patients need to travel to urban or specialised hospitals for diagnosis) (Table 2). In the plant health setting, plant doctors are geo-dispersed throughout the countries where plant clinics exist, and direct contact with farmers via plant clinic chatgroups has been minimal to none. Instead, plant doctors themselves have face-to-face interactions in local plant clinics, complemented in some cases with mobile SMS messaging.

Reported challenges of chatgroups' use in healthcare and in plant health contexts

There have been some underlying concerns and drawbacks voiced towards the use of chatgroups in healthcare settings throughout the reviewed literature (Table 3). The main concerns are that there is evidence that the use of online chatgroups in human healthcare settings is driven largely by employees (De Benedictis *et al*., 2019; Mars *et al*., 2019), thus its use has unfolded spontaneously and informally (Weaver *et al*., 2022). As a result, there is a lack of guidelines for the management of online chatgroups and for their secure, ethical and sustained use (Zhang *et al*., 2019). Concerns also exist that online chatgroups may compromise confidential patient data; potentially increase staff time spent working and reproduce social inequalities between platform participants (Masoni and Guelfi, 2020; Ryani *et al*., 2023).

There are parallels in plant health, although core differences, hence any lessons from the challenges (Table 3) must be contextualised. First, in plant clinic chatgroups, although human subjects are not involved, there are some issues related to confidentiality, and ambiguity around following correct procedures. Some key informants raised concerns of the disruptive effect of chatgroups and other information communication technologies (ICTs) on the formal communication flows related to reporting new plant pests. This is because the incorrect reporting of the presence of a quarantine pest can affect the capacity of a nation to trade and can lead to rejections of exported produce, in cases where information leaks prior to being confirmed officially. Plant health clinic networks are therefore looking to adopt specific guidelines that could improve the correct use and overall functioning of online chatgroups to ensure correct reporting of new plant pests.

Second, concerns have been raised in plant clinic network chatgroups regarding slow responses to queries and simultaneous chatting by several members about unrelated topics. Concerns were also raised about the high volumes of messages, which relate to the fact that use of the chatgroups requires expensive data bundles. In Ghana, key informants stated that the sharing of too many images and other media not only uses up data but also quickly fills up the memory of the phone. In all the surveyed countries, most of the key informants interviewed stated that advice shared on groups by plant health experts was difficult to understand. Periodic face-to-face refresher courses and regular check in as practiced in healthcare settings might aid with this.

Table 3. Reported challenges to the use of chatgroups in healthcare.

Reported challenges	Citation
Data confidentiality and lack of usage guidance	
Process related to the gathering, transmission and storage of confidential patient data	Mars and Scott (2016)
	Soriano *et al*. (2017)
	Hogan *et al*. (2019)
	Mars *et al*. (2019)
Lack of patient consent to share images, data and information in chat rooms	Mars and Scott (2017)
	Woods *et al*. (2019)
Lack of clear institutional policies and training on online data security	Schaller (2016)
	Bal (2017)
	De Benedictis *et al*. (2019)
Legal implications of poor use of chatgroups, including healthcare workers being investigated, warmed or suspended	Rimmer (2017)
Inadequate guidelines for use in healthcare settings	Gould and Nilforooshan (2016)
	Mars and Scott (2016, 2017)
	Mars *et al*. (2019)
	Taylor and Loeb (2019)
	Bouter *et al*. (2020)
Increased workloads and over-saturation of information	
Nuisance messaging (constant messaging) and increased workloads	Dorwal *et al*. (2016)
	Mars and Scott (2017)
	De Benedictis *et al*. (2019)
	Martin *et al*. (2019)
	Woods *et al*. (2019)
Online interactions may also lead to misunderstandings, conflicts, and cognitive overloads, disrupting healthcare delivery	Martin *et al*. (2019)
Continuous advice seeking can harm the emergence of independence among younger participants	Mars and Scott (2017)
Technical limitations	Martin *et al*. (2019)

Source: Author compilation based on review of the literature.

Finally, reports of the technical limitations related to devices and ICT infrastructure that chatgroups require to function were rare in the healthcare sector (Table 2). In rural settings of the Global South, smartphones are often not ubiquitous and internet access is either absent, limited or associated with high access costs. However, literature promoting chatgroup use for healthcare in such contexts rarely assessed overall device procurement costs, inferring that doctors would already own and use private smartphones for work (Murphy, 2019). In contrast, this was a commonly cited issue among plant clinic networks. In Africa, where the rollout of tablets to support plant doctors at clinics took place, many technical issues were faced and in some cases remained unresolved. Key challenges cited by survey respondents and key informants included lack of adequate technical support, user failure, poor network coverage and limited access to and high costs of data. Also respondents stated that in some cases, critical information arrived late – either due to plant doctors remaining offline for prolonged periods because of the cost of data packages, or simply because queries remained unanswered.

CONCLUSION

Using mixed methods, we draw lessons from the use of online chatgroups in human health, for plant health. Emerging evidence from online chatgroups in plant health networks and stakeholder surveys of plant doctor practitioners, shows that there exists both benefits and pitfalls with the use of chatgroups in plant health, as is the case in human healthcare, where chatgroups have long been in use and studied. Parallels between human healthcare and plant health systems enable us to make the case for the use of chatgroups in plant health systems.

Emerging evidence from the four countries involved in the plant clinic network shows that the benefits observed in human health chatgroups are also emerging in plant health. The simplification and improvement of interactions across vertical chains of communication resulted in increased cohesion among plant health network members. Additionally, the sharing of uncommon symptoms in plant clinic chatgroups was also observed to contribute to early detection and rapid response systems by raising awareness of potential outbreaks and rapidly sharing information on the correct identification of pests and diseases and on how to manage the problem. Most notably, chatgroups improved the ease of communication in sharing information with plant doctors and in linking plant health experts in urban settings with those in rural isolated areas – resulting in improved and timely diagnosis.

Given these observed benefits, networks of plant clinics now seek to extend their overall use of online chatgroups with hopes of further benefiting frontline agricultural extension services. We may assume from online plant clinic evidence that larger chatgroups may very well improve top-down dissemination of information from experts to plant doctors and provide a means for plant doctors to report complex queries from the field, helping to recognise the spread of new pests and diseases nationally. Smaller groups, in turn, may provide regional plant doctors with local support, while extending social connectedness among fellow colleagues. The use of chatgroups in plant health should, however, not be a ‘copy and paste’ approach of the human health experience. This is because the lack of evidence-based research related to healthcare practices on online management limits the replicable insights available to fine-tune plant clinic chatgroups that support plant doctors to diagnose problems and deliver advice. Plant clinic chatgroups are also known to be much larger than the groups used by healthcare professionals discussed in the reviewed literature, and at times guided by, and dealing with different matters of urgency, when compared with those of the healthcare sector.

Further research is needed to better understand the dynamics and benefits of larger but more silent groups as compared to smaller, more active groups to determine which produce the desired outcomes, especially when used to disseminate information in both directions between many plant doctors and experts. This research should delve into understanding whether increasing chatgroup activity (with higher numbers of messages and media content shared per member) could benefit specific plant health objectives; or whether, in certain cases, it would only lead to increased labour and costs, and complicate automation processes; or even be counterproductive towards the online participation of plant doctors. In addition, there is need to understand if interactions between plant doctors are guided by the sharing of knowledge between those with more insight and those in doubt, and also to determine if the potential increase in members’ average level of expertise over time could lead to the number of queries raised diminishing. All future research should ensure to check changes in user perspectives resulting from the COVID-19 pandemic.

CONFLICT OF INTEREST

The authors have no conflicts of interest to declare.

ETHICS STATEMENT

Use of the chats in the chatgroup was guided by ‘Social Media Research: A Guide to Ethics’ (Townsend and Wallace, 2016). The Telegram groups were considered private communities of CABI and therefore permission to analyse chats and access members of the chatgroups was granted by CABI. In the case of the Ghana survey, the principal researcher was added to the Telegram groups in order to share the self-administered questionnaire. In the case of the surveys, key informants and participants were informed of the purpose and use of their contributions as follows: prior to an interview, enumerators explained the purpose of the survey/interview and stressed that participation was voluntary. The respondents were asked to decide whether or not to participate in the survey/interview, and this information was recorded on the questionnaire by the enumerators.

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AUTHOR CONTRIBUTIONS

S Jomantas carried out the literature review. N Munthali carried out the Ghana survey and contributed to the narrative. W Ochilo, contributed to the narrative. M Thakur, carried out the analysis of the chatgroups. D Romney supported the work analysing chatgroups and contributed to the narrative, particularly integrating the findings from the plant clinic network online interactions. A Wood contributed to the narrative. M Kadzamira provided overall review and rewriting of the manuscript, contributed to the literature review and provided editorial support.

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DATA AVAILABILITY

Chatgroup data cannot be made available given the subject matter concerns. Data from the online survey and key informant interviews can be made available upon reasonable requests to the authors.

CONSENT FOR PUBLICATION

All authors have read the final manuscript and have given consent for it to be published.

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