

# Realizing the potential of real-time clinical collaboration in maternal–fetal and obstetric medicine through WhatsApp

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## Abstract

**Background:** This study aimed to explore the potential of using instant messaging to enhance patient-care and physician-education in obstetric medicine and maternal–fetal medicine.

**Methods:** This retrospective study examined real-time correspondence between a closed group of maternal–fetal medicine physicians and fellows-in-training. Correspondence was grouped into four domains. Time to obtain a response and their utility was analysed.

**Results:** Over the two-year period, 41 international members contributed 534 clinically relevant messages (291 stems and 243 responses). Of these, 33% were advice seeking, 23.4% case-sharing, 35% educational content and 8.2% miscellaneous content. The median response time was 52 min, and 53% responded in less than 60 min. At least one response in each case influenced clinical management.

**Conclusion:** Instant messaging is effective for real-time clinical collaboration and could serve as an important platform for enhancing management and continuing education for obstetric medicine and maternal–fetal medicine physicians. International societies should consider exploring this avenue further.

## Keywords

Continuing medical education, instant messaging, maternal–fetal medicine, obstetric medicine, real-time collaboration, WhatsApp

## Introduction

While obstetric medicine (OM) focuses on the care of pregnant women with medical conditions, maternal–fetal medicine (MFM) is a subspecialty within obstetrics and gynaecology that focuses on complex and rare medical or surgical conditions in the mother and/or fetus. Depending on the geographical region and available resources, an OM and/or MFM physician is often the only specialist in an institution, city, or sometimes even a country that possesses the unique skill set, training and knowledge to adequately assess and/or treat complex maternal and fetal conditions. The rarity of cases, acuteness of presentation, limited evidence-based guidelines and lack of collegial help from colleagues with similar expertise make it challenging to diagnose, counsel and manage complex patients and to continue

medical education upon completion of training. Advances in electronic and mobile communication technologies have made it easier for clinicians to

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reach out to colleagues and experts around the world, to overcome these challenges by facilitating discussion and debate concerning the management of challenging cases and to continue to acquire knowledge and expertise in their specialties.<sup>1-9</sup> The aim of this study was to explore the potential of instant messaging in enhancing patient-care and physician-education in MFM that could be applicable to both OM and MFM.

## Methods

The University of Toronto in Canada has one of the largest MFM fellowship programmes in the world, which attracts large numbers of Canadian and international obstetrics trainees to pursue two to three years of specialist training in MFM. Each year, five to six MFM fellows are enrolled into the MFM division that comprises 26 staff physicians across three academic sites. The MFM fellowship program that was started in 1991 also has a large number of alumni who continue to correspond with current fellows and staff physicians both formally and informally. Taking advantage of the fact that all current and former fellows use smartphones, regardless of the geographical area in which they practice, and that most use the instant-messaging application WhatsApp, one of the former-fellows (AA) created an instant messaging group in October 2013 and invited current and former MFM fellows to join the group with the aim of developing an international collaborative network of MFM physicians to facilitate discussion on challenging cases seen in clinical practice. The invitation was extended to all University of Toronto MFM fellows, alumni and staff physicians. Given the informal nature of this group and as most members were known to each other, simple ground rules were established and disseminated to every new member. These included protecting patient confidentiality by eliminating patient-identifiers of any kind in the messages and refraining from using offensive or derogatory language when posting content. No application locking or other security mechanisms were requested for the users in order to participate in this group.

All correspondence on this platform including text and multimedia messages saved by the instant messaging application (IMA) in its database folder was decrypted from the native database backup using the application Omni-Crypt.<sup>10</sup> Then, the application 'Backup Text for Whats'<sup>11</sup> was used to export and convert the group messages to Microsoft Excel format. Verbal consent was obtained from members of the group for analysing these messages.

Two reviewers (SC and NA) independently analysed the group thread from its inception in October 2013 until October 2015 and filtered social content from

clinical content. They then organized the clinical content into four categories: *advice seeking*, where a specific scenario involving a patient required management or counselling; *clinical case-sharing*, where the individual shared his or her clinical experience for the purpose of enhancing knowledge within the rest of the group; *educational content*, which included messages containing links to publications, presentations, or useful bibliography and *miscellaneous content*, for messages with clinical content that did not fit into the first three categories. For the advice seeking category, the initial message or question was tagged and numbered, its subject was determined and all responses or comments that contributed to help in addressing the problem or situation were labelled 'replies'. The number of replies to each subject was then tagged and counted. Repeated comments made by a single individual were counted as one reply. The duration between the initial question and each reply was noted until the point of resolution of the discussion, as determined by explicit or implicit confirmation by the sender of the original subject. For the three other categories, each contribution was regarded as a single event. Other variables included the proportion of messages in each category and the geographical distribution of the contributions.

Cohen's Kappa coefficient, which measures inter-rater agreement for qualitative items and takes into account the agreement occurring by chance, was calculated.<sup>12</sup> Discrepancies were settled by mutual discussion and, in the absence of consensus, through adjudication by a third reviewer. The proportion of messages in each category was calculated in order to determine their relative contribution. Results were presented as numbers, proportions, medians and inter-quartile ranges for continuous variables. Since no patients were involved and all correspondence between physicians was anonymized, research ethics board approval was not required for this study. Also, a survey (Supplementary Data – Figure 1) was distributed to all members in order to determine individual perspective on the usefulness of the group.

## Results

Within a month of initiation, the group comprised 21 MFM specialists and fellows and by the end of the observation period in October 2015, membership had reached 41 (40 MFM staff/fellows and 1 Prenatal Geneticist).

In the two-year period of the study, a total of 5050 messages were posted. Of these, 534 (10%) were clinically relevant (comprised 291 discussion topics and 243 replies). Of the 291 discussion topics, 97 (33%) were classified under advice seeking, 68 (23%) under clinical case-sharing, 102 (35%) under educational content and

24 (8%) under miscellaneous content. Examples of these are shown in Supplementary Data – Figure 2.

Regarding the advice-seeking topics, of the 97 questions in the two-year observation period, 93 received 243 replies, with an average of 2.5 replies per question. Only four requests for advice remained unanswered. The topics of the advice-seeking messages were very specific within the MFM specialty, except for nine questions about other areas like gynaecology, paediatrics, and general obstetrics. Ultrasound diagnosis and fetal therapy was the most discussed topic followed by maternal medicine and timing of delivery (Table 1). The quickest response to an advice-seeking question was received in 41 s and the slowest took 40.5 h, with a median time of 52 min to obtain a response per question. Most questions (53%) were responded to within 60 min of posting a question with 6% taking over 12 h (Table 2). The mean time from initial posting to arriving at a decision was 172 min.

For the clinical case-sharing topics, 43 (63.24%) discussed cases involving fetal diagnosis and therapy, while 25 (36.76%) discussed medical disorders in pregnancy. With regard to educational material, 77 (75.49%) were links to bibliography and 22 (21.57%) were presentations delivered by members of the group; the others included laboratory and ultrasound reference ranges and information on educational courses. Of the miscellaneous topics, 6 (25%) requested information on medical supplies for fetal diagnostic and

therapeutic procedures, 11 (45.3%) were clinical opinions that could not be classified under the above three headings, and 7 (29.17%) were discussions on existing clinical guidelines.

Of the above messages, 217 involved sharing multimedia messages including radiological images or video clips such as ultrasound, magnetic resonance imaging (MRI) and X-ray images, de-identified photographs of surgical procedures, placentas and neonates, and miscellaneous screenshots of medical literature and technology such as interesting references or quotes to support an opinion or screenshots of published bibliography and devices (Table 3). As many as 71 links to published literature were also posted for the group to access in real-time and on-demand.

Participation in the group varied from country to country, with the most active regions in Canada (where most of the staff and fellows were located) and Saudi Arabia (where the founder and initial promoter of the group currently resides). Most of the clinically relevant messages originated from Belgium, Canada, Israel and Saudi Arabia, with good collaboration from the other participating countries (Table 4).

The survey response rate was 75%, of which 27 (90%) of the respondents had actively participated in the group. Members found the group extremely helpful in finding solutions to specific cases (80%), increasing knowledge and stimulating interest in rare cases (97%), obtaining educational material (73%) and changing clinical practice (30%). Of those who responded to the survey, the average number of years since commencement of MFM practice was five years. The average time-to-practice interval between those initiating the discussions and those responding were three and five years, respectively.

**Table 1.** Advice-seeking subjects classified by topic.

Topic	n	%
Ultrasound diagnosis	26	26.8
Fetal therapy	25	25.8
Maternal medicine	16	16.5
Labour and delivery	16	16.5
General obstetrics	6	6.2
Prenatal investigations	4	4.1
Gynaecology	3	3.1
Cerclage	1	1.0
Paediatrics	1	1.0
	97	

**Table 2.** Time interval between posting an advice-seeking message and obtaining the first reply.

	n	%
Under 30 min	89	36.6
Between 30 min and 1 h	40	16.5
Between 1 h and 12 h	99	40.7
Over 12 h	15	6.2
Total	243	

**Table 3.** Summary of shared multimedia elements.

	n	%
Radiological images		
Ultrasound	110	50.7
MRI	8	3.7
X-ray	2	0.9
Video clips		
Ultrasound	54	24.9
Photographs		
Neonates	13	5.9
Surgical procedures	3	1.4
Placenta	2	0.9
Miscellaneous screenshots		
Medical literature and technology	25	11.5
Total	217	

MRI: magnetic resonance imaging.

**Table 4.** Geographic distribution of clinically relevant messages.

	Member(s)	Advice seeking	Replies	Case	Education	Miscellaneous	Total
Australia	1	4	2	0	1	2	9
Barbados	1	1	0	3	1	1	6
Belgium	1	6	43	4	1	1	55
Canada	24	4	62	7	12	1	86
China	1	0	2	0	0	0	2
Germany	1	0	2	0	1	0	3
Ireland	2	10	14	5	6	7	42
Israel	1	7	32	3	6	4	52
Jamaica	1	0	0	0	2	0	2
Kuwait	1	0	9	0	1	1	11
Oman	1	1	4	0	0	0	5
Qatar	2	13	5	3	1	3	25
Saudi Arabia	3	43	57	43	68	4	215
Switzerland	1	8	11	0	2	0	21
Total	41	97	243	68	102	24	534

## Discussion

OM and MFM physicians have traditionally relied on their experience and the knowledge obtained from reference texts and websites to manage rare cases. However, given the rarity and acuity of many conditions and the rapid evolution of the sub-specialties, physicians sometimes need to resort to real-time strategies such as seeking opinions and advice from colleagues via email or telephone calls. The widespread use of smartphones and the developments in telecommunications that have made it possible to use alternate methods to share, create and edit multimedia content widely and have real-time discussions has tremendous potential for application in clinical practice.

The medical community has made progress in all forms of communication. Clinicians have started to slowly replace pager systems with their own mobile phones as they allow faster and more detailed communication,<sup>13</sup> and they are becoming more enthusiastic about using electronic media to facilitate clinical discussions. Email discussion groups or 'listservers' have contributed towards facilitating clinical discussions among physicians since the 1990s.<sup>14,15</sup> Although the intent of this paper was to explore the role of instant messaging in global clinical discussion, we thought it important to briefly highlight the contributions of other methods of global electronic communication. The International Society of Travel Medicine reported in 2009 that over an eight-month period in 2006, 47% of their members subscribed to the TravelMed listerv and 19% authored postings, first highlighting the potential for the use of listservers for educational initiatives, clinical problem solving and program evaluation.<sup>16</sup> The clinical forum on the North American Society of OM, although initially underutilized, after distribution of an email list of North American and

international members, showed improved membership, usage and communication.<sup>17</sup> There have been similar reports on the success of existing listservers by some other groups,<sup>18-20</sup> although some others reported that although they functioned well as information boards, they did not function effectively for scientific case discussions.<sup>21,22</sup>

Given the mixed experience with the use of email listservers, our focus was to specifically assess the use of mobile phone applications in facilitating online clinical discussions. There are a number of online medical communities on publicly accessible websites and also on different platforms including, but not limited to, Facebook, Google+ and Twitter.<sup>23</sup> Indeed, these communication tools that connect physicians and potential patients can be very useful resources for reaching out to specialties that are heavily booked or even unavailable in certain regions. Some specialties have already considered social media as an integral part of their clinical practice.<sup>24</sup>

The smartphone software developer market is continually evolving and creating communication applications that allow users to reach friends, family or other contacts, regardless of where they are located in the world or what type of connectivity they have. Various IMAs are currently available that share similar features and benefits, but they all have one major limitation – the need for all involved parties to use the same application for communication. Finding the most suitable application is therefore a challenge, with the 'best' application being determined by popularity and usage statistics.

WhatsApp is a smartphone messaging application that was introduced in 2009 with the intention of using mobile networks or Wi-Fi to send and receive messages including text messages, pictures, audio or

voice notes and video clips at no additional cost, as opposed to Short Message Service (SMS), which are usually fee-based depending on the carrier. This IMA currently supports iPhone, Android, Blackberry, Nokia and Windows Phone mobile devices and allows exporting chat sessions through email with different limitations depending on the mobile platform and email clients used.<sup>25</sup> The messages themselves are saved in text format (.txt file), and all the group members contact information is saved as individual vCard (.vcf) files. Images, videos and voice messages are saved in JPG, MP4 and AAC formats, respectively. For the purposes of our study, we used the Android application 'Backup Text for Whats'<sup>11</sup> to export and convert the group messages to Microsoft Excel format as automated formatting options that resulted in breaking the structure of messages did not allow for direct conversion into a spreadsheet format.

Sharing knowledge and opinions is a very common practice in the medical community and, in the last decade, medical interaction has left the closed hospital or university environments and is taking advantage of advances in communication technologies by using teleconferences, online seminars and webcasts for this purpose. Although email/email applications also may not require users to be 'online' at the same time, emails could take a variable amount of time to reach their destinations depending on content, attachments, spam filters and firewalls. This is where instant messaging has an advantage, as modern smartphones have integrated these communication platforms in their core functionality, providing personalized and direct connectivity to the user.

There have been a number of publications reporting the use of IMAs as a healthcare networking tool in various settings. These include studies assessing improvement of patient management through consultation between team staff members of plastic and reconstructive surgery departments,<sup>1</sup> exchange of imaging studies between emergency department and consulting physicians,<sup>2</sup> communication between emergency physicians in a rural hospital and interventional cardiologists and a tertiary care center,<sup>3</sup> assessing inter- and intra-observer agreement in assessing images for tibial plateau fractures,<sup>4</sup> enhancing communication channels in palliative home care management between patient, palliative care doctor, caregiver, and local family physicians,<sup>5</sup> enhancing intra-service communication within a laboratory management system with regard to images, alerts, accident reports, rosters and education.<sup>6</sup> In the area of healthcare education, it has also been reported to be useful as an efficient way of interaction between senior and junior members of clinical teams in general surgery,<sup>7</sup> liver surgery<sup>8</sup> and orthopedics.<sup>9</sup> Although IMAs are currently being used in

many healthcare jurisdictions for both professional advice seeking and instant communication, our study is the first to demonstrate the utility of instant messaging in the management of rare maternal and fetal clinical conditions through the involvement of an international group of specialists and trainees. During our period of observation, actionable solutions were provided after advice was sought on 97 occasions with 243 replies and counselling from several countries very short time periods.

Social media and instant messaging have some disadvantages, however. Professionals are exercising caution and even avoiding being involved in discussions that, despite well-intentioned, could damage their reputation or, worse, involve them in legal disputes.<sup>26</sup> Protection of patient information is a major factor in the workflow of any healthcare organization. Organizations are also expected to invest time and resources in establishing roles and responsibilities, stipulating acceptable uses of information as well as education to promote consciousness towards sensitive data protection. Since the implementation of electronic health record systems, with a few simple clicks, physicians can have access to vast amounts of patient information that can easily be captured with mobile technologies like smartphones. Special care has been taken among healthcare institutions to enforce protection of this information, backed up with national or regional policies and laws like the Health Insurance Portability and Accountability Act (HIPAA) in the United States<sup>27</sup> and Personal Health Information Protection Act (PHIPA) in Ontario, Canada.<sup>28</sup> In our study, all members took precautions to not disclose any kind of patient-sensitive information by excluding identifiers like names, initials, or any kind of hospital numbers in the messages; this also applied to the multimedia elements that were posted. We believe that the ultimate benefit of using an IMA is the ability to transcend geographical boundaries, time zones and levels of expertise in order to reach quick, efficient and varied sources of experience and debate for cases so rare that no textbook or journal article could provide enough helpful information in a timely fashion. We acknowledge that external factors like the different time zones, individual working schedules and telecommunication networks downtimes can cause messaging delays, but the large number of members in these groups can counter these limitations and should be studied further with greater detail.

Another problem with instant messaging is moderating messages that are not clinically relevant. While analysing our data, we noticed that members often deviated from the original clinical discussion in favour of a range of social and personal issues. While this is probably the result of ours being a closely-knit

group where most members know most others personally, this may be a concern in larger and more formal groups. This highlights the importance of clearly stated and explicitly agreed guidelines and of enforcing these appropriately. Yet another limitation of instant messaging is validating posted content and the potential medical-legal implications of erroneous advice. Legal implications of using posted recommendations from social media or private specialists' discussion groups for diagnostic or therapeutic purposes remain to be determined. At the present time, it is safe to say that physicians should take this kind of information and subject it to the same analysis as something extracted from journals and appraise it alongside local guidelines and policies. One would assume that if the online network is closed enough or the members are all part of a small subspecialty community, these ethical and legal risks and implications would not apply. Even if the network or online group is small, there are still risks of third parties retrieving its information through hacking techniques or by accessing the hardware being used for communication, be it a desktop computer, laptop or smartphone. The importance of anonymizing personal health information cannot be over-emphasized. This can be accomplished by excluding patient identifiers, but also as the cases get rarer they can become identifiers themselves if a time period and geographical location are associated.<sup>29,30</sup> It is therefore worth considering the involvement of regional health authorities in the regulation prior to its widespread use.

The duration of time for which messages are kept on the company servers varies from provider to provider. For the instant messaging app used in our study, messages are kept on company servers only as long as the recipients have not been able to get them on their mobile devices or until 30 days. The application's terms of service state that the delivered messages or any of their content are not retained, with the exception of dates, time stamps, phone numbers associated with the messages, and other information they are legally required to keep. In addition, as of April 2016, the IMA used in our study provides end-to-end encryption using the Signal Protocol by Open Whisper Systems, the purpose of which is to keep third parties that may be listening in between from accessing the data contained in the messages.<sup>31,32</sup> Unfortunately, no software or hardware is 100% secure, and content that has been posted through the internet cannot be fully anonymous, nor it can be considered completely erased, so precautions need to be taken at the highest level to maintain privacy.

Varied time zones rather than being a deterrent seemed to work as an advantage with respondents in other time zones more likely to respond immediately, while clinicians in the same time zone were unable to do

so either due to operating/clinic schedules or when emergency messages were posted after midnight.

Some of the limitations of our study include the retrospective nature of the analysis, unmoderated social conversation in addition to clinical discussions and the focus on a single mobile application. Due to the organic manner in which this group evolved, no guidelines were set with regard to restricting social conversation among clinicians who had trained together but were now practicing in different parts of the world. This could have been restricted by appropriate moderation. Also, while we acknowledge that there are other tools for online communication, not just restricted to mobile phone applications but that also include email list-servers and web portals, a comparison between these online communication systems was considered beyond the scope of this paper.

## Conclusion

Social media and instant messaging now have an established place in our societies and have made their way into medical practice and are being seen as an alternative to emails and other online tools over the past decade. In our experience and, in light of the results presented in this paper, we found that the benefits of having real-time communication and discussion platforms that allow physicians to share experiences, concerns and can support their discussions with images or different kinds of media, no matter where they are located around the world, outweighs the potential disadvantages and their successful and efficient use should continue to be studied in all medical fields, although the possibility of formalizing their use and legal and ethical implications warrants further research. It is up to clinicians to ensure that these technologies are being used ethically and appropriately in the interest of patient-care and physician education.

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## Ethical approval

N/A.

## Guarantor

SC.

## Contributorship

SC conceived the study, performed all primary analysis and wrote the manuscript. NA independently extracted data for quality assurance. AA commenced and administered the WhatsApp group. RD helped with study conceptualization, plan for analysis, data presentation and writing up.

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