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ORIGINAL ARTICLE

Can mobile phone multimedia messages and text messages improve clinic attendance for Aboriginal children with chronic otitis media? A randomised controlled trial

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Aim: Does phone multimedia messages (MMS) to families of Indigenous children with tympanic membrane perforation (TMP): (i) increase clinic attendance; (ii) improve ear health; and (iii) provide a culturally appropriate method of health promotion?

Methods: Fifty-three Australian Aboriginal children with a TMP living in remote community households with a mobile phone were randomised into intervention ($n = 30$) and control ($n = 23$) groups. MMS health messages in local languages were sent to the intervention group over 6 weeks.

Results: Primary outcome: there was no significant difference in clinic attendance, with 1.3 clinic visits per child in both groups (mean difference –0.1; 95% confidence interval (CI) –1.1, 0.9; $P = 0.9$).

Secondary outcomes: (i) there was no significant change in healed perforation (risk difference 6%; 95% CI –10, 20; $P = 0.6$), middle ear discharge (risk difference –1%; 95% CI –30, 30; $P = 1.0$) or perforation size (mean difference 3%; 95% CI –11, 17; $P = 0.7$) between the groups; (ii) 84% (95% CI 60, 90) in the control and 70% (95% CI 50, 80) in the intervention group were happy to receive MMS health messages in the future. The difference was not significant (risk difference –14%; 95% CI –37, 8; $P = 0.3$).

Conclusions: Although there was no improvement in clinic attendance or ear health, this randomised controlled trial of MMS in Indigenous languages demonstrated that MMS is a culturally appropriate form of health promotion. Mobile phones may enhance management of chronic disease in remote and disadvantaged populations.

Key words: Aboriginal; MMS; mobile phone; otitis media; text message.

What is already known on this topic

1. Remote Indigenous Australians have the highest reported rates of otitis media in the world.
2. Technology such as text messaging and MMS hold considerable promise in health promotion.
3. Adherence to chronic otitis media treatment in remote settings is generally poor.

What this paper adds

1. This study is the first randomised controlled trial in remote Australian Indigenous settings to evaluate the use of mobile phone MMS and text messaging to promote ear health.
2. It demonstrates that a mobile phone-based MMS and text messaging intervention is acceptable to this population, but it had no short-term impact on clinic attendance or ear health.
3. This is the first published study on the use of MMS and text messaging to promote ear health in high-risk populations.

Aboriginal children living in remote areas of the Northern Territory (NT), Australia have the world's highest reported rates of tympanic membrane perforation (TMP), with the problem continuing into adulthood.[1–3] The associated hearing loss may have significant effects on language, education and social outcomes.[1,4–6] Acute otitis media with perforation (AOMwiP) frequently progresses to chronic suppurative otitis media (CSOM). This is often a persistent disease that leads to a large TMP. Treatment recommendations for AOMwiP involve long courses of antibiotics. Recommendations for CSOM include weekly clinic reviews to monitor progress, frequent daily ear cleaning and topical antibiotic drops. Treatment may be required for many months.[6–8]

In 2002, the prevalence of TMP among children of 6 to 30 months of age in 2 remote communities was 23% and 38%.[9] In non-Aboriginal children, the prevalence is 0.1%.[8] Furthermore, general practitioner presentations in Australia for severe otitis media were 8% in Indigenous populations and 2% in non-Indigenous populations. Presentations for discharging ears were 40 times greater (4% vs. 0.1%).[8] Overall, ear problems were the fourth most common problem managed Australia wide, with

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otitis media seen more commonly in Indigenous than non-Indigenous children (10% vs. 7% of consultations).[8]

Indigenous families living in remote communities struggle to provide the level of care needed for the effective resolution of otitis media in their children, particularly CSOM. Attendance rates at Aboriginal health services in the Australian Capital Territory for any form of otitis media have typically been low.[10] In the NT in the first year of life in five separate communities, ear problems were a frequent reason for clinic attendance.[11] However, considering the high burden of disease, attendance rates were low.

Improving clinic attendance rates and adherence to treatment is likely to improve health outcomes for children with treatable conditions. Mobile phone ownership in remote Indigenous communities has increased exponentially with nearly every household owning a mobile phone.[12,13] Previous studies have shown that mobile phone-based interventions in low socio-economic populations can have significant benefits in terms of clinic attendance, long-term adherence to treatment plans and medication compliance.[12–17] Personalised text messages were more effective than generic messages.

The impact of sending health-related text and multimedia messages (MMS) to remote Australian Indigenous populations has not previously been evaluated. This pilot randomised controlled trial, conducted in 2010 over 6 weeks in two remote NT communities, investigated the possible attendance and health benefits of sending regular MMS to families of children with CSOM.

Methods

Study design

This was a multi-centre, parallel group, randomised controlled trial conducted in two remote communities in the NT, Australia.

Ethics approval

Informed consent was obtained from parents or guardians. This study was approved by the Human Research Ethics Committee of the NT Department of Health and Families and the Menzies School of Health Research (HREC–EC00153) and conformed to the provisions of the Declaration of Helsinki in 1995 (as revised in Tokyo 2004).

Study settings

The study took place over a 6-week period in two remote NT Indigenous communities between October and December 2010. Both communities have a medical clinic with a full-time doctor on site. Children are able to visit the doctor, nurse or Aboriginal health worker on any working day, without an appointment. In these communities, English is an infrequently used second language.

Participants

Participants had to satisfy each of the following eligibility requirements: (i) be an Indigenous child aged 13 years or under; (ii) have an acute or chronic TMP; (iii) live in one of the two remote communities long term; and (iv) have a parent/carer or other family member living in the same household with a working mobile phone who was willing to receive the messages.

Intervention

Eligible participants were randomised into two groups: intervention and control. The primary carers (or someone else in the household with a mobile phone) in the intervention group were sent seven ear health MMS in the local Indigenous language, one every 4 days, with a window of ±24 h. The MMS were accompanied by personalised ear health text messages in English that included a prompt to visit the clinic for the children's health check-ups.

The control group received no MMS and accompanying text messages. However, both groups received two stand-alone text messages in English, one at the start acknowledging their participation in the study and one at the end asking them to attend the clinic for the final assessment. Both groups received an information sheet with local clinical treatment guidelines and advice to attend the clinic weekly for review.

The messages were sent using the Telstra Online Text Buddy system. The videos were short, non-identifiable caricature animations of Indigenous role models, such as elders, grandparents, Aboriginal health workers or football players. The emphasis of each video was to remind families of the importance of hearing in an Aboriginal context. For example, 'to be a good hunter, you need good hearing' or 'to be a good footballer, you need to be able to hear well. Remember to go to the clinic this week to get your kids' ears checked'.

Ear assessments

Initial and 6-week end of intervention ear examinations were performed by trained ear research nurses using a tympanometer (Grason Stadler GSI 38, USA), a voroscope (Welch Allyn LumiView, USA) with Siegel's speculum for pneumatic otoscopy and a video-otoscope (Welch Allyn macroview or MedRx video-otoscopes, USA). Standardised data forms were used to record the clinical findings and document baseline demographic and medical information. Using recommended clinical criteria for diagnosis in this population,[7] we categorised middle ear states as follows: [0] normal, [1] normal mobility but abnormal appearance, [2] retracted mobile drum, [3] otitis media with effusion, [4] acute otitis media without perforation, [5] AOMwiP, [6] dry perforation (DP) and [7] CSOM. The overall diagnosis reflected the state of the child's more severely affected ear (using the ordered categories described above). Children with an initial diagnosis of [5], [6] or [7] for one or both ears were eligible to participate. Eligible children were then randomised. Assessors were blinded to the intervention allocations. Ear examinations were video recorded. To reduce observer variation, a second blinded assessor reviewed all the video recordings. Any perforation size difference of >10% between the primary examiner and second blinded assessor were reviewed by a third assessor. If there was any persistent disagreement, the assessment was based on the initial examiner's findings.

Sample size

In order to have 80% power to detect a difference of two clinic visits during the 6-week study period (from an estimate of one visit in the control group to three visits in the intervention group) with a two-sided alpha value of 5%, the estimated required sample size was 70. We aimed for a sample size of 90 to allow for attrition.

Randomisation: sequence generation and allocation

We used Stata Version 11.1 for participant randomisation.[18] The randomisation sequence was stratified by age and community, with a 1:1 allocation.

Outcome measures

The primary outcome of this study was measured as the number of clinic appointments attended, for any reason, during the 6-week intervention period by each child. Attendance was determined by accessing the community clinic's electronic primary care information system.

The secondary outcomes were (i) ear health state at the end of the study period (healed tympanic membrane, presence of ear discharge, reduced perforation size); and (ii) participant satisfaction with text messages and MMS, assessed by face-to-face structured interviews using standardised questionnaires.

The end of study questionnaire included a mixture of dichotomous, open-ended and multiple choice questions such as 'Did you see any phone messages from the Menzies Ear Health Team?' and 'Would you be happy to receive other health-related videos in the future?'

Statistical methods

We used Stata Version 11.1 for data analysis.[18] Continuous variables including clinic attendance and perforation size were compared using the Student's *t*-test. Binary outcomes, such as 'happy to receive messages', ear discharge and resolved ear state (healed perforation) were analysed using Fisher's exact test. P values of <0.05 were considered statistically significant. We analysed our primary outcome using both an intention to treat approach (i.e. we included data from all the participants, irrespective of whether they received the intended intervention) and a treatment received analysis. Secondary outcomes are reported by intention to treat for all children with available data.

Results

We received signed informed consent for 181 children. Fifty-three (30%) children were able to be randomised (Fig. 1). The control group had 23 participants and the intervention group had 30. Clinic attendance was determined for all 53 children. Forty-seven (89%) children had a follow-up ear examination and 49 (92%) participant families completed a follow-up interview.

At follow-up, we interviewed 19 (83%) participants from the control group and 30 (100%) participants from the intervention group. For both groups, 28 (57%) respondents were primary carers (mostly the child's mother or grandmother) who owned the phone, 11 (23%) were primary carers (mostly child's mother or grandmother) who did not own the phone and 10 (20%) respondents were the nominated household relatives who owned the phone (child's father, aunt or older sibling). Eight (29%) primary carers (who owned the phone) and six (55%) primary carers (who did not own the phone) reported that they did not see any of the messages.

In the intervention group, 10 (33%) respondents reported not seeing any of the messages. Of these, two had broken phones, one phone number had been incorrectly transcribed, four said a relative had the phone, and one reported that the messages did not work. We received no explanation from the remaining two participants.

Primary outcome – clinic attendance

Intention to treat analysis

Thirty-three (62%) children attended the clinic at least once and nine (17%) attended at least once where the primary reason was for an ear problem.

The mean number of clinic visits per child for any reason was 1.3 (95% confidence interval (CI) 0.6, 2.1) for the control group and 1.3 (95% CI 0.6, 1.9) for the intervention group (Table 1a). There was no statistically significant difference between these two groups (mean difference −0.1, 95% CI −1.1, 0.9; $P = 0.9$).

Treatment received analysis

In this analysis (Table 1b), we excluded 10 families in the intervention group who reported not having seen any messages. The total number of clinic visits for any reason in the intervention group was 1.5 (95% CI 0.5, 2.5). The mean difference of 0.2 (95% CI −1.0, 1.4) between the two groups remained statistically non-significant ($P = 0.7$).

Secondary outcomes (intention-to-treat analyses)

Ear health outcomes

At the start of the 6-week study, participants were categorised according to their more severely affected ear (Table 2). Of the 53 children randomised, we were able to perform clinical examinations on 47 (89%) children at follow-up (Table 3). One child in the control group and three children in the intervention group had healed perforations. These differences were not significant (risk difference 6%, 95% CI −10, 20; $P = 0.6$). Around 70% in each group still had CSOM (risk difference −1%, 95% CI −30, 30; $P = 1.0$) and 20–25% of children had a DP.

In the control group, the average baseline perforation size in the worst ear was 20% (95% CI 10, 30). At follow-up, it was unchanged at 20% (95% CI 11, 30). The average perforation size in the intervention group had increased from 20% (95% CI 15, 25) of the total eardrum at baseline to 25% (95% CI 15, 35). The mean difference in perforation size in the worst ear at follow-up between the two groups was 3% (95% CI −11, 17) and was non-significant ($P = 0.7$).

Participant views on mobile phone messaging in health care

Thirty-seven (76%) of all participants at follow-up said they were happy to receive health messages in the future (Table 4). Sixteen of the 19 (84%) families in the control (95% CI 60, 90) and 21/30 (70%) families in the intervention group (95% CI 50,

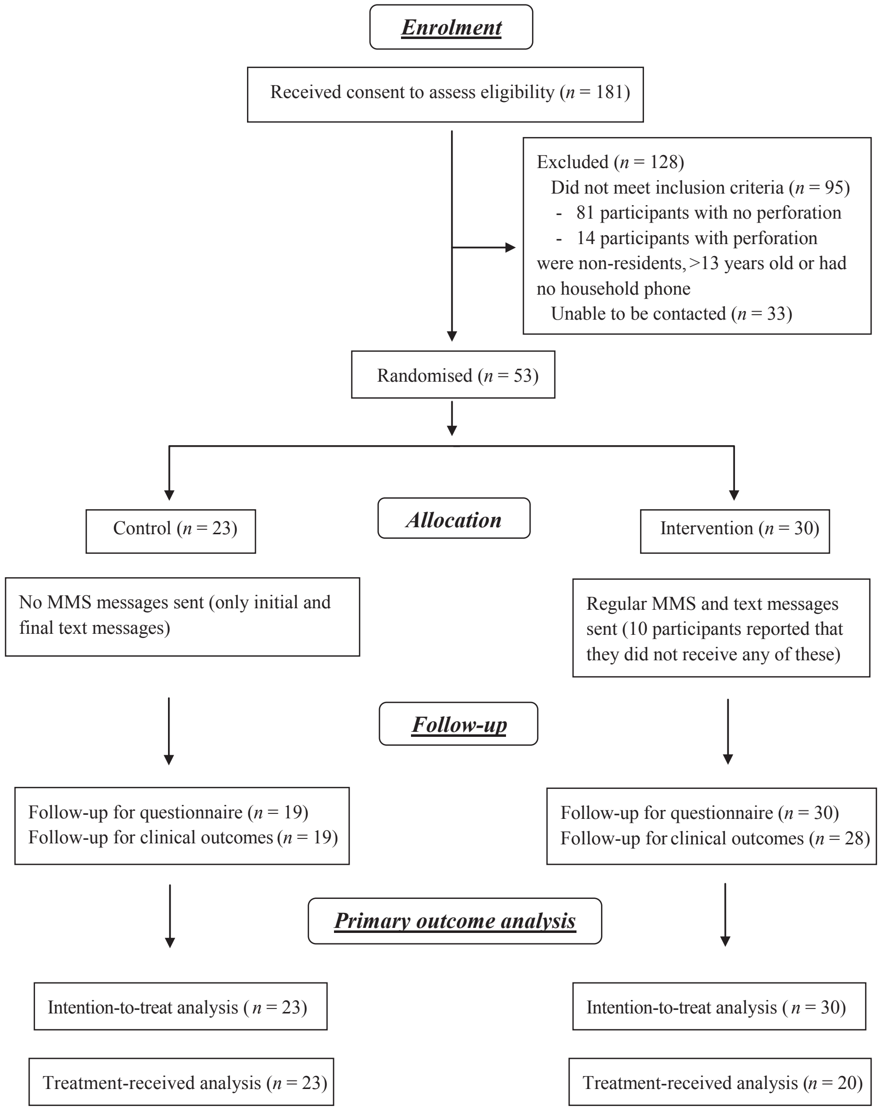

Fig. 1 Flow diagram detailing the structure of the research project, from enrolment to allocation, follow-up and primary outcome analyses. MMS, multimedia messages.

Table 1a Clinic attendance rates over the 6-week period for all children enrolled in the study (n = 53)

	Control group n = 23	Intervention group n = 30	Mean difference (95% CI)
No. clinic attendances	31	38	N/A
Clinic attendances per child	1.3 (0.6, 2.1)	1.3 (0.6, 1.9)	–0.1 (–1.1, 0.9) P = 0.9
Clinic attendances per child (for ear problem)	0.4 (0.0, 0.9)	0.2 (0.0, 0.3)	–0.3 (–0.8, 0.2) P = 0.5

N/A, not applicable; CI, confidence interval.

80) reported that they were happy to receive text or MMS health-related messages in the future. The risk difference of −14% (95% CI −37, 8) was not statistically different (P = 0.3).

We sent a single, plain text message in English to all participants stating that we were in the community clinic over the next few days to do interviews. Nine (17%) participants presented to the clinic on the day they received this text message. Three participants said that they would prefer simple text messages with a specific appointment time rather than MMS health messages.

Table 1b Clinic attendance rates over the 6-week period for all children who received intended treatment (n = 43)

	Control group n = 23	Intervention group n = 20	Mean difference (95% CI)
No. clinic attendances	31	29	N/A
Clinic attendances per child	1.3 (0.6, 2.1)	1.5 (0.5, 2.5)	0.2 (–1.0, 1.4) P = 0.7
Clinic attendances per child (for ear problem)	0.4 (0.0, 0.9)	0.1 (–0.4, 0.2)	–0.1 (–0.4, 0.2) P = 0.6

N/A, not applicable; CI, confidence interval.

Table 2 Baseline diagnoses, by worst ear, for all children enrolled in the study (n = 53)

	Control group n = 23		Intervention group n = 30	
	No.	%	No.	%
Acute otitis media with perforation	1	4	1	3
Dry perforation	2	9	7	24
Chronic suppurative otitis media	20	87	22	73

Discussion

This pilot randomised controlled trial did not identify significant differences in the attendance rates or ear health outcomes resulting from regular MMS messaging. These finding suggest attendance rates for severe otitis media in this population are very low when compared with the recommended weekly clinic review. We were able to confirm the acceptability of mobile phone-based interventions to promote health outcomes in these settings.

Strengths

The style, design and interpretation of messages were determined in consultation with local Indigenous teachers and interpreters. The decision to use MMS rather than text alone was based on local advice that MMS were a more interesting, novel and potentially a more appealing method of communication than texts and that the videos could be shared among families.

Overall, feedback received from participants indicated that the information provided by the messages was interesting and appreciated, and many did share the videos with others. In general, they did not object to future messages being sent. Some participants reported that they would prefer simple text messages with a specific appointment time and date. It was interesting to note that some presented spontaneously for the follow-up examination after receiving a simple text message. Our video messages may have been unclear or confusing, and simple text messages may be more effective.

Weaknesses

This pilot study was not able to recruit the desired sample size of 90 participants. One factor that contributed to this was unrest and fighting in one of the communities before and during the study, which restricted our time to contact and enrol families. Importantly, the low rates of clinic attendance and the smaller than anticipated variance meant that the likelihood of detecting a difference of two visits was not affected (study power >90%).

In addition, although some surveys have reported that nearly every household in remote Indigenous communities owns a mobile phone,[12,13] in the two communities that participated in this study, phone ownership was lower than anticipated. These issues could be resolved in a similar trial conducted over a longer period of time and involving a greater number of remote communities. Long waiting times at the local clinics can be a disincentive, and we were also not able to assess if participants did present to the clinic but did not wait to be seen. Taking into account our finding that the primary carer of the child was less likely to see the phone messages if other family members within the household owned the phone, it is probable that this type of intervention would be more effective if the primary carer owned the phone.

Recommendations for research

We were not able to design our pilot study to address all the questions around the benefits or harms of mobile phones in health care. Previous studies investigating the impact of mobile phones on behavioural change have shown significant benefits from an intervention period of between 26 and 52 weeks in low socio-economic populations.[11–15,19] It is possible that short, simple text messages with appointment times or treatment at home reminders would be more effective in encouraging short-term behaviour change. However, our aim was to assess effectiveness for a chronic condition in children. Alternatively, a study conducted over a longer time period would potentially be more effective.

Recommendations for clinical practice

This trial was the first of its kind in a remote Indigenous setting to determine the acceptability and efficacy of using MMS to promote behavioural change in an Australian Indigenous population. In this small study, we were not able to document any beneficial effects. While MMS offers health care providers and health promoters an accessible and acceptable approach for

Table 3 Follow-up diagnoses, by worst ear, for all children seen at week 6 (n = 47)

	Control group n = 19		Intervention group n = 28		Risk difference (95% CI)
	No.	%	No.	%	
No perforation	1	5	3	11	6% (–10, 20) P = 0.6
Acute otitis media with perforation	0	0	0	0	N/A
Dry perforation	5	26	6	21	–5% (–30, 20) P = 0.7
Chronic suppurative otitis media	13	69	19	68	–1% (–30, 30) P = 1.0

N/A, not applicable; CI, confidence interval.

Table 4 Proportion of families who reported being happy to receive messages in the future (n = 49)

	Control group n = 19		Intervention group n = 30		Risk difference (95% CI)
	No.	%	No.	%	
Yes	16	84	21	70	–14% (–37, 8) P = 0.3
No	2	11	3	10	N/A
Not sure	1	5	6	20	N/A

N/A, not applicable; CI, confidence interval.

engaging families in remote Aboriginal communities, further research is needed to determine if it promotes clinic attendance and/or improves health outcomes.

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