Does a Digital Communication Device Facilitate Caregiving to Home-dwelling Frail Older Persons? Results of a Pilot-study in the Netherlands

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ABSTRACT

Background: Collaboration among informal and formal caregivers in a mixed care network of home-dwelling elderly may benefit from using a device for digital networked communication (dfDNC).

Objectives: The study aims to describe and explain differences in the use and evaluation of the dfDNC by members of the care network, and to come up with a list of conditions that facilitate (or restrict) the implementation of a dfDNC by a homecare organization.

Methods: A pilot-study collected information on digital communication in seven care networks of clients of a homecare organization in the Netherlands. Semi-structured interviews with four care recipients, seven informal carers (of which three spoke on behalf of
the care receiver as well because of receivers’ suffering from dementia), three district nurses, five auxiliary nurses, and three managers were conducted three times in a period of six months. Additionally we observed relevant workshops initiated by the homecare organization, and studied login data created by the users of the dfDNC.

**Results:** The qualitative data and monthly retrieved quantitative login data revealed three types of digital care networks: Arranging the care network, Discuss the care network and Staying connected network. Differences between network types were attributed to health impairment and digital illiteracy of the care recipients, motivation of informal caregivers, and commitment of formal caregivers. Positively evaluated were the easy availability of up-to-date information, the ability to promote a sense of safety for the carers, and short communication lines in case of complex care situations. Improvement is needed of device functionalities related to issues of privacy.

**Conclusion:** Based on the results, it is concluded that digital communication is beneficial for organizing and discussing the care within a care network. More research is needed to study its impact on care burden of informal carers, on quality of care, and on quality of life of home-dwelling frail older adults.

**Key words:**
informal care; formal care; homecare organization; digital communication; implementation triggers; care network; frailty; self-efficacy

**INTRODUCTION**

Frail community-dwelling older adults often receive care from formal and informal caregivers over a long period of time [1]. The presence of multiple types of caregivers and complex care tasks require an adequate coordination of the care in order to optimize its quality. Yet,
communication between formal and informal caregivers is generally low, in particular in care networks lacking a cohabiting informal caregiver [2]. Especially when the care recipient is in poor health and less able to manage his own care, the lack of communication among formal caregivers and non-cohabiting informal caregivers becomes a pressing issue.

In the era of digital communication, the deployment of online communication tools seems a logical way to organize care more efficiently around people at home. This is also reflected by the increasing number of homecare agencies using a digital device to enable care coordination. Those devices combine several functionalities like registering goals and action plans, calendar managing and networked communicating. The empirical evidence regarding the effect of these devices on communicating among different types of caregivers is limited. Most studies are only dealing with theoretical models of information and communication technology adoption [3, 4]. Moreover, a lot of studies are performed from an one-sided perspective only, like the viewpoint of the care receiver [5]. Other computer-mediated health studies are limited to the communication in hospital care, for example between the medical specialist and his patient at home [6].

To increase insight in how digital communication may improve collaboration between formal and informal caregivers in the home setting, we conducted a pilot-study among members of care networks around seven clients of a homecare organization in the Netherlands. These care recipients and their formal and informal caregivers were hooked onto a device developed for digital communication in a closed care network. We examined the use of the e-tool for a period of six months using multiple ways of data collection. Based on acquired data, we aim to 1) to describe and explain differences in the use of the digital communication device by the members of the care network, and 2) to come up with a list of conditions that facilitate (or restrict) the implementation of such a device by a homecare organization. The section below provides a short literature overview in order to identify conditions that predict differences in the actual use of the digital communication device and its effects on the process of caregiving.
Online care networks
Digital networked communication (DNC) may help mixed homecare networks to create online communities for coordinating care tasks and exchanging information. Similar to offline care networks, online care networks can be described regarding their structural (size, composition) and functional characteristics (tasks, frequency and content of discussion about care) [2]. In general, three types of offline mixed care networks are to be found among community-dwelling older care recipients: a small partner care network with few other helpers; the larger informal care network, composed of adult children, other relatives, non-kin and formal caregivers; and the larger formal care network with few informal caregivers (mainly spouse or children) [7]. Which type of care network is present depends on the care needs and the economic, social and psychological resources of the care recipient (e.g. health status, income, partner status and sense of self-efficacy). It can be expected that the composition of an online care network reflects the composition of an offline care network, but there are two important argument that nuance this expectation.

First, not everybody desires or is able to use online tools. There are differences in determinants as age, the severity of an illness, and attitudes towards DNC [8]. Older persons may feel restraint to use an assistive device because they did not grow up with it. A Scandinavian [9] and a Dutch study [10] on care networks in which elderly were included showed that for people with mild dementia, technical errors and the unclearness of benefit lowered the initial trust in the device. Another reason to refrain from DNC is that some highly valued characteristics of personal communication do not translate into digital practices [11]. Such distrust in digital devices may also be present among older informal caregivers and homecare professionals, and may limit the use of a dfDNC in mixed care networks.

Second, offline communication between informal and formal caregivers largely depends on the meeting opportunities of the caregivers, defined by, for example, overlapping types of care activities and the co-residence of the informal caregiver [12]. In contrast, online communication provides ongoing meeting opportunities because any message communicated by any caregiver can be read by all other caregivers. But assuming that for care recipients and informal caregivers there is no time limit to communication, for formal
caregivers this is limited by their working hours and by how their organization has equipped teams to provide 24/7 attention to needs of clients [13]. In this line of reasoning it is likely expected that an online care network represents only a part of the offline care network. The above leads to two main research questions that guided our pilot: RQ1) What are the characteristics of digital networked communication in terms of size and composition of the digital network, and the frequency and content of communication? And RQ2) what might be the effects of using online communication tools for the coordination of care, the efforts from informal carers to help, and the perceived quality of care?

The role of the homecare organization and usability of the communication device
In addition to individual variation within the care network, there are several barriers and facilitators of success when implementing eHealth into care organizations. The extent to which the intervention fitted with the existing workflow and how well it is integrated within current working processes were found to influence implementation [14]. Nowadays nurses experience a pressing responsibility of the economic aspect of their work; every task has to be done as efficient as possible [15]. In addition, it is increasingly expected that they integrate informal caregiver involvement in formal work processes. Results of a study of two agencies and their clients in the Netherlands [16] show that the nurses were aware of the organizational policy which stated that they should proactively keep connected with informal caregivers. But most of them acknowledge that they hardly ever did so. The main reasons were lack of time, too little initiative from the informal carer, and no clarity on which team member is responsible and accountable for the informal caregiver involvement. A device for DNC (dfDNC) may deal with some of these issues and can be assistive for formal caregivers in stimulating informal helpers to communicate within online care networks. Currently, those devices used in homecare organizations are more comparable with Facebook, WhatsApp, and Google agenda than with electronic health record software. The devices look attractive and are comfortable to use, and swiping to activate this types of digital tools is a nice feeling. Since they are installed on vehicles as mobile phones, professionals can communicate with
each other and with their clients at every moment, and any place. Complementary, using the devices instead of visiting someone to communicate with is time saving, and in opposite to telephone use, the information can be reread [17, 18].

The above elaboration leads to the third research question: RQ3) which organizational conditions facilitate and restrict the implementation of a digital communication device in a homecare organization?

METHOD

Sample and design
The research team, the developer of the device and a homecare organization in a rural area in the eastern part of the Netherlands, agreed to develop a pilot-study to monitor and examine among clients of one specific team, the implementation of the dfDNC.

The device was software developed for digital communication in a closed network. Using an internet browser, the software could be implemented on an IPad, IPhone and/or personal computer. It contained a calendar to schedule meetings and tasks and users could leave e-messages and photos. Users received prompts to indicate new messages were present. The district nurse and team manager asked clients and/or their informal carers to participate in the pilot, and finally seven care networks around clients agreed to use the device. These networks all met the criterion that at least one informal caregiver and one formal home caregiver could be hooked on to the device. Other criteria for selection were not used and clients varied in health conditions and living arrangements. Three (out of seven) care receivers suffered from dementia to the extent that they could not participate themselves in interviews. In their case, informal caregivers spoke on their behalf. The seven care networks were hooked on to the device starting February 2015 (T0). At the same time, information was collected on characteristics of the care recipient, the informal caregivers and formal caregivers involved. The interviews were held face-to-face, by phone or via Skype. Follow-ups were planned after three months (T1) and six months (T2). Monthly updates on login information was obtained from the developer of the tool. Auxiliary nurses who became member of the digital networks were interviewed during one focus group session, and
fieldnotes were made while observing two workshops to inform clients and/or their care network about the digital device. For the sake of completeness, three managers of the care agency were questioned about their vision and expectations on the DNC as part of the structural work of their staff. During the period of research, we conduct 42 semi-structured interviews with twenty-two participants (N = 22), consisting of four clients, seven informal carers (of which three spoke on behalf of the care receiver as well), three district nurses, five auxiliary nurses, and three managers. Informed consents are obtained from the participants, and in field notes and transcriptions their names are withheld for reasons of confidentiality.

**Procedure**
Completed questionnaires were used to provide a short description of the clients, and what types of care he/she got from whom. The gathered information was calculated using IBM SSPS 23.0. Login data was provided monthly in an Excel sheet: actions, appointments, actors and messages were coded (e.g. action = entering text; appointment = going to the dentist; actor = district nurse; message = care related/not care related), and total number of different types of logins were counted. The audiotape-recorded interviews are transcribed verbatim. For answering the three research questions, we investigated the transcriptions, field notes and e-messages by using qualitative, directed content analysis [19]. The analysis consisted of reading and re-reading the different types of data, and writing down citations addressing the research questions. The next step was to search for linking themes, and interpret them by means of constant comparison. Finally, the transcriptions are worked through by the qualitative research software Atlas.ti 7.5. Multiple ways of data-collection have thus been used with multiple types of respondents. An overview of which information is provided by whom is given in table 1.
<table>
<thead>
<tr>
<th>Networks</th>
<th>Respondents, logdata</th>
<th>T-0</th>
<th>T-1</th>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
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<td>2, 5</td>
<td>3</td>
<td>3, 5</td>
</tr>
<tr>
<td></td>
<td>IC</td>
<td>2, 5</td>
<td>3</td>
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<td>IC incl cl</td>
<td>2, 5</td>
<td>3</td>
<td>3, 5</td>
</tr>
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<td>2, 5</td>
<td>3</td>
<td>3, 5</td>
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<td></td>
<td>AN</td>
<td></td>
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<td>1</td>
</tr>
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<td></td>
<td></td>
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<td>1, 3</td>
<td>3, 5</td>
</tr>
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<td></td>
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<td>3</td>
<td>3, 5</td>
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<td>AN</td>
<td></td>
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<td>1, 3</td>
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<td>AN</td>
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<td>2, 3</td>
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</tr>
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<td>2</td>
<td>3, 5</td>
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<td>1, 3</td>
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<td></td>
<td>AN</td>
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<td>4</td>
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<td>1, 3, 5</td>
<td>3, 5</td>
</tr>
<tr>
<td></td>
<td>IC</td>
<td></td>
<td>1, 3, 5</td>
<td>3, 5</td>
</tr>
<tr>
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<td>DN</td>
<td></td>
<td>3, 5</td>
<td>3, 5</td>
</tr>
<tr>
<td></td>
<td>Log data</td>
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<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>NW 1-5</td>
<td></td>
<td></td>
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<td></td>
<td>DN van NW</td>
<td>1-5</td>
<td>1, 4, 5</td>
<td>1, 3, 5</td>
</tr>
</tbody>
</table>

DN of cl not started 3
AN of cl not started 3
Team manager 4
Division manager 3
Sector manager 3

**CL=client, IC=Informal Carer, DN=District Nurse, AN=Auxiliary Nurse, NW=mixed care network 1=observation, 2=face to face interview, 3=telephone or Skype interview, 4=focus group interview, 5=questionnaires**
RESULTS

Descriptions of the care recipients and their networks

The seven networks (NW) which were involved in our research can be distinguished because of varieties between their care situations. Of four networks (NW1, NW4, NW6 and NW7) the clients needed care due to physical restrictions, but they were cognitively functioning well and capable to use the dfDNC. Their networks consisted mainly of nurses who give personal care. Informal carers are helping with transportation and arranging tasks, and do on an irregularly base some household work. NW1 and NW7 comprise a cohabitated informal carer, respectively a son and a partner. The client of NW7 has arranged several formal carers via internet, like the district nurse who is involved in our research as well. The other three networks (NW2, NW3, and NW5) comprised clients which have varying degrees of dementia, and are therefore not capable to use dfDNC. They are all fragile, but especially the client in NW3 is restricted in her instrumental daily activities. The informal carers of these networks are all strongly motivated to cooperate with the formal helpers. Further details can be found in table 2.

<table>
<thead>
<tr>
<th>network</th>
<th>client; type of helpers; amount and type of help</th>
<th>dfDNC users</th>
<th>Frequency of using</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Middle aged man, sharing his home with his adult son, average level of education, cognitive functioning well, physically restricted, wheelchair depended, socially active. Per week, 4 hours of private household work, 3 hours of formal household work, 5 hours of personal care by AN.</td>
<td>1: DN</td>
<td>Three times in the whole period</td>
</tr>
<tr>
<td><strong>2</strong></td>
<td>Woman, 74 years of age, widowed, lives on her own, suffering from dementia, socially active especially with family. Besides her daughter (IC, 43 years of age), there are 5 family members helping with household work, with transportation and finances. One time a day, AN look how she's doing. In the mixed care network is as well as a DN and a CM are involved.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2: DN, IC</td>
<td>Less than once a month</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| **3** | Woman, 92 years of age, widowed, lives on her own, low level of education, suffering from dementia, restricted in her instrumental daily activities. Besides a son (IC, 66 years of age), there are 4 other family members helping with household work, transportation and arranging tasks (3 hours a week). Every day AN are taking care of heating the food in the microwave, intake of her medication, bathing and dressing (13 hours a week). |
| 5: DN, IC, AN, PHW, FM | Once a month |

| **4** | Woman, 80 years of age, widowed, lives on her own, average level of education, cognitive functioning well, physically restricted, wheelchair depended, socially somewhat restricted. Her IC is an acquaintance (woman, 39 years of age), she assists the client with arranging tasks. She has a step daughter living abroad. Other relatives are a friend and neighbor, they do some household work. AN come 5 times a day for helping her with meals, personal care and nursing tasks. |
| 5: CL, DN, IC, AN, FM | Once a week |

| **5** | Couple, both suffering from dementia. But with some difficulty, the woman is able to support her husband a little bit. Between 80 and 85 years of age, living on their own, low level of education. Besides a son (IC, 45 years of age), there are 6 other family members helping with household work, transportation and arranging tasks. Per week, 3 hours of household work and 3 hours of helping with their medication intake by AN. |
| 6: DN, AN, IC, CM, two FM’s | Once a week |

| **6** | Woman, 88 years of age, widowed, living on her own, low level of education, fragile. Besides a daughter (IC, 56 years of age) there is one other daughter helping with household work, transportation and arranging tasks. Per week, 2 hours household work and 3,5 hours of personal care by AN. |
| 5: CL, DN, IC, AN, FM | Since June more activity |

| **7** | Man, 64 years of age, cohabiting partner. Average level of education, substantial functional restricted, wheelchair depended. Per week, 32 hours household work, 24 hours personal help, 4 hours nursing tasks and 2 hours transportation by partner (IC, 55 years of age). A son, friend and neighbor help with e.g. transportation and arranging tasks. Per week, 4 hours of household work, 11 hours of personal care and 7 hours of nursing tasks by DN or/and AN from different agencies. |
| 8: CL, DN, IC, FM, four AN’s of another agency | More than weekly |

**CL = client, DN = district nurse, AN = auxiliary nurse, IC = informal carer, PHW = private household worker, CM = case manager, FM = family member**

**Functional use of the device**

The login data we collected over time showed how often communication occurred, who were central senders of e-messages, and who responded to senders. These data gave rise to the insight that the communication varied by the aim for which the device was used. The three
most dominating aims were: (1) to arrange care tasks, (2) to communicate about the circumstances of the care receiver, and (3) to keep in touch/informed about the care situation. Together with characteristics of senders and content of information, three different types of online networks surfaced from the data:

The ‘Arranging the care network type’

This type of network is characterized by highly frequent (daily to weekly) usage of the digital agenda which is used to plan care activities and shifts of caregivers (NW7). The one who directed this digital network is the care recipient himself. His input was focused on making appointments with the formal caregivers. The most digital communication occurred between the client and the district nurse. The characteristic of the content is pragmatically and concerns the organization of care. The login data revealed that the other dfDNC-members (spouse, relative, auxiliary nurses) logged in regularly for checking information but rarely posted an e-message. During the period of our observation, there was no deterioration in the functional abilities of the client. Therefore there was no need for additional hours of care over time which explains the stable usage of the tool in the course of the time. The functional use of the device is clear from the following quote of the care recipient:

“... it depends on ... is it a privacy issue or not. But if it is a task what can be changed in general, than undoubtedly ... it has to be mentioned on dfDNC, to make everyone aware.” (Interview, NW7, client)

The ‘Discuss the care network type’

In this type of digital network, the client does not take part him/herself due to severe cognitive impairments (NW2, NW3, NW5) and the central informal carer and the district nurse or auxiliary nurse are communicating frequently with each other about the care situation. In NW3 and NW5, there is weekly till monthly activity on dfDNC. The central informal carer of
NW2 uses it rarely due to a lack of computer skills. Two networks (NW2, NW3) hardly used the digital agenda and action register, but conversely NW5 used both often. Sometimes the e-messages contained information about housekeeping issues and public healthcare services concerning the client, like the following two citations.

"As requested by XXX (the auxiliary nurse), I collected bandages from the pharmacy and brought them to mother (they are in the closet where the Care manual is also placed)." (Login, NW3, informal caregiver) --- “This morning, I paid a visit to your mother. To me, she seemed cheerful. The wound heals well. I am glad that now her bed is at the proper height.” (Login, NW3, auxiliary nurse)

As in the aforementioned type of network, login data of this type showed regular logins from other helpers just to inform themselves, mostly without leaving an e-message behind. It should be noted that all of the affiliated informal carers of NW3 met each other face-to-face on a regular basis, which reduced the need to take actively part in the DNC. During the study period the functional abilities of the care recipients decreased, which required adjustment of care activities. This coincided with an increased use of the digital device in NW3 and NW5 and digital discussion of specific situations and care needs.

The 'Staying connected network type'

Different from the other two network types, this network type comprised an equal contribution in communication by the client, the informal carer and the nurse (NW4 and NW6). During the entire period of observation the login data showed a low level of activity. Compared to the Discuss network, the necessity for DNC seemed to be missing because the care recipients were still able to communicate themselves, there was no deterioration in the functional abilities of the care recipients and no change in care needs in the period of observation. So, quite a lot of e-messages were not about care, but about leisure spending of the care recipients, periods of absence of the carers and daily issues. Both care recipients explained
that they experienced a lack of benefit of using the tool. They preferred communicating by phone or face-to-face to digital communication.

"If I want to go out this afternoon, I can put a message on the device, but she (the auxiliary nurse) might not see it on time. That's why I prefer to call her by phone."

(Interview, NW4, client)

The central informal carers of NW4 and NW6 articulated that the possibility to login on to dfDNC increased the peace of mind; although not living nearby, in a split second they can be alarmed if the health condition deteriorates. Or otherwise, if everything is going well with their beloved one, they were reassured by reading e-messages like this one:

“How kind of you sending me a message! I'm doing well, hope you’re fine. Dear regards.” (Login, NW6, client)

Consequences of using the digital communication device

During the interviews we asked clients and their helpers what might be the effects of using dfDNC for the coordination of care, the efforts from informal carers to help, and the perceived quality of care. The forms which were supplied to the clients and informal carers included relevant questions with scales to measure changes herein during the period of observation.

Effects on coordination of care

In general, the participants seemed to agree with each other that using dfDNC contributes to a quicker, better and intensified connection between the affiliated members of the mixed homecare network. Especially the informal carers emphasized the advantage that everyone can be immediately aware of what is going on. By logging in, the information became visible, so everyone can be informed about which tasks has to be done by whom.

“Well, you see ... for example ... look here, here are the appointments [He shows the interface on his laptop]. This is an enumeration of work to do, we arranged that by mutual discussion. My brother, weekly he buys the groceries. My girlfriend and I are
the back up. My other brother does the garden, and his sons are the back up."

(Interview, NW5, informal carer)

Despite their low use of the tool, the informal carers in the Staying Connected network type appreciated the opportunity to see online information that would have been otherwise obtained by reading the hard-copy dossier at the client's home. One of the informal carers therefore stressed that the ability to have short lines in the triangle of client-caregiver-professionals was the main motivator for her to use dfDNC.

"In the past week I have checked the device and it decreases the necessity for other modes of contact. We will use it more to maintain the communication within the triangle." (Interview, NW3, informal caregiver)

In contrast, the client of NW7 mentioned several shortcomings of the tool that hindered coordination of caring tasks. Most of them were functional issues such as the inability to rehearse arrangements in the agenda in a simple way. Notably, the clients of NW4 and NW6 expressed that dfDNC would be an innovative idea for carers of people with dementia, but not for themselves because they are cognitively still functioning well. So, they prefer face-to-face or phone consultation rather than digital contact to coordinate care. Finally, table 2 shows that during the period of observation, there was no mutual communication at all in NW1. The reason for the client and his cohabiting son not to use dfDNC was their familiarity with other digital communication tools. Besides that, the helping family members live nearby, so there was no need for them as well. Overall, for all the members of NW1 there were not enough triggers to use dfDNC. But till the end of the project, they were eager to provide information on effects of using mainly WhatsApp to coordinate all types of helping tasks. One of the consequences was, that except for arranging transportation, the telephone is hardly used anymore.

For the homecare workers, the downside of dfDNC was the huge amount of posts to be read by them. A lot of the nurses read the e-messages in their spare time, especially the ones who received not yet an appropriate mobile phone from the agency. Furthermore,
during the period of observation, there was the disadvantage of the existence of various methods to submit the same information, like via dfDNC, on the intranet of the care agency, and in the dossier at client's home. Therefore, as an example, it may happen that the nurses must inform everybody in four different ways about the period of their holidays.

Effects on degree of help from informal carers

At the end of our period of observation of only six months, it was not possible to determine if the e-tool causes a statistically significant increase of informal help within the networks. The sample was too small to calculate differences. Neither was it possible to establish a significant decrease of formal help. If more helping hours per week were reported at T2 compared to T0, it seemed related to an increased demand for care of the client. But by interviewing the informal carers on three consecutive times, we can conclude that they became more engaged with the tool, and that they felt more comfortable using the device later on than in the beginning.

It is relevant to mention here that some homecare workers expressed that they gained more insight into the degree of resilience of informal carers.

“Although we see on dfDNC only elaborations about care situations, it's ok. It gives us a chance to determine their ability to care.” (Interview, district nurse NW1-5)

Besides, not earlier than in the final phase of the study, we saw in the login data some cautious insinuations from nurses to get a task done by an informal carer.

“Would/could you discuss with the general practitioner which medical options there are to lessen the pain of your mother? Please, take into account that some medication increases the risk of falling.” (Login, NW3, district nurse)

On the other hand, one of the district nurses said she felt encumbered to ask for more help if only one informal carer is connected on dfDNC.
Effects on quality of experienced care

Of our research group, the client who has the highest degree of dependence on care because of his physical limitations was very enthusiastic about using dfDNC:

"dfDNC is the central point where carers can find the latest information. It gives me confidence that they know what to expect and how to handle." (Interview, NW7, client)

His central formal carer confirmed this improvement in quality from her perspective:

"dfDNC increases the client’s self-efficacy on his life and caring tasks." (Interview, NW7, district nurse)

The formal caregivers mostly admitted that dfDNC can be helpful when dealing with complex care, and that the tool could also relieve their daily work practice.

"Before we go to the house of the client we can inform and prepare ourselves just by logging in on dfDNC." (Group session, auxiliary nurse)

Finally to enhance the quality of care some affiliated members suggested to invite other disciplines then the participants of the mixed care network. For example, the general practitioner, case manager dementia and physiotherapist, such professionals could use dfDNC as well. In that case, e.g. photos that provide insight into the healing tendency of wounds can be exchanged, some nurses expressed. But at the same time, there was hesitation concerning issues as privacy and integrity.

Organizational conditions which facilitate or restrict the implementation of dfDNC

During gathering data from homecare workers and their managers, it appeared that different factors contributed to (non) using the e-tool (RQ3). The coordination of care has been mentioned several times by the managers as an important potential benefit of dfDNC. But in the first place, they see the device as a tool to monitor the care situation of each of their clients. Nowadays elderly live at home in spite of a high degree of vulnerability. Therefore, monitoring is necessary for safety reasons and for getting information about what can be
done by the informal carers, and when and how formal care is needed. Yet, the management stresses to be cautious while using dfDNC concerning the data protection legislation.

Regarding the existing workflow of the homecare workers, the recent reforms in long-term care are mentioned by auxiliary nurses several times as a barrier to implement dfDNC. Due to a decrease in time to give personal care; they see lesser opportunities to be busy with the tool. Although their pessimism reduced in the course of the time, during the T1 meeting they told to be distrustful because dfDNC might be at the expense of their leisure time. For example, while being at home receiving a notification on their mobile phone that there is an e-message waiting to be answered. Next, an auxiliary nurse told that dfDNC can lower the threshold for informal carers to ask nurses doing tasks that belongs not to their job responsibilities (anymore). In contrast, the district nurses showed from the start more adoption of tools like dfDNC. In a later stage of the implementation, the attitude towards dfDNC of both types of nurses became more similar. They saw as potential benefit that links between the informal and formal carers can be shortened by dfDNC if appropriate agreements are made.

“If you have questions about their father or mother, and they just do not pick up the phone, then it may take too long before we have connection with each other. When they decide to use dfDNC to communicate with us, then there is a commitment. In that case, they should at least once a week have to deal with dfDNC.” (Focus group session, team manager)

The usability of dfDNC can be obstructed when it remains unknown who is responsible for assisting the informal carers. The following two citations makes clear that an informal carer had difficulties with the e-tool, but was motivated to get instructions from the device developer:

“…, and I had as well difficulties with another functionality. I tried a few times, without succeeding. Yeah, what to do about it”. --- “The developer comes this week to help me,
I hope he don’t forget it. We have to wait again.” (Respectively interview and login, NW2, informal carer)

The district nurse of NW2 is during the T2 interview clear in her opinion that the developer failed to take his responsibility to instruct this client in using dfDNC.

“I thought he is the one who should have helped her till she knows how to use it.” (Interview, NW2, district nurse)

DISCUSSION

More reliance on informal caregivers of older people living at home asks for more connection and communication among all types of caregivers. Therefore, the main aim of this study was to explore the variety of digital networked communication within different types of mixed homecare networks. Studying the qualitative and quantitative information gave us insight in which aspects three types of actors (clients, informal and formal carers) showed similarities and differences in views on using an e-tool to communicate with each other, and barriers and facilitators for its implementation.

Overall, a digital tool for networked communication can facilitate coordination of help between the client, informal and formal carers. How it will be used, depends largely on the involvement of the client. If he/she has a high capacity to use the tool and engagement to optimize the coordination, it may lead to more use of the agenda instead of communication about care. On the other hand, in case of lower or absence of involvement of the client, then the chance of communication between carers increases, especially when the informal helper has a strong motivation to use the digital tool. In small offline networks when the care situation is stable and the client has no/little involvement a digital network surfaces which exists but is not used very often. In that case, the informal carer uses the tool for his peace of mind. Looking at these insights, there is a tendency to say that online networks in particular reflect the needs, capabilities and attitudes toward DNC of the care recipient and the informal caregiver(s).
Another finding is that the e-tool has a special function for mixed care networks which have a lot of members. In this type of network it is not necessary that all participants are communicating with each other, care coordination can be arranged between just a few, but their e-messages are for everybody available when they log in on the tool. So, the most important benefits of the tool for the client and his carers seem to be: the easily availability of up-to-date information, the ability to give a sense of safety for the carers, and short communication lines in case of complex care situations. On the other hand, there is no clarity yet about whether e-communication contributes to an increase of hours and types of informal help.

**Remarks and recommendations**

Based on our findings several steps can be identified that homecare organizations need to take when starting to use a dfDNC. The first step is to identify the targets that the use of a dfDNC may deliver. This may be efficiency targets as increased digital contact, and decreased face-to-face contact with their clients. Other targets may be a larger involvement of informal carers and improved coordination of care within the mixed homecare network. Secondly, the homecare workers need to select clients and their caregivers for whom the dfDNC might work. This in particular concerns capable clients and caregivers who value digital communication. The third step is to identify the mixed homecare network around the determined client and arrange a meeting about who to invite to connect on the digital device, what type of communication is allowed (privacy of information) and how often communication is expected. The three types of digital care networks identified in this study can be used as examples for the homecare staff in which different agreements with clients and caregivers can be made. Finally, continuous monitoring of the actual use of the device is warranted. Care situations change which need to be reflected in the use of the dfDNC. For example, only filling in the calendar can be sufficient when the client is cognitive functioning well, but may fall short as his/her health deteriorated. In that case, adjustment of the way of communicating is necessary because the digital arranging-network may need to become a discuss-network type.
**Strengths and limitations**
The strengths of our design is that multiple types of participants (clients, caregivers, managers) were interviewed, thereby representing a wide range of perspectives. Furthermore, multiple ways of data-collection made it possible to come up with rich information to answer our research questions and to contribute to the process of theorizing new sociological phenomena as digital networked communication.

Limitations of the study are the following: there were a few inclusion/exclusion criteria for the pilot-study, so there is a high variability among the cases included; the small size of the sample, which did not allow for statistical analyses to generalize our findings. Moreover, the period of observation was relatively short and did not allow for significant changes in structural and functional characteristics of the mixed care networks. Longitudinal large-scale studies are needed to examine how DNC can indeed affect collaboration among its members.

**To conclude**
This small-scale study is one of the first to report on digital communication tools in mixed homecare networks. Due to the information collected with multiple methods and from different types of actors, we were able to come up with (RQ1) three types of communication patterns in homecare networks to illustrate the different functional usages of the dfDNC. These differences are clearly related to the health capacities of the care recipient, the motivation of client and informal caregivers, and the opportunities for the formal caregivers to use the tool. Although the online care network may be rather comparable to the offline care network, digital communication is limited to specific network members and mostly focused on the arrangement of care in times that this was most needed. Our findings show that dfDNC (RQ2) enhanced the care management of the digital literate care recipients, the feelings of safety among informal caregivers, and efficiency of organization by the formal caregivers, which are all basic ingredients of good quality of care [20]. Before actually using an e-tool, it is important to (RQ3) consider the several barriers and facilitators of success when implementing it into homecare organizations, such as anticipating on changes in data protection legislation [21]. Finally, digital networked communication may enhance the
linkages in the triangle of client, informal caregiver and professional caregiver, and increase peace of mind amongst all users.

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**Conflicts of Interest**
None declared

**References**


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Abbreviations

DNC: digital networked communication
dfDNC: device for digital networked communication
NW: network