A digital assistant for healthcare providers targeting 10 to 15-year-old patients with asthma and their family: results from a pilot study

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Background: Asthma is one of the most common chronic conditions worldwide. Successful asthma management requires knowledge about the condition, treatment adherence, and behavioral skills. In addition, when treating children with asthma, a trustful and empathetic collaboration between healthcare providers, patients and their family is necessary for successful asthma management. However, resources of healthcare providers are limited to few face-to-face consultations, and personal support in the everyday life of chronic patients is not feasible. Digital assistants may overcome this challenge, because they are computer programs that imitate human interactions and can be designed to support healthcare providers in reaching out to patients in their everyday lives. Until now, however, it has not been clear whether digital assistants would be adopted by healthcare providers, patients or supportive family members and whether they could have a positive impact on the management of asthma in children.

Objective: The goal of this project was to develop and test an empathetic digital assistant for healthcare providers that targets 10 to 15-year-olds with asthma and a supportive family member.

Method: The digital assistant MAX was collaboratively designed by healthcare providers, young patients, a media didactician, a clinical psychologist and computer scientists. MAX communicated with all relevant stakeholders along a pre-defined intervention schedule, i.e., with healthcare providers via email, with patients via a mobile chat app and with a family member via SMS. The 14 lessons focused on asthma knowledge (e.g., what to do in case of an asthma attack), treatment adherence (i.e., discussion of medication plans), and behavioral skills (i.e., inhalation and breathing techniques). A family member was requested to actively participate in seven lessons. Healthcare providers were requested to assess patients' inhalation technique based on video clips recorded by a family member.

A pilot study was carried out to assess reach, impact, therapeutic alliance, technical feasibility and acceptability of MAX. Reach was measured by the proportion of patients approached and those who started to interact with MAX. Impact was assessed via a pre-post asthma knowledge test of a validated asthma quiz and by the number of inhalation mistakes made after healthcare providers gave their feedback. Therapeutic alliance between MAX and patients was assessed by the Session Alliance Inventory. Finally, technical feasibility and acceptance of MAX were evaluated by patients' adherence, the number of technical shortcomings, and qualitative feedback gathered from healthcare providers, patients and family members. The study was approved by the first author's institutional review board.

Results: Overall, 99 children with asthma were screened by healthcare providers at 6 study sites (4 hospitals and 2 local Swiss Lung Association sites, a home care provider for integrated care in Switzerland) between January and April 2019. Overall, 49 (49.5% of those screened) young patients (33 male, 27 iOS and 22 Android users) with an average of 12 years (SD=1.54) fulfilled all inclusion criteria (i.e., asthma diagnosis, 10 to 15 years old, German-speaking, smartphone available, interested in investing ca. 4h of their time, supportive family member with smartphone access), and started to interact with MAX. Thirty-nine (79.6%) patients who completed Lesson 2 indicated that they had lived with asthma for 5.61 years (SD=4.17) and 13 (30%) reported that they were uncertain about how

to manage their asthma. The average completion rate of the 49 participants regarding the 14 MAX lessons was 80.4%, and 37 (75.5%) patients completed all lessons in 3 weeks. A paired t-test with the baseline observation carried forward showed that asthma knowledge had increased significantly from the first lesson until the last lesson with a large effect (d=0.91). Out of 192 random lesson assessments, patients indicated 86 times (44.8%) that they learned a lot, 73 times (38.0%) that they learned some new aspects and 33 times (17.2%) that they already knew everything about asthma. The technical quality of all 42 inhalation video clips was good, and it took healthcare providers ca. 118s to assess each video clip. Patients received feedback on their inhalation technique within 1.9 days through a second chat channel of the MAX app dedicated to communication with their healthcare provider. On average, healthcare providers identified 1 inhalation mistake in each video clip, and 3 serious inhalation mistakes were identified and corrected in a second video clip. Out of 275 lessons, patients indicated 269 times (97.8%) that they were supported by family members in collaborative exercises. Only 74 (0.5%) of all chat interactions took place in the chat channel dedicated to healthcare provider communication whereas 15'087 (99.5%) interactions took place in the scalable chat channel with MAX. Therapeutic alliance was rated very high by the patients, who also enjoyed using the mobile app and stated they wanted to continue working with MAX. The young patients also found the MAX app easy to use and reported that it offered clear benefits. Overall, MAX was assessed very positively by all relevant stakeholders, and several suggestions for improvement and technical barriers, particularly related to the technical infrastructure in the participating hospitals, were provided (e.g., lack of easy WIFI access to patients or access to state-of-the-art browser technology for healthcare providers).

Conclusion: Digital assistants for healthcare providers targeting 10 to 15-year-old patients with asthma and a family member have the potential to improve asthma knowledge, treatment adherence, and behavioral skills. The reach of such interventions is limited by the technical infrastructure of healthcare providers. Future work should assess the impact of digital assistants on asthma outcomes.

Project website (in English): https://www.c4dhi.org/projects/health-literacy-children-asthma/
Study website (in German): https://www.max-asthmacoach.ch