Effectiveness of WhatsApp reminder on compliance of colorectal cancer screening

Thomas YT Lam, Martin CS Wong, Jessica YL Ching, Joseph JY Sung
MSc, BN, RN
PhD Student in Medical Science
Nursing Officer
Institute of Digestive Disease
Department of Medicine and Therapeutic
Faculty of Medicine
The Chinese University of Hong Kong
Possible conflicts of interest

• Nil conflicts of interest
Trend of incidence of Colorectal Cancer

CRC screening

• CRC screening reduces incidence and mortality\textsuperscript{1-3}

• Common screening strategies:
  1. Fecal immunochemical test (FIT) every 1 – 2 years
  2. Flexible sigmoidoscopy every 5 years
  3. Colonoscopy every 10 years

Challenge of CRC screening – poor compliance

Longitudinal Adherence to Colorectal Cancer Screening Guidelines

Anissa Cyhaniuk, MA, and Megan E. Coombes, MSc

151,638 average risk individuals at age 50-54

17,174 used FIT as CRC screening tool

268 (1.6%) adherent to yearly FIT over 10 years

8776 (51.1%) received 1 – 9 FIT over 10 years

8330 (48.5%) received only one FIT over 10 years

How to improve FIT compliance?

Validated effective tools¹⁻³:
• Mailing reminder
• Telephone reminder
• Short message service (SMS) text reminder

Potential useful tool:
• Smartphone mobile messenger apps reminder

Smartphone penetration

Smartphone user penetration as percentage of total global population from 2014 to 2021

- 2014: 21.6%
- 2015: 25.3%
- 2016: 29.5%
- 2017: 32.3%
- 2018: 34.7%
- 2019: 36.8%
- 2020: 38.5%
- 2021: 40%

35% worldwide

Smartphone penetration rate as share of the population in the United States from 2010 to 2022*

- 2010: 20.2%
- 2011: 29.8%
- 2012: 38.8%
- 2013: 45.7%
- 2014: 53.6%
- 2015: 59.4%
- 2016: 64.55%
- 2017: 68.9%
- 2018: 72.47%
- 2019: 75.32%
- 2020: 77.5%
- 2021: 79.25%
- 2022: 80.57%

72% in US

Source: eMarketer
© Statista 2018

Additional Information: Worldwide: eMarketer, 2014 to 2017

Source: Statista DMO
© Statista 2017

Additional Information: United States: Statista DMO, 2010 to 2016; Individuals of any age who own at least one smartphone and use it per month.
Mobile messenger apps penetration

Most popular global mobile messenger apps as of April 2018, based on number of monthly active users (in millions)

<table>
<thead>
<tr>
<th>App</th>
<th>Monthly active users in millions</th>
</tr>
</thead>
<tbody>
<tr>
<td>WhatsApp</td>
<td>1.500</td>
</tr>
<tr>
<td>Facebook Messenger</td>
<td>1.300</td>
</tr>
<tr>
<td>WeChat</td>
<td>1.000</td>
</tr>
<tr>
<td>QQ Mobile</td>
<td>783</td>
</tr>
<tr>
<td>Skype*</td>
<td>300</td>
</tr>
<tr>
<td>Viber*</td>
<td>260</td>
</tr>
<tr>
<td>Snapchat**</td>
<td>255</td>
</tr>
<tr>
<td>LINE</td>
<td>203</td>
</tr>
<tr>
<td>Telegram</td>
<td>200</td>
</tr>
</tbody>
</table>

Sources: We Are Social; Kepios; TechCrunch © Statista 2018

Number of monthly active WhatsApp users worldwide from April 2013 to December 2017 (in millions)

Sources: WhatsApp; Facebook © Statista 2018

Additional Information:
Worldwide; WhatsApp; April 2013 to December 2017
Use of WhatsApp in clinical researches

The Effectiveness of a Psychoeducation Intervention delivered via WhatsApp for mothers of children with Autism Spectrum Disorder (ASD) in the Kingdom of Saudi Arabia: A randomized controlled trial

A. Hemdi¹,²,³ | D. Daley¹,³,⁴

Effects of a Whatsapp-delivered physical activity intervention to enhance health-related physical fitness components and cardiovascular disease risk factors in older adults.

Muntaner-Mas A¹, Vidal-Conti J², Borràs PA², Ortega FB³, Palou P².

Using WhatsApp and Facebook Online Social Groups for Smoking Relapse Prevention for Recent Quitters: A Pilot Pragmatic Cluster Randomized Controlled Trial

Yee Tak Derek Cheung¹. PhD; Ching Han Helen Chan². MPhil; Chi-Keung Jonah Lai². MSW; Wai Fung Vivian Chan³. MPhil; Man Ping Wang³. PhD; Ho Cheung William Li³. PhD; Sophia Siu Chee Chan¹. PhD; Tai-Hing Lam¹. MBBS
Study design and objective

Objective

• To investigate the effectiveness of WhatsApp reminder when compared with usual care (i.e. no reminder) on compliance of CRC screening by FIT.

Design

• A randomized, parallel group, open-label trial (Clinicaltrials.gov, Identifier: NCT03209765)
Study population

Inclusion Criteria
• Asymptomatic subjects aged 40-70; who
• Joined a population-based CRC screening program; with
• Negative FIT result in index year and expected to follow up for annual FIT in the subsequent year

Exclusion Criteria
• Lack of access to WhatsApp Messenger
Successful FIT return

Intervention timeline

Index month of annual FIT

- Enrolment of CRC screening programme
- Picked up and returned of FIT
- Verbal and written instructions to repeat FIT in same calendar month of next year

A month before due date of subsequent annual FIT

- Randomization
  - A WhatsApp message reminder was sent to intervention group
  - No reminder for usual care group

Same calendar month as of index annual FIT in last year

- Pick up of FIT kit

By the end of the month following FIT picked up

- Return of FIT kit with stool collected

Index year

Subsequent year

June 2017

May 2018

June 2018

Successful FIT pick up

July 2018

Successful FIT return
Materials – usual care and WhatsApp reminder group

- Quantitative FIT (OC Sensor, Eiken, Chemical Co., Tokyo, Japan)
- Single FIT kit per year
- Self pick up in a community centre
- Written instruction of next FIT (same calendar month of next year)
- Free-of-charge
Materials – WhatsApp broadcasting

Broadcast

Senders

 Receivers

Group

Senders

 Receivers


WhatsApp reminder with standard script:

1. Compliance to screening can effectively prevent CRC
2. Reminder of FIT picking up in the coming month
3. Subjects were encouraged to enquire via WhatsApp
4. Centre operating time, address and contact no.
Study outcome

• Primary outcome
FIT return rate: proportion of subjects returned the completed FIT kit with stool collected on time

• Secondary outcome
FIT pick up rate: proportion of subjects picked up FIT kit on time
Sample size estimation

- Assumed the baseline FIT return rate as 68%
- To detect increase of 12% return rate
- A power calculation indicates that a total of 500 subjects (250 in each group) would provide 80% power (at the 5% level).

### Baseline characteristics

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>WhatsApp (N=250)</th>
<th>Usual care (N=250)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean age (SD)</td>
<td>57 (6.8)</td>
<td>58 (6.7)</td>
<td>0.038</td>
</tr>
<tr>
<td>Male gender</td>
<td>154 (61.6%)</td>
<td>153 (61.2%)</td>
<td>0.927</td>
</tr>
<tr>
<td>Mean BMI, kg/m² (SD)</td>
<td>24.6 (3.4)</td>
<td>24.8 (3.7)</td>
<td>0.487</td>
</tr>
<tr>
<td>Educational Level</td>
<td></td>
<td></td>
<td>0.283</td>
</tr>
<tr>
<td>Primary or below</td>
<td>30 (12.0%)</td>
<td>37 (14.8%)</td>
<td></td>
</tr>
<tr>
<td>Secondary</td>
<td>153 (61.2%)</td>
<td>160 (64.0%)</td>
<td></td>
</tr>
<tr>
<td>Tertiary of above</td>
<td>67 (26.8%)</td>
<td>53 (21.2%)</td>
<td></td>
</tr>
<tr>
<td>Monthly household income</td>
<td></td>
<td></td>
<td>0.293</td>
</tr>
<tr>
<td>≤HK$10,000 or not reported</td>
<td>47 (18.8%)</td>
<td>43 (17.2%)</td>
<td></td>
</tr>
<tr>
<td>HK$10,001 - HK$20,000</td>
<td>66 (26.4%)</td>
<td>82 (32.8%)</td>
<td></td>
</tr>
<tr>
<td>&gt;HK$20,000</td>
<td>137 (54.8%)</td>
<td>125 (50.0%)</td>
<td></td>
</tr>
<tr>
<td>Work status</td>
<td></td>
<td></td>
<td>0.542</td>
</tr>
<tr>
<td>Unemployed/Retired/Housewife</td>
<td>89 (35.6%)</td>
<td>96 (38.4%)</td>
<td></td>
</tr>
<tr>
<td>Part-time</td>
<td>29 (11.6%)</td>
<td>22 (8.8%)</td>
<td></td>
</tr>
<tr>
<td>Full-time</td>
<td>132 (52.8%)</td>
<td>132 (52.8%)</td>
<td></td>
</tr>
<tr>
<td>Marital status: married</td>
<td>205 (82.0%)</td>
<td>208 (83.2%)</td>
<td>0.356</td>
</tr>
<tr>
<td>Family history of CRC in a FDR</td>
<td>98 (39.2%)</td>
<td>97 (38.8%)</td>
<td>0.927</td>
</tr>
<tr>
<td>Smoking (current / Past)</td>
<td>96 (38.4%)</td>
<td>95 (38%)</td>
<td>0.994</td>
</tr>
<tr>
<td>Drinking</td>
<td>43 (17.2%)</td>
<td>48 (19.2%)</td>
<td>0.562</td>
</tr>
<tr>
<td>Comorbidities:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diabetes</td>
<td>52 (20.8%)</td>
<td>59 (23.6%)</td>
<td>0.451</td>
</tr>
<tr>
<td>Fatty liver</td>
<td>70 (28.0%)</td>
<td>60 (24.0%)</td>
<td>0.308</td>
</tr>
<tr>
<td>Obesity (BMI≥25)</td>
<td>113 (45.2%)</td>
<td>111 (44.4%)</td>
<td>0.857</td>
</tr>
<tr>
<td>Hypertension</td>
<td>71 (28.4%)</td>
<td>72 (28.8%)</td>
<td>0.921</td>
</tr>
<tr>
<td>Heart disease</td>
<td>0 (0%)</td>
<td>1 (0.4%)</td>
<td>0.317</td>
</tr>
<tr>
<td>Chronic lung disease</td>
<td>1 (0.4%)</td>
<td>1 (0.4%)</td>
<td>1.000</td>
</tr>
<tr>
<td>Stroke</td>
<td>0 (0%)</td>
<td>1 (0.4%)</td>
<td>0.317</td>
</tr>
<tr>
<td>Gastro-oesophageal reflux disease</td>
<td>14 (5.6%)</td>
<td>18 (7.2%)</td>
<td>0.465</td>
</tr>
<tr>
<td>Others</td>
<td>50 (20.0%)</td>
<td>52 (20.8%)</td>
<td>0.824</td>
</tr>
<tr>
<td>NSAID use</td>
<td>14 (5.6%)</td>
<td>15 (6.0%)</td>
<td>0.848</td>
</tr>
</tbody>
</table>
CONSORT flow diagram

Assessed for eligibility (n=516)

Excluded (n=16)
- No access to WhatsApp Messenger

Randomization

Allocated to WhatsApp reminder group (n=250)

Allocated to usual care group (n=250)

Follow-up call for subjects who did not pick up FIT on time within the scheduled month (N=128; control=103; WhatsApp=50; Usual care group: 22 cannot be contacted, 9 busy, 70 forgotten, 2 received colonoscopy in private setting; WhatsApp reminder group: 12 cannot be contacted, 12 busy, 18 forgotten, 1 died)

Excluded from analysis (n=3)
- Usual care group: received private colonoscopy (n=2)
- WhatsApp reminder group: died (n=1)

Analysed after expected return (n=249)

Analysed after expected return (n=248)
Results

500 eligible subjects

Randomization

WhatsApp reminder group (n=250)

Included to analysis (n=249)

1 subject died

Pick up of FIT kit (n=200)

Return of FIT kit with stool collected (n=199)

Usual care group (n=250)

Included to analysis (n=248)

2 subjects received private colonoscopy

Defaulted (n=101)

Pick up of FIT kit (n=147)

Return of FIT kit with stool collected (n=142)

Defaulted (n=49)

Phone contact for reason of defaulted

2 subjects received private colonoscopy

1 subject died
## Performance of WhatsApp reminder

<table>
<thead>
<tr>
<th></th>
<th>Usual care N=248</th>
<th>WhatsApp reminder N=249</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FIT pick up rate</strong></td>
<td>147/58.8%</td>
<td>200/80.0%</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td><strong>FIT return rate</strong></td>
<td>142/56.8%</td>
<td>199/79.6%</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

Both pick up and return rate improved by about 20% in WhatsApp reminder group.
Subgroup regression analysis* of WhatsApp reminder on FIT return rate (using usual care group as referent)

<table>
<thead>
<tr>
<th>Subgroup</th>
<th>Usual care</th>
<th>WhatsApp reminder</th>
<th>AOR</th>
<th>95% C.I.</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Overall</strong></td>
<td>142/248 (57.3%)</td>
<td>199/249 (79.9%)</td>
<td>3.15</td>
<td>2.10-4.73</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td><strong>Subgroup</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Male Gender</strong></td>
<td>82/153 (53.6%)</td>
<td>121/154 (78.6%)</td>
<td>3.82</td>
<td>2.25-6.47</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td><strong>Female Gender</strong></td>
<td>60/97 (61.9%)</td>
<td>78/96 (81.3%)</td>
<td>2.67</td>
<td>1.39-5.15</td>
<td>0.003</td>
</tr>
<tr>
<td><strong>Primary education level or below</strong></td>
<td>21/37 (56.8%)</td>
<td>23/30 (76.7%)</td>
<td>2.50</td>
<td>0.86-7.28</td>
<td>0.092</td>
</tr>
<tr>
<td><strong>Secondary education level or below</strong></td>
<td>121/213 (56.8%)</td>
<td>176/220 (80.0%)</td>
<td>3.39</td>
<td>2.18-5.27</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td><strong>Monthly household income ≤HK$10,000</strong></td>
<td>28/43 (65.1%)</td>
<td>34/47 (72.3%)</td>
<td>2.16</td>
<td>0.84-5.52</td>
<td>0.109</td>
</tr>
<tr>
<td><strong>Monthly household income &gt;HK$10,001</strong></td>
<td>114/207 (55.1%)</td>
<td>165/203 (81.3%)</td>
<td>3.84</td>
<td>2.43-6.07</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td><strong>Married</strong></td>
<td>115/208 (55.3%)</td>
<td>164/205 (80.0%)</td>
<td>3.51</td>
<td>2.24-5.49</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td><strong>Other marital Status</strong></td>
<td>27/42 (64.3%)</td>
<td>35/45 (77.8%)</td>
<td>2.45</td>
<td>0.89-6.70</td>
<td>0.082</td>
</tr>
</tbody>
</table>

*Regressions using backward stepwise controlling for age, gender, marital status, educational level and household income. *Other marital Status: Single, separated, divorced or widowed.

### Subgroup regression analysis* of WhatsApp reminder on FIT pick up rate (using usual care group as referent)

<table>
<thead>
<tr>
<th></th>
<th>Usual care N (%)</th>
<th>WhatsApp reminder N (%)</th>
<th>AOR</th>
<th>95% C.I.</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall</td>
<td>147/248 (59.3%)</td>
<td>200/249 (80.3%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2.96</td>
<td>1.97-4.44</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Subgroup</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male Gender</td>
<td>85/153 (58.8%)</td>
<td>122/154 (79.2%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female Gender</td>
<td>63/97 (64.9%)</td>
<td>78/96 (81.3%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary education level</td>
<td>22/37 (59.5%)</td>
<td>23/30 (76.7%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>or below</td>
<td></td>
<td></td>
<td>3.58</td>
<td>2.11-6.08</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Secondary education</td>
<td>125/213 (58.7%)</td>
<td>177/220 (80.5%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>level or below</td>
<td></td>
<td></td>
<td>2.45</td>
<td>1.27-4.73</td>
<td>0.008</td>
</tr>
<tr>
<td>Monthly household income</td>
<td>29/43 (67.4%)</td>
<td>34/47 (72.3%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤HK$10,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;HK$10,001</td>
<td></td>
<td></td>
<td>2.35</td>
<td>0.91-6.06</td>
<td>0.077</td>
</tr>
<tr>
<td>Married</td>
<td>120/208 (57.7%)</td>
<td>165/205 (80.5%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other marital Status</td>
<td>27/42 (64.3%)</td>
<td>35/45 (77.8%)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Regressions using backward stepwise controlling for age, gender, marital status, educational level and household income. Other marital Status: Single, separated, divorced or widowed.

# Reasons of FIT non-compliance

<table>
<thead>
<tr>
<th>Reasons</th>
<th>Whatsapp (n=50)</th>
<th>Control (n=103)</th>
<th>All subjects (n=153)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cannot be contacted</td>
<td>13 (26.0%)</td>
<td>22 (21.4%)</td>
<td>35 (22.9%)</td>
</tr>
<tr>
<td>Busy</td>
<td>18 (36.0%)</td>
<td>9 (8.7%)</td>
<td>27 (17.6%)</td>
</tr>
<tr>
<td>Forgotten</td>
<td>18 (36.0%)</td>
<td>70 (68.0%)</td>
<td>88 (57.5%)</td>
</tr>
<tr>
<td>Died</td>
<td>1 (2.0%)</td>
<td>0 (0%)</td>
<td>1 (0.7%)</td>
</tr>
<tr>
<td>Received colonoscopy in other settings</td>
<td>0 (0%)</td>
<td>2 (1.9%)</td>
<td>2 (1.3%)</td>
</tr>
</tbody>
</table>
Limitation

• Single centre study

• All subjects were Chinese

• Assumed all subjects with access to WhatsApp Messenger knows how to use it

• Investigated only one year of compliance
Conclusion

• WhatsApp messenger is an effective tool to improve compliance of annual FIT screening for CRC

• WhatsApp reminder is easy to set-up and only limited resources are required

• Future studies should evaluate the long-term effectiveness of WhatsApp reminder on the longitudinal compliance
Thank you!