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### **A systematic review on the effect of ICT on social support measures in healthcare**

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# A SYSTEMATIC REVIEW ON THE EFFECT OF ICT ON SOCIAL SUPPORT MEASURES IN HEALTHCARE

## ABSTRACT

**Background:** With increased popularity in the use of ICT in healthcare to provide support to individuals, it is imperative to investigate the impact of ICT on social support measures in health and social care.

**Objective:** This study aims to review literature on the effectiveness of ICT-based tools and intervention on social support measures with reference to health and illness.

**Methods:** Relevant databases (PubMed/MEDLINE, clinicaltrials.gov and Cochrane Library) were systematically searched using a combination of key search terms. To be included in the review, studies had to be published in English language, involve human subjects, be published between 2000 and 2017, apply ICT intervention on a health-related condition and report the effect of ICT on social support measures.

**Results:** The database search returned 4020 articles. After screening, 30 eligible papers were selected for the review. The studies were quite heterogeneous in terms of study design, age of participants, reported outcome, outcome measuring tool and health condition of participants. 20% of included studies were rated as low quality evidence, with a high risk of research bias. Over 75% of reviewed studies reported positive impact of ICT on social support measures. The results show that ICT interventions have a statistically significant positive impact on social support measures. Social network was found to be the ICT intervention with the most impact on social support measures.

**Conclusion:** There is need for more high quality research on the effect of ICT on social support measures. The results of this systematic review suggest that ICT could effectively provide social support to individuals, although the degree of its effect could depend on the nature of ICT tool used and the well-being status of individuals. Further work in the use of ICT to provide social support for preventive healthcare is recommended. Also, more research investigating the effect of using Smartphone-based instant messaging applications (such as WhatsApp and Snapchat) and virtual reality technology on social support is encouraged.

**KEYWORDS:** social support, ICT intervention, health, impact, social network, Internet

## 1. INTRODUCTION

The computerization of healthcare has changed the expectations of people concerning service delivery and the way health is delivered, and it appears those expectations exceed the changes already realized in health. This computerization is achieved through the use of Information and Communication Technology (ICT) tools such as the Internet and services it facilitates like social media, online games and the like. With the present shift of health from a focus on treatment to wellness, a greater proportion of these services are targeted towards wellness management. In 2015, consumer health apps for wellness management accounted for about two-thirds of the mHealth apps in Apple iOS and Google app platforms [1]. Particularly, the Internet has the potential to provide a more effective medium of communication between the parties involved in healthcare - patients, healthcare professionals and other caregivers [3].

More recently, ICT has been identified as technology capable of creating transformative ways of providing healthcare services that would better meet the needs of the society [15]. The stakeholders of healthcare have somewhat different needs to be met. Patients need faster service, better availability and high quality of healthcare services, the doctors need high quality equipment and services, conducive work environment and perhaps an opportunity for research, and healthcare providers are interested in procuring more affordable budget, acceptable quality and no unfavourable media coverage. With the fast changing needs of the population for efficient health care services, healthcare providers are growing more interested in finding ways to support more physically or mentally ill people, who might have difficulties meeting their everyday personal and social needs, at home and this has increased the popularity of ICT devices in health and social care over the years [38]. Hence the question - do individuals actually experience social support when using ICT in the context of healthcare and social care?

Social support is a multifaceted concept and it is defined as the feeling of being accepted or cared for experienced by an individual or tangible support received by an individual from other individual(s) within a group [51]. It is also highly intercorrelated with loneliness as they are both considered lower-order endpoints of a higher-order construct of general social attachment [40]. According to [9], the four functional dimensions of social support are emotional, informational, instrumental and validation. The components of these types of social support as outlined in [54] include:

- emotional support: sympathy, listening, understanding or empathy and encouragement
- informational support: suggestions or advice, referral, situation appraisal and teaching
- instrumental support: loan, direct or indirect task, active participation and willingness
- validation support: compliment and relief of blame

Searching literature identified four existing reviews that investigate the effect of ICT on general health and social care outcomes [2, 15, 31] and the impact of social support on health outcomes [51]. It has been reported that ICT can improve coordination of care and exchange of knowledge [15], enhance the relationship between the patient and healthcare professional [2] and manage eating disorders [31]. Higher levels of social support have been reported to improve clinical outcomes and help individuals adopt healthy lifestyle activities [51]. However, little is known on the impact ICT has on social support measures in healthcare. To our knowledge, the only existing review with similar focus is that of Chen and Schulz [10] that investigated the effect of ICT interventions on social isolation in the elderly. They reported that ICT has a positive effect on social support, although this effect seemed to be short-lived and failed to last more than six months after the ICT intervention was administered.

The objective of this systematic review is to present evidence on the impact of ICT interventions on social support measures in health and social care context, irrespective of age, methodology or setting.

## 2. METHODS

Systematic reviews present summaries of literature in a specific research area using explicit and reproducible methods to identify, select, appraise, and synthesize results from similar but separate studies [22]. In addition to summarizing research findings on a particular area or field, systematic reviews are useful for identifying any research gaps in existing literature for a research area. They tend to answer very specific research questions, in contrast to scoping reviews which are less likely to address a specific research question [33]. The fundamental steps for conducting a systematic review outlined in [22] were followed.

### 2.1 Definition of Review Question

The aim of this systematic review is to answer the question *Does ICT have an impact on social support measures in healthcare?* Although some evidence exists on the impact of social support on health outcomes, few evidence-based reviews on the impact of ICT on social support have been conducted. Answering this question is important because it could help inform cost-effective policies on the use of ICT to provide social support to improve health outcomes. It could also inform policies on the coproduction of healthcare, which enhances collaboration between individuals and healthcare providers towards the creation of healthcare services, via the use of eHealth apps.

### 2.2 Literature Search Strategy, Inclusion Criteria and Study Selection

The PubMed\MEDLINE, clinicaltrials.gov, and Cochrane Library databases were searched from March 2016 to January 2017. The search used a combination of these keywords social support, ICT, social media, social network, telemedicine, telecare, telehealth, tele\* and online games. These keywords were chosen in order to capture as many forms of ICT intervention as possible.

This search produced 4,209 citations. The references of reviews returned in the search results were also assessed for relevant studies and 17 citations were identified as relevant. This yielded 4,226 citations in total.

Studies were first sifted using the pre-screening method which involved deciding which studies to retrieve for further attention based on their titles (and abstracts when titles do not provide sufficient information). The second sifting process involved selecting retrieved studies to be included in the review by reading the full text. Eligible studies were selected based on the inclusion criteria decided on by the authors. The inclusion criteria are:

- published in 2000 - January 2017, to ensure the review is current and relevant
- published in English language, in consideration of the language limitations of the authors
- non-qualitative study

- apply ICT intervention on a health- and care-related condition
- interventions/programs administered on more than one participant, to ensure the study is not based on a single person's opinion
- social support measured as an independent variable

After the first sift, 4020 articles were excluded and 206 articles were retrieved for further assessment. The second sift further excluded 167 articles. During the data extraction process, 9 articles were also excluded because they (i) were a sub-paper of another included paper ( $n = 3$ ); (ii) did not measure social support with a research tool ( $n = 4$ ) and; (iii) were a secondary data analysis study ( $n = 2$ ). A total of 30 articles, which met the inclusion criteria, were included in this review. An overview of the study search and selection process is outlined in Figure 1.

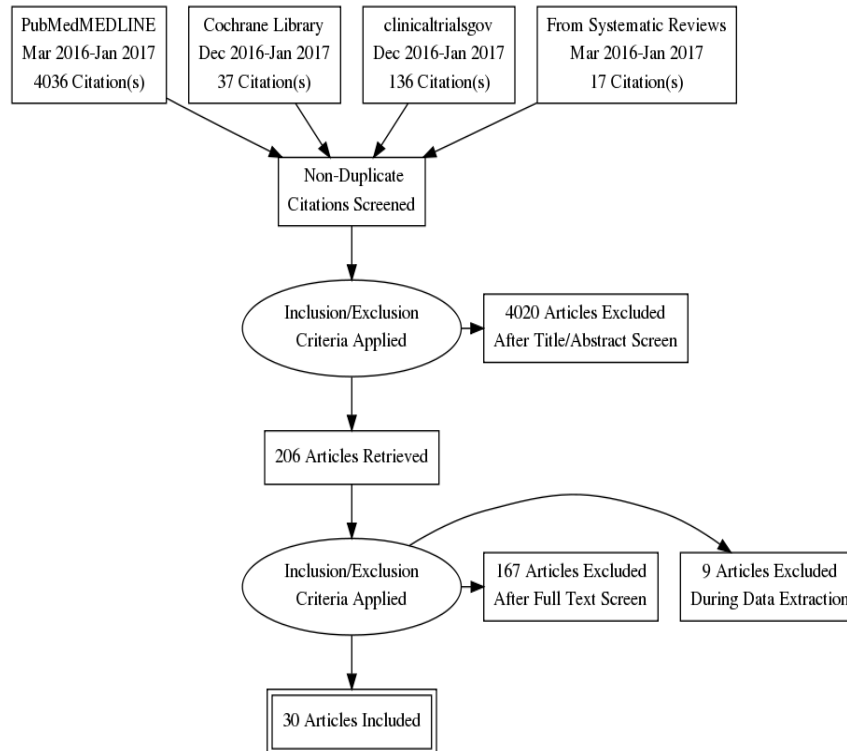


Figure 1. Study selection flowchart

### 2.3 Study Quality Assessment

A revised version of MacLehose *et al.*'s instrument outlined in [37] was used to assess the methodological quality of studies. This instrument was chosen because it permits quality assessment across different study designs. The instrument asked questions concerning reporting, external validity (EV), internal validity (bias [IVB] and confounding [IVC]) of a study. Scores from these questions were summed to give an overall quality score for each study, with higher scores indicating higher study quality.

The assessment yielded 3 articles (all randomized controlled trials [RCTs]) as high quality evidence, 6 as low quality evidence and the remaining 21 as fair quality. A summary of the quality assessment for each study is outlined in Table 1, with the studies arranged in descending order of overall quality score. The result of this assessment is similar to the findings in [37] as RCTs were discovered to have better quality than non-randomised studies (NRSs), although not statistically significant ( $P = .09$ ), and RCTs also had a significantly higher IVC score than NRSs ( $P = .02$ ). The combined quality of all studies is rated as fair quality evidence. To receive a rating of high quality, the score had to be greater or equal to the 80% mark of the maximum score; a rating of fair required a score greater or equal to the 50% mark while low quality was assigned if otherwise.

Table 1. Quality assessment summary

Citation	Reporting	External Validity	Internal Validity Bias	Internal Validity Confounding	Overall Quality Score
Joseph 2015 [29]	☑	☒	☑	☑	☑
Gerber 2013 [21]	☑	☒	☑	☑	☑
Belle 2006 [7]	☑	☑	☑	✓	☑
Slegers 2008 [49]	☑	☑	✓	✓	✓
Longman 2009 [35]	✓	✓	☑	✓	✓
Cobb 2014 [12]	☑	☑	✓	✓	✓
Hightow 2015 [26]	✓	☒	☑	✓	✓
Smith 2012 [50]	✓	☒	☑	✓	✓
Cavallo 2012 [8]	☑	☒	✓	✓	✓
Barbabella 2016 [4]	✓	☒	☑	✓	✓
Gustafson 2012 [23]	☑	✓	✓	✓	✓
Richardson 2010 [44]	☑	☑	☒	✓	✓
Hill 2006 [28]	☑	☒	✓	✓	✓
Czaja 2013 [16]	☑	☒	✓	✓	✓
Nguyen 2008 [41]	☑	✓	✓	✓	✓
Gustafson 2001 [24]	☑	☑	✓	☒	✓
Torp 2008 [52]	✓	☒	☑	☒	✓
Gellis 2012 [20]	✓	✓	✓	☒	✓
Nield 2012 [42]	☑	☒	✓	☒	✓
Ruland 2013 [45]	✓	☒	✓	☒	✓
Tsai 2011 [53]	☑	✓	☒	☒	✓
Jung 2015 [30]	✓	☒	✓	☒	✓
Lykens 2014 [36]	✓	☒	☑	☒	✓
Hill 2004 [27]	✓	✓	✓	✓	✓
Finkel 2007 [19]	✓	☒	✓	☒	☒
Lindsay 2008 [34]	✓	✓	☒	☒	☒
Eisdorfer 2003 [18]	✓	☒	☒	☒	☒
Kim 2012 [32]	✓	☒	☒	☒	☒
Côté 2015 [14]	✓	☒	☒	☒	☒
Marziali 2011 [39]	✓	☒	☒	☒	☒

☑ - high quality; ✓ - fair quality; ☒ - low quality

## 2.4 Data Analysis

Data on study setting (research location, sample and participant characteristics), study design, type of ICT intervention, and study outcomes were extracted from each study. A summary of studies included in this review is available on request. The included studies were heterogeneous in their design, outcome measuring tool, and ICT intervention; however, a forest plot helps present a clear picture of the overall result of this review. The tool used for building the forest plot is Cochrane's Review Manager 5.3 (<http://community.cochrane.org/tools/review-production-tools/revman-5/about>).

## 3. RESULTS

## **3.1 Study Setting**

### **3.1.1 Location and Date of Publication**

All included studies were published between 2000 and 2017, with 11 published before 2010 and 19 published in or after 2010. The studies were conducted in 11 countries (Australia, Canada, Germany, Italy, Netherlands, Norway, South Korea, Sweden, Taiwan, United Kingdom, and United States of America) with the highest number of studies from the United States of America (n = 19).

### **3.1.2 Sample Characteristics**

All but 4 studies were fully conducted at the participants' homes or regular living environments. Three had the study conducted at home and senior center [30], hospital [32], clinic or community center [23] (where participants went for follow-up interview), and nursing homes [53]. The sample size of included studies ranged from 15 to 1,503 participants. Fourteen studies (47%) had a sample size of 100 or less, five (17%) had a sample size between 100 and 200 while eleven (36%) had a sample size greater than 200. Excluding studies which did not describe the number of participants lost to follow-up [14, 27, 32, 34, 39] and an exploratory study [35], the overall participant attrition (or drop-out) rate of included studies is 26.85%. The length of studies ranged from 1 month to 18 months, with majority of the studies lasting for 6 months (n = 9). See figure 2 for a distribution of the study lengths.

### **3.1.3 Participant Characteristics**

Participants in the included studies had mean age ranging from 8-83 years. Twenty-two studies were designed for male and female participants, seven for female participants alone and one [26] for male participants alone. Although [42] was designed for both genders, only male participants were recruited for the study. Previous research has reported that women are more likely to easily exchange social support than men [5], this could account for the significant difference observed in the number of female- and male-specific studies.

In terms of participants' health characteristics, nine studies targeted participants with a chronic illness [14, 20, 23, 27, 28, 30, 34, 41, 42], ten studies targeted caregivers [4, 7, 16, 18, 19, 32, 36, 39, 50, 52], two studies targeted participants with cancer [24, 45], four studies on participants working on improving their physical activity and weight maintenance [8, 21, 29, 44], two studies were interested in improving participants' psychological well-being [35, 53] and two studies had an interest in improving participants' overall well-being [12, 49].

## **3.2 Study Design**

The study design of included studies include nineteen (63%) randomized controlled trials (RCTs) [7, 8, 12, 18–21, 23, 24, 27–29, 34, 41, 42, 44, 45, 49, 50], five (17%) quasi-experimental studies [14, 30, 32, 39, 53], two (7%) pre- and post- trials [4, 36], two (7%) pilot studies [26, 52], one (3%) feasibility trial [16] and one (3%) exploratory online survey [35]. Only nine RCTs reported using an adequate method of randomization [7, 20, 21, 23, 29, 41, 44, 45, 50], others did not report the method of randomization used. Given the nature of the intervention, it was impossible to blind study participants to intervention group assignment. However, only seven studies made an attempt to blind the outcome assessors from participants' group assignment [7, 12, 16, 19, 20, 41, 50]. Studies without a control group were not required to blind outcome assessors.

## **3.3 Type of ICT Intervention**

There are ten different types of ICT intervention administered in the included studies. Fifteen studies (50%) administered a web-based application; all but two of them had a dedicated social network incorporated in the application. One of the two studies without a dedicated social network [8] used Facebook to facilitate social interaction between participants. Four studies (14%) administered a computer-telephone integrated (CTI) technology, which permits the interactions on a computer and telephone to be integrated in such a way that the computer can initiate and manage telephone calls. Two studies (8%) used telehealth technology, which

provides services for remote exchange of data and information between a patient and clinician via electronic technology such as Skype or telephone. Three studies (10%) administered video technology which consisted of video-conference technology, video telehealth and videophone. Telephone, Internet, Online game, Social media (Facebook) were all used by one study (3%) each. One study (3%) administered a PC-based application with social network and one study (3%) used social network and videophone. See figure 3 for a distribution of the types of ICT intervention used. Some studies administered more than one ICT intervention; in this case, the main ICT intervention in the study has been used to make reporting uniform.

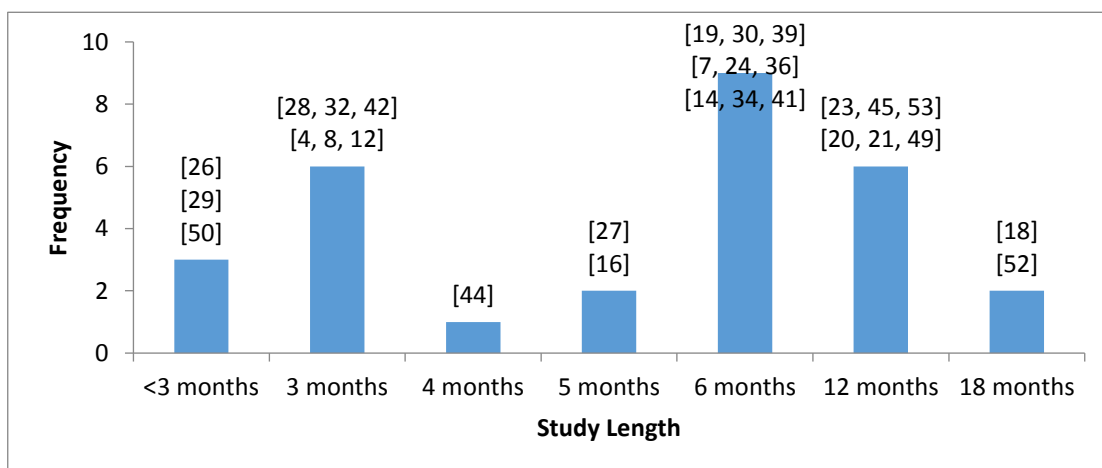


Figure 2: Distribution of study length

### 3.4 Study Outcomes

Social support is the outcome of interest for this review. Of the included thirty studies, twenty-three (77%) reported a positive impact of ICT intervention on social support measures while seven (23%) reported no impact of ICT intervention on social support [4, 8, 14, 44, 45, 49, 50]. A positive impact was either significant or insignificant (in which case, the improvement in social support measures could not confidently be attributed to the ICT intervention). Sixteen studies (54%) reported a significant positive impact [7, 16, 19, 20, 23, 24, 26, 28–30, 32, 34, 35, 39, 42, 52] while seven studies (23%) reported an insignificant positive impact of ICT intervention on social support [12, 18, 21, 27, 36, 41, 53]. Hence, the study outcomes are grouped into three categories: studies which report significant positive impact, insignificant positive impact and no impact of ICT on social support measures. The last category is tagged "no impact" instead of "negative impact" because there isn't enough evidence to conclude that ICT had a negative impact on social support in those studies. See figure 4 for the distribution of the study outcomes. The studies that reported a difference in social support measures by follow-up which favoured the control group or pre-intervention condition were placed in the "no impact" category, in addition to studies which found no between-group differences in social support measures [44, 45, 49].

Since there are no known widespread devices or medical instruments for measuring social support, different instruments (in the form of questionnaires) are used to measure social support. The instruments used in included studies are Medical Outcomes Study Social Support Survey (MOS-SSS) [48], The Personal Resource Questionnaire (PRQ) [56], Social Support Behaviours Scale [55], Inventory of Socially Supportive Behaviors [6], Multidimensional Scale of Perceived Social Support (MSPSS) [58], Interpersonal Support Evaluation List (ISEL) [13], Social Influence on Physical Activity Scale [11], Revised University of California, Los Angeles (UCLA) Loneliness Scale [43], Social Support for Exercise [46], de Jong-Gierveld Loneliness Scale [17], questionnaires designed by study authors themselves, and unnamed scales used in existing literature. Two studies [26, 34] did not report the instrument used to measure social support. MOS-SSS is the most used instrument in the included studies (n = 8, 27%). MOS-SSS, MSPSS, and De Jong Gierveld Loneliness Scale were identified by [47] as three of the leading instruments for the assessment of social functioning/isolation. However, no significant effect of instrument used on social support outcome was found ( $P = .71$ ).

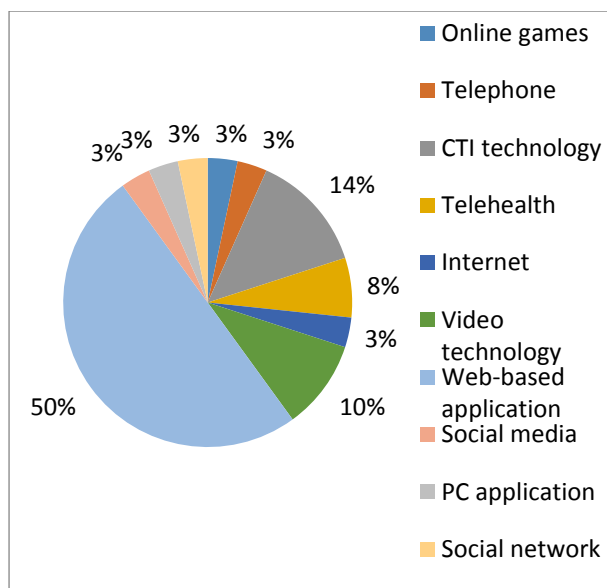


Figure 3. Type of ICT intervention (n = 10)

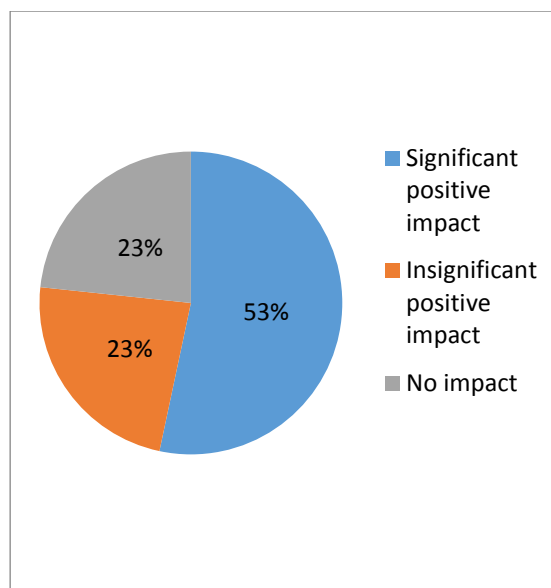


Figure 4. Distribution of study outcomes

**Significant positive impact:** Of the 16 studies in this category, majority of the studies (n = 10, 63%) are RCTs. The most commonly-used type of intervention is Web-based application with social network features (n = 6, 38%). The mean sample size is 141.25 (median = 99.5) and the modal study length is 6 months (n = 6, 38%). Excluding studies without a description of participant drop-out or attrition [32, 35, 39], collective participant attrition in this category is 12.79%. The most used social support instrument are unnamed scales used in existing literature and MOS-SSS (n = 4 each, 29%).

**Insignificant positive impact:** Of the 7 studies in this category, all but two studies (71%) were RCTs, one study was a quasi-experimental study and the other one was a pre-/post- trial. The most commonly-used type of intervention is Web-based application with social network features (n = 3, 43%). The mean sample size is 384.57 (median = 225). The collective participant attrition in this category is 41.14%, excluding studies with no description of participant drop-out or attrition [27]. The modal study length is 6 and 12 months (n = 2 each, 29%). The most used social support instrument are questionnaires designed by the study authors (n = 2, 25%).

**No impact:** Of the 7 studies in this category, five studies (71%) were RCTs, one study was a quasi-experimental study and one study was a pre-/post- trial. The most used type of intervention is Web-based application (n = 6, 86%), which includes the two applications without social network features. The mean sample size is 194.14 (median = 179). Excluding studies without a description of participant drop-out/attrition [14], the collective participant attrition is 18.39% in this category. The most used social support instrument is MOS-SSS (n = 3, 43%).

### 3.5 Data Synthesis

A forest plot combines these results to obtain a single estimate of the relationship between ICT intervention and social support (see figure 5). Social support estimates (21 studies with 3001 participants) were heterogeneous ( $I^2 = 53\%$ ,  $P = .003$ ), with an average effect size of 0.17 (CI, 0.05 to 0.29). This method of analysis has been used with the intention of presenting an estimate of social support measures across studies with varying design, target population, and settings. Nine studies were not included in the forest plot because they did not report mean and/or SD/SE measures at follow-up/post-intervention stage [12, 19, 23, 24, 32, 44, 45], were an exploratory study without follow-up measures [35] or the social support instrument used varied from the rest in that the higher the score, the lower the social support received [49]. The forest plot consists of RCTs and NRSs; in the case of a study without a control group, the pre- and post-intervention measures were used instead.

## 4. DISCUSSION

This systematic review aimed to describe evidence from quantitative studies of the impact of ICT intervention on social support measures in health- and care-related conditions. To our knowledge, this is the first review to address this question without any age, cultural or health-related restrictions. More than 70% of the included studies report a positive impact of ICT intervention on social support measures.



## 4.1 Social Network as the Most Effective ICT Intervention

For the purpose of this analysis, the web-based applications and PC application with features for social network, and social media are grouped as social network interventions. Of the 16 studies that administered this kind of intervention, all but 4 studies report a positive impact of ICT on social support. Thus, we can suggest that social network is the most effective ICT intervention used in this review. The sense of social support is better increased by the provision of real-time interaction in the form of regular interaction with another person interested in the participants' well-being [42]; which is not readily obtainable from programs without this form of interaction (say Internet programs) which do not provide individually tailored content or feedback. Particularly, Internet programs when used alone are arguably a poor medium for improving social support because they offer more informational and network support [34]. However, when used in conjunction with an ICT intervention that provides real-time interaction such as social support, it tends to be more effective as was the case in [52].

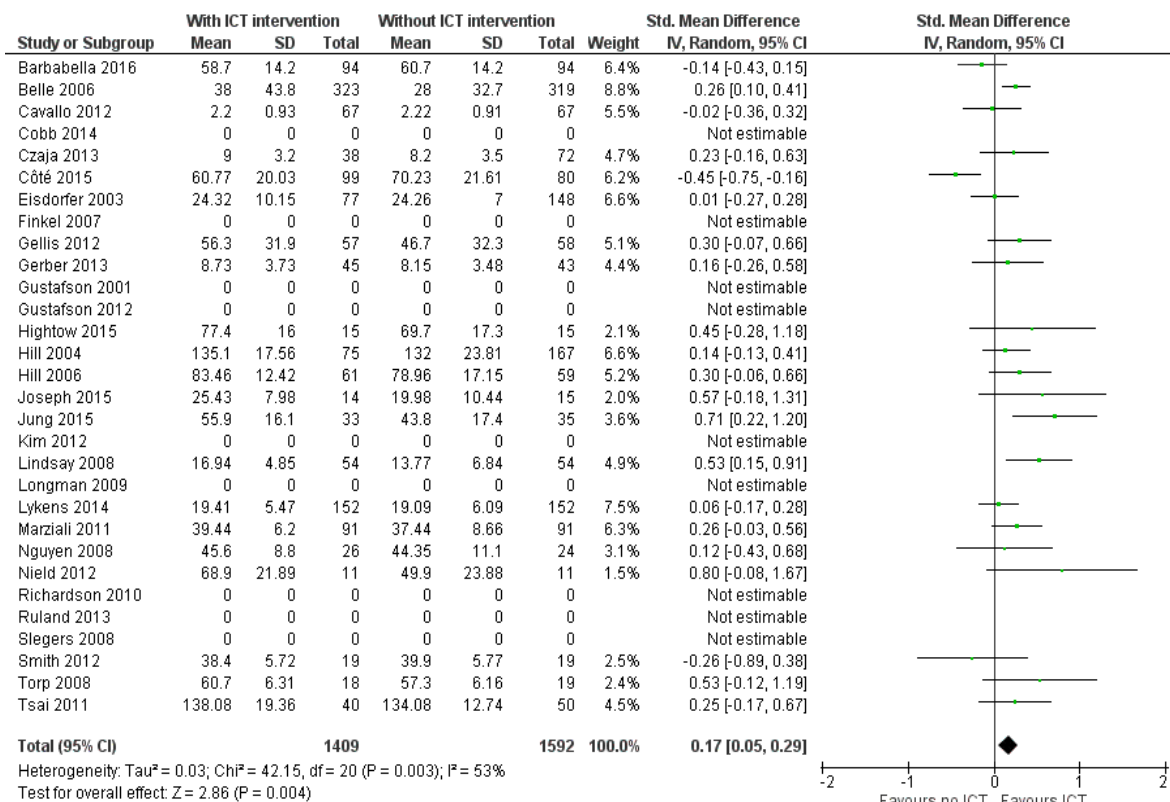


Figure 5. Forest plot of included studies

## 4.2 Impact of ICT on Social Support

The findings from figure 5 suggest that ICT intervention has a statistically significant, positive impact on social support measures ( $P = .004$ ). However, this result should be interpreted carefully as 53% of observed between-studies variance could be due to real differences in the effect size, rather than random error.

### 4.2.1 Lack of ICT Impact on Social Support

It would be helpful to discuss plausible explanations as to why seven studies reported no impact of ICT on social support measures. It appears the highest occurring limiting factor is the lack of proper control in order to limit the effect of intervention use in the study control group. All the studies in this review were investigating the effect of a certain ICT intervention on social support measures; however, some studies still administered some form of ICT intervention to participants in the control group. This was the case in [50] and [8] where both study groups had access to the website intervention, although the control group could only access educational features and were not invited to join the study's Facebook group (applies to [8]). In the same vein, [45] gave participants in its control group access to publicly-available, cancer-relevant Internet sites; even though the ICT intervention administered to experimental group participants is a Web-based application with social support

features. Giving the control group access to any form of the intervention under consideration could have unexpected effects on outcome measures.

The social support instrument used in [44] was a single-item unvalidated survey question designed to provide data to a message-tailoring algorithm and not to precisely measure social support. Social support is a multi-faceted concept which, arguably, cannot be sufficiently captured with a single question. An absence of randomization and presence of deep selection bias in [14] led to the formation of highly heterogeneous groups in terms of affective and cognitive variables, as the participants in the intervention group reported less perceived social support than those in the control group at baseline. Unsurprisingly, this between-group difference was also observed at follow-up.

The authors' suggestion for the slight decrease in social support by post-intervention in [4] is that being exposed to the intervention could have caused the caregivers to recognize the lack of adequate support received from family and significant others due to the website's provisions for information and support. This, in turn, could have stimulated a new appraisal of the caregiving situation which could have caused participants to rate social support received much lower than baseline measures. As this study had no control group, it is difficult to test the validity of this assumption.

The participants in [49] were fit older adults (between 64-75 years old) who were not yet limited in their physical, mental and social capabilities (as observed in many of the outcome variables). The authors intentionally chose elderly participants with the assumption that people at that age are usually retired from work and hence, would have enough time to participate in the study. This assumption could be wrong, given that participants had no functional limitations. Additionally, the ICT intervention administered was the Internet. The use of Internet alone for health promotion may be more valuable to people with a chronic illness or susceptible to poor health [34]. The participants in this study had no chronic illness and the eligibility criteria ensured they were not susceptible to poor health at the time of joining the study. These factors could account for the non-positive impact reported in this study, even though the study was properly controlled.

#### **4.2.2 Insignificant Impact of ICT on Social Support**

The reasons for insignificant impact of ICT on social support discovered include lack of proper control for intervention effect [18, 27], insignificant intervention utilization [21, 41], limitations in outcome measure tool [12, 53], and high attrition rate [36]. Interestingly, the collective participant attrition rate for studies in this category is 41.14%, which is substantially higher than the collective rate for studies in the other two categories. Attrition or participant drop-out occurs for different reasons; it could occur as a result of illness, death, inability to re-contact participants, failure of the participant to return survey response, or withdrawal of the participant from the survey [57]. The occurrence of drop-out or attrition in studies can deteriorate generalizability of study results and affect study outcomes. However, there are cases where attrition is not necessarily viewed as a negative occurrence. For instance, if an application is designed to help the user achieve a change in health behaviour(s), attrition is considered a positive occurrence if users drop out when they become less dependent on the application and eventually reduce or stop using it because it has achieved its goal.

The ICT technology administered by [21] was not utilized as planned; 47% of the participants in the intervention group did not engage in DVR (video telehealth) viewing. Participants did not also utilize the opportunity to communicate with an instructor and other members of the intervention group via email. In [41], numerous significant technical difficulties and usability challenges were encountered with the Web and PDA tools used in the study which decreased participant engagement with the intervention. If participants did not engage properly with the intervention, it is clear to see how their social support measures might not significantly increase by follow-up.

Participants in the control group of [18] and [27] received support via a form of ICT intervention (telephone) different from that administered to participants of experimental group. Receiving such support could have influenced the outcome measures. Post-intervention measures for participants who dropped out in [36] were not available; this is particularly important because participant attrition for this study is 64.17%.

In addition to having a high attrition rate of 39%, the social support measure used in [53] computed total social support values as a summation of values for emotional, instrumental, informational, and appraisal support collected via the questionnaire. This could have affected the total social support value as only emotional and appraisal support increased by post-intervention, as family members could be limited in providing proper instrumental and informational support. The social support measure used in [12] is an abridged version of the original tool which captured questions that refer to accessibility of physically local support which might not be very useful in capturing social support received via the ICT intervention.

Most of the studies in this category are longitudinal studies which lasted for 6 months or more. Longitudinal studies are considered important in public health; but unfortunately the longer the follow-up period, the higher the tendency of participants to drop out [25]. Hence there is a possibility that the longer an ICT intervention is used, the less effect it could reportedly have on social support measures. Further research into this phenomenon is encouraged.

### 4.3 Further Work

With the current shift of healthcare from treatment to wellness, it is becoming increasingly relevant for individuals to learn how to prevent illness and diseases by practising preventive healthcare. And with the focus of healthcare in developed countries shifting to "well" individuals, it is more important now than before to understand how ICT can provide support needed to help individuals adopt healthy lifestyles - as healthy individuals might have less motivation to use health-related applications. Hence, we recommend that more research is conducted to present more evidence on the role ICT plays in providing social support to individuals, irrespective of their susceptibility to poor health.

Also given that different cultural groups have preference for different sources of social support; it would be helpful to gain more knowledge on why these groups have these preferences and conduct research to test if these preferences could be fairly generalizable across the groups. For instance, [51] reports that individuals in minority groups exhibited greater preference for social support from family and friends as opposed to Caucasians who tended to rely more on support from media and health professionals than from family and friends.

With the rising popularity of instant messaging platforms such as WhatsApp and Snapchat, investigations could be conducted to ascertain how these platforms provide social support (informational and emotional) for individuals and staff in health and social care institutions. Also with the rapid development of ICT, it would be interesting to investigate how recent technology, such as virtual reality technology and headset, influences social support and health outcomes.

### 4.4 Limitations

This study presents results from randomized and non-randomized studies which can be interpreted as either a strength or a limitation. Its strength lies in its integration of various designs and methodologies to produce a single conclusive result. However, this makes it mandatory for the reader to carefully interpret the results as difference in study methodologies could have unprecedented effect on outcomes.

The limited number of electronic databases searched could be a limitation as some high-quality; relevant studies may have failed to be included in this review. Generalizability of the results could also be limited by the heterogeneous nature of the included studies. However, the choice of varying types of studies was intentional in order to give an overview of how ICT influences social support.

## 5. CONCLUSION

In this review paper, we have explored the impact of ICT on social support measures with reference to health and illness. It was discovered that the most effective ICT intervention on social support measures is social network while the use of Internet alone only seems to work with individuals who are susceptible to poor health. There is need for more literature on the effect of ICT on social support measures in health and social care. The sparse quantity of existing research papers could be a limitation in this study. However, this paper has added to the knowledge on the effect of ICT on social support by reviewing the available literature to present a conclusive result - there is promising evidence that ICT has a positive effect on social support measures. However, the degree of impact could depend on the nature of ICT intervention used and the physical well-being of the users.

## REFERENCES

- [1] Aitken M, Lyle J (2015). Patient Adoption of mHealth: Use, Evidence and remaining Barriers to Mainstream Acceptance. *Parsippany, NJ: IMS Institute for Healthcare Informatics*.
- [2] Åkesson KM, Saveman BI, Nilsson G (2007). Health Care Consumers' Experiences of Information Communication Technology – A Summary of Literature. *International Journal of Medical Informatics*, 76(9):633–645.
- [3] Ambinder EP (2005). A History of the Shift toward Full Computerization of Medicine. *Journal of Oncology Practice*, 1(2):54–56.
- [4] Barbabella F, Poli A, Andréasson F, Salzmann B, Papa R, Hanson E, Efthymiou A, Döhner H, Lancioni C, Civerchia P, Lamura G (2016). A Web-Based Psychosocial Intervention for Family Caregivers of Older People: Results from a Mixed-Methods Study in Three European Countries. *JMIR Research Protocols*, 5(4).
- [5] Barbee AP, Cunningham MR, Winstead BA, Derlega VJ, Gulley MR, Yankeelov PA, Druen PB (1993). Effects of Gender Role Expectations on the Social Support Process. *Journal of Social Issues*, 49(3):175–190.

- [6] Barrera M, Sandler IN, Ramsay TB (1981). Preliminary Development of a Scale of Social Support: Studies on College Students. *American Journal of Community Psychology*, 9(4):435–447.
- [7] Belle SH, Burgio L, Burns R, Coon D, Czaja SJ, Gallagher-Thompson D, Gitlin LN, Klinger J, Koepke KM, Lee CC, Martindale-Adams J (2006). Enhancing the Quality of Life of Dementia Caregivers from Different Ethnic or Racial Groups: A Randomized, Controlled Trial. *Annals of internal medicine*, 145(10):727–738.
- [8] Cavallo DN, Tate DF, Ries AV, Brown JD, DeVellis RF, Ammerman AS (2012). A Social Media–Based Physical Activity Intervention: A Randomized Controlled Trial. *American journal of preventive medicine*, 43(5):527–532.
- [9] Chaparro-Diaz L (2013). ICT as a Social Support Mechanism for Family Caregivers of People with Chronic Illness: A Case Study. *Aquichan*, 13(1):27–40.
- [10] Chen YRR, Schulz PJ (2016). The Effect of Information Communication Technology Interventions on Reducing Social Isolation in the Elderly: A Systematic Review. *Journal of medical Internet research*, 18(1).
- [11] Chogahara M (1999). A Multidimensional Scale for Assessing Positive and Negative Social Influences on Physical Activity in Older Adults. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, 54(6):S356–S367.
- [12] Cobb NK, Poirier J (2014). Effectiveness of a Multimodal Online Well-being Intervention: A Randomized Controlled Trial. *American journal of preventive medicine*, 46(1):41–48.
- [13] Cohen S, Mermelstein R, Kamarck T, Hoberman HM (1985). Measuring the functional components of social support. In *Social support: Theory, research and applications*, pages 73–94. Springer.
- [14] Côté J, Godin G, Ramirez-Garcia P, Rouleau G, Bourbonnais A, Guéhenec YG, Tremblay C, Otis J (2015). Virtual Intervention to Support Self-Management of Antiretroviral Therapy among People Living with HIV. *Journal of medical Internet research*, 17(1).
- [15] Craig SL, Calleja Lorenzo MV (2014). Can Information and Communication Technologies Support Patient Engagement? A Review of Opportunities and Challenges in Health Social Work. *Social work in health care*, 53(9):845–864.
- [16] Czaja SJ, Loewenstein D, Schulz R, Nair SN, Perdomo D (2013). A Videophone Psychosocial Intervention for Dementia Caregivers. *The American Journal of Geriatric Psychiatry*, 21(11):1071–1081.
- [17] de Jong-Gierveld J, Kamphuis F (1985). The Development of a Rasch-type Loneliness Scale. *Applied psychological measurement*, 9(3):289–299.
- [18] Eisdorfer C, Czaja SJ, Loewenstein DA, Rubert MP, Argüelles S, Mitrani VB, Szapocznik J (2003). The Effect of a Family Therapy and Technology-based Intervention on Caregiver Depression. *The Gerontologist*, 43(4):521–531.
- [19] Finkel S, Czaja SJ, Martinovich Z, Harris C, Pezzuto D, Schulz R (2007). E-care: A Telecommunications Technology Intervention for Family Caregivers of Dementia Patients. *The American journal of geriatric psychiatry*, 15(5):443–448.
- [20] Gellis ZD, Kenaley B, McGinty J, Bardelli E, Davitt J, Ten Have T (2012). Outcomes of a Telehealth Intervention for Homebound Older Adults with Heart or Chronic Respiratory Failure: A Randomized Controlled Trial. *The Gerontologist*, 52(4):541–552.
- [21] Gerber BS, Schiffer L, Brown AA, Berbaum ML, Rimmer JH, Braunschweig CL, Fitzgibbon ML (2013). Video Telehealth for Weight Maintenance of African-American Women. *Journal of telemedicine and telecare*, 19(5):266–272.
- [22] Gopalakrishnan S, Ganeshkumar P (2013). Systematic Reviews and Meta-analysis: Understanding the Best Evidence in Primary Healthcare. *Journal of family medicine and primary care*, 2(1):9.
- [23] Gustafson D, Wise M, Bhattacharya A, Pulvermacher A, Shanovich K, Phillips B, Lehman E, Chinchilli, V, Hawkins R, Kim JS (2012). The Effects of Combining Web-based eHealth with Telephone Nurse Case Management for Pediatric Asthma Control: A Randomized Controlled Trial. *Journal of medical Internet research*, 14(4):e101.
- [24] Gustafson DH, Hawkins R, Pingree S, McTavish F, Arora NK, Mendenhall J, Cella DF, Serlin RC, Apantaku FM, Stewart J, Salner A (2001). Effect of Computer Support on Younger Women with Breast Cancer. *Journal of general internal medicine*, 16(7):435–445.
- [25] Gustavson K, von Soest T, Karevold E, Røysamb E (2012). Attrition and Generalizability in Longitudinal Studies: Findings from a 15-year Population-Based Study and a Monte Carlo Simulation Study. *BMC Public Health*, 12(1):1.
- [26] Hightow-Weidman LB, Muessig KE, Pike EC, LeGrand S, Baltierra N, Rucker AJ, Wilson P (2015). HealthMpowerment.org Building Community Through a Mobile-Optimized, Online Health Promotion Intervention. *Health Education & Behavior*, 42(4):493–499.
- [27] Hill W, Schillo L, Weinert C (2004). Effect of a Computer-Based Intervention on Social Support for Chronically Ill Rural Women. *Rehabilitation Nursing*, 29(5):169–173.
- [28] Hill W, Weinert C, Cudney S (2006). Influence of a Computer Intervention on the Psychological Status of Chronically Ill Rural Women: Preliminary Results. *Nursing research*, 55(1):34.
- [29] Joseph RP, Keller C, Adams MA, Ainsworth BE (2015). Print versus a Culturally-Relevant Facebook and Text Message Delivered Intervention to Promote Physical Activity in African American Women: A Randomized Pilot Trial. *BMC women's health*, 15(1):1.
- [30] Jung H, Lee JE (2015). The Impact of Community-based eHealth Self-management Intervention among Elderly Living Alone with Hypertension. *Journal of telemedicine and telecare*, page 1357633X15621467.
- [31] Kendal S, Kirk S, Elvey R, Catchpole R, Prymachuk S (2016). How a Moderated Online Discussion Forum Facilitates Support for Young People with Eating Disorders. *Health Expectations*.

- [32]Kim S, Kim E, Cheon J, Chung S, Moon S, Moon K (2012). The Effectiveness of Home-based Individual Tele-care Intervention for Stroke Caregivers in South Korea. *International nursing review*, 59(3):369–375.
- [33]Lauckner H, Hutchinson S (2016). Peer Support for People with Chronic Conditions in Rural Areas: A Scoping Review. *Rural Remote Health*, 16:3601.
- [34]Lindsay S, Bellaby P, Smith S, Baker R (2008). Enabling Healthy Choices: Is ICT the Highway to Health Improvement? *Health*, 12(3):313–331.
- [35]Longman H, O'Connor E, Obst P (2009). The Effect of Social Support Derived from World of Warcraft on Negative Psychological Symptoms. *Cyber Psychology & Behavior*, 12(5):563–566.
- [36]Lykens K, Moayad N, Biswas S, Reyes-Ortiz C, Singh KP (2014). Impact of a Community Based Implementation of REACH II Program for Caregivers of Alzheimer's Patients. *PLoS One*, 9(2):e89290.
- [37]MacLehose R, Reeves B, Harvey I, Sheldon T, Russell I, Black A (1999). A Systematic Review of Comparisons of Effect Sizes Derived from Randomised and Non-randomised Studies. *Health technology assessment (Winchester, England)*, 4(34):1–154.
- [38]Martin S, Kelly G, Kernohan WG, McCreight B, Nugent C (2008). Smart Home Technologies for Health and Social Care Support. *Cochrane Database Syst Rev*, 4.
- [39]Marziali E, Garcia LJ (2011). Dementia Caregivers' Responses to 2 Internet-based Intervention Programs. *American Journal of Alzheimer's Disease & Other Dementias*®, 26(1):36–43.
- [40]Newcomb MD, Bentler PM (1986). Loneliness and Social Support: A Confirmatory Hierarchical Analysis. *Personality and social psychology bulletin*, 12(4):520–535.
- [41]Nguyen HQ, Donesky-Cuenco D, Wolpin S, Reinke LF, Benditt JO, Paul SM, Carrieri-Kohlman V (2008). Randomized Controlled Trial of an Internet-Based versus Face-to-Face Dyspnea Self-Management Program for Patients with Chronic Obstructive Pulmonary Disease: Pilot Study. *J Med Internet Res*, 10(2):e9.
- [42]Nield M, Hoo GWS (2012). Real-Time Telehealth for COPD Self-Management using Skype™. *COPD: Journal of Chronic Obstructive Pulmonary Disease*, 9(6):611–619.
- [43]Peplau LA, Cutrona CE (1980). The Revised UCLA Loneliness Scale: Concurrent and Discriminant Validity Evidence. *Journal of personality and social psychology*, 39(3):472–80.
- [44]Richardson CR, Buis LR, Janney AW, Goodrich DE, Sen A, Hess ML, Mehari KS, Fortlage LA, Resnick PJ, Zikmund-Fisher BJ, Strecher VJ (2010). An Online Community improves Adherence in an Internet-Mediated Walking Program. Part 1: Results of a Randomized Controlled Trial. *Journal of medical Internet research*, 12(4):e71.
- [45]Ruland CM, Andersen T, Jeneson A, Moore S, Grimsbø GH, Børøsund E, Ellison MC (2013). Effects of an Internet Support System to Assist Cancer Patients in Reducing Symptom Distress: A Randomized Controlled Trial. *Cancer Nursing*, 36(1):6–17.
- [46]Sallis JF, Grossman RM, Pinski RB, Patterson TL, Nader PR (1987). The Development of Scales to Measure Social Support for Diet and Exercise Behaviors. *Preventive medicine*, 16(6):825–836.
- [47]Sansoni J, Marosszeky N, Sansoni E, Fleming G (2010). Final Report: Effective Assessment of Social Isolation.
- [48]Sherbourne CD, Stewart AL (1991). The MOS Social Support Survey. *Social science & medicine*, 32(6):705–714.
- [49]Slegers K, Van Boxtel MP, Jolles J (2008). Effects of Computer Training and Internet Usage on the Well-Being and Quality of Life of Older Adults: A Randomized, Controlled Study. *The journals of gerontology series B: Psychological sciences and social sciences*, 63(3):P176–P184.
- [50]Smith GC, Egbert N, Dellman-Jenkins M, Nanna K, Palmieri, PA (2012). Reducing Depression in Stroke Survivors and their Informal Caregivers: A Randomized Clinical Trial of a Web-based Intervention. *Rehabilitation psychology*, 57(3):196.
- [51]Strom JL, Egede LE (2012). The Impact of Social Support on Outcomes in Adult Patients with Type 2 Diabetes: A Systematic Review. *Current diabetes reports*, 12(6):769–781.
- [52]Torp S, Hanson E, Hauge S, Ulstein I, Magnusson L (2008). A Pilot Study of how Information and Communication Technology may Contribute to Health Promotion among Elderly Spousal Carers in Norway. *Health & social care in the community*, 16(1):75–85.
- [53]Tsai HH, Tsai YF (2011). Changes in Depressive Symptoms, Social Support, and Loneliness over 1 Year After a Minimum 3-month Videoconference Program for Older Nursing Home Residents. *Journal of medical Internet research*, 13(4):e93.
- [54]Turner-McGrievy GM, Tate DF (2013). Weight Loss Social Support in 140 Characters or Less: Use of an Online Social Network in a Remotely Delivered Weight Loss Intervention. *Translational behavioral medicine*, 3(3):287–294.
- [55]Vaux A, Riedel S, Stewart D (1987). Modes of Social Support: The Social Support Behaviors (SS-B) Scale. *American Journal of Community Psychology*, 15(2):209–232.
- [56]Weinert C, Brandt PA (1987). Measuring Social Support with the Personal Resource Questionnaire. *Western Journal of Nursing Research*, 9(4):589–602.
- [57]Young AF, Powers JR, Bell SL (2006). Attrition in Longitudinal Studies: Who Do You Lose? *Australian and New Zealand journal of public health*, 30(4):353–361.
- [58]Zimet GD, Powell SS, Farley GK, Werkman S, Berkoff KA (1990). Psychometric Characteristics of the Multidimensional Scale of Perceived Social Support. *Journal of personality assessment*, 55(3-4):610–617.