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Web-based interventions on the resilience of informal caregivers: a systematic review and meta-analysis

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ABSTRACT

Informal caregivers play an increasingly important role in the provision of care services, especially for the ageing population. At present, the evidence on the resilience of the Internet to family caregivers is still limited. The purpose of this study was to evaluate the factors related to the resilience of the Internet to family caregivers. We searched retrieved randomized controlled trials (rct) of the effects of Internet interventions on resilience in informal caregivers from the beginning of the database to 1 November 2022. A preliminary search identified 3348 studies, 5 of which met the inclusion criteria. The studies involved 482 participants from four countries. Our results show that compared to the control group, internet intervention can effectively improve the resilience level of caregivers [SMD = 0.65, 95%CI(0.04, 1.26), $P \leq 0.05$]. In our study, Web-based interventions can significantly improve the adaptability of informal caregivers. In addition, our research also pointed out many resources that can be used, such as online learning, online answers and online psychological counseling provided for caregivers through the Internet, which can effectively reduce their burden of care and thus improve their resilience. In the future, these findings can be used to develop projects to improve the resilience of caregivers through personalized Internet intervention, so as to meet the care needs of patients.

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Internet; caregiver; resilience; psychological; meta-analysis

Introduction

With the aging of the population and the annual growth of the prevalence rate of chronic diseases (Wiederhold et al., 2013), most elderly patients with chronic diseases have weak health awareness, low ability to accept new knowledge, deterioration of body functions, reduction of memory and cognitive ability, and the daily management of patients with chronic diseases is complex, so the care of chronic diseases is a long-term and uninterrupted work (Li et al., 2020; Slev et al., 2016). Most patients choose to recuperate at home, mainly taken care of by their spouses, adult children or nannies. This group is called informal family caregivers (Geng et al., 2018; Sun et al., 2022). Most family caregivers support the intervention in a 'face to face' way, but the use effect does not meet the expectations (Lam & Lam, 2009). Especially in the COVID-19 pandemic period, patients with

chronic diseases were forced to reduce the opportunity to go out for medical treatment, and their disease care became a major task for family caregivers (Mitnick et al., 2010).

The process of disease care is considered to be one of the most stressful experiences, because family caregivers may face long-term problems in managing activities, behaviors and psychological conditions of daily life of chronic diseases (Drummond et al., 2019; Spigelmyer & Schreiber, 2019; Zamani et al., 2021), nursing and providing emotional support (Tatangelo et al., 2018; Zwingmann et al., 2018). In addition, improper nursing behavior will also lead to various behavioral and psychological problems of the nursing subjects (Jennings et al., 2015). However, due to the lack of supportive resources and disease related knowledge (Zarit et al., 2010), family caregivers have insufficient confidence in managing care (Nabuurs-Franssen et al., 2005). When their relatives have disease related behavior problems, need emotional support, and need to coordinate disease care (Luo et al., 2020; Peeters et al., 2010), they do not know what to do. Helping family caregivers improve their resilience is therefore likely to become an increasingly pressing social issue.

Family resilience refers to the positive behavior patterns and the ability to maintain normal operation of individuals and families under stressful situations, and is the feature and performance of promoting family recovery and becoming strong in crisis (Li et al., 2018; Palacio et al., 2020). Family resilience is not a static concept (Heathcote et al., 2021). It emphasizes the dynamic process of how families show their ability or advantages to cope with stress when facing adversity, and plays a decisive role in family stress adaptation (Miller-Graff et al., 2020; Ousey et al., 2015). As a family advantage, family resilience is of positive significance to family health and the growth and development of individual members (Lai et al., 2020), studies by Kim (Kim et al., 2018) and Whitehead (Whitehead et al., 2018) have shown that the burden of family caregiving for chronically ill patients negatively affects family adaptation, and that better family resilience is a key force in achieving good family adaptation. In the digital era, people obtain a large amount of health information from the Internet (Duggleby et al., 2019), providing new opportunities for disease management, and continuously and in real time increasing bilateral exchanges between medical personnel and patients inside and outside hospitals (van den Berg et al., 2016; Wasilewski et al., 2017). With the rapid development of information science and technology and the wide application of smart phones (Meichsner et al., 2019), mobile health care has gradually become a convenient and efficient health management monitoring tool. It has been recognized that the Internet is effective in providing health information to the public (Loughnan et al., 2019). In addition, Internet-based ACT has been reported to be promising in managing trauma-related anxiety, depression, chronic pain, and distress, as well as promoting caregiver mental health and psychological flexibility (Brown et al., 2016; Lappalainen et al., 2015), consistent with Kaltenbaugh's research (Kaltenbaugh et al., 2015).

The aim of this study is to summarize and critically explore the level of Internet-based interventions on caregiver resilience in published research to date and to identify ways in which Internet-based interventions can increase the level of caregiver resilience. Here, we present a systematic review to document the nature and extent of the literature related to the resilience of Internet interventions for informal caregivers, including levels and relevance, to provide a valuable scientific basis for health policymakers.

Material and methods

Meta-analysis was performed based on the general principles of the Cochrane Handbook for Systematic Reviews of Interventions (Becker & AD, 2011). The review was registered on PROSPERO (NO.CRD42022335820).

Search strategy

We systematically searched the literature concerning health literacy in cancer caregivers across six databases, CNKI, PubMed, MEDLINE, CINAHL, EMBASE and Web of Science between the establishment of the database and November 2022. Databases was systematically searched using free-text terms related to 'Internet' and 'resilience' and 'Caregivers'.

Selection criteria

All articles that describe a study specifically evaluating the resilience of the Internet to family caregivers are targeted. If the empirical articles (1) measure the resilience level of informal caregiver quantitatively, (2) include participants of any type of Internet intervention on family informal caregiver, (3) the publication language was limited to English or Chinese, and (4) design: randomized controlled trials (RCTs), they are eligible for inclusion. If (1) there is no clear concern about the impact of the Internet on informal caregivers' family resilience, or (2) the article does not describe empirical research (such as reviews, comments, editorials, etc.), these studies are excluded.

Data extraction

Titles and abstracts of identified articles from the searches were independently screened for eligibility by two reviewers (WJW and WM). Following this, the full texts of the remaining articles were subsequently sought and assessed for eligibility by the two reviewers according to the inclusion and exclusion criteria mentioned previously. Any discrepancies between reviewers' decisions were resolved through discussion and consensus or through the help of a third reviewer (YH).

Quality assessment

Two researchers (WJW and WM) used Cochrane 5.1.0 system (Li et al., 2020) evaluation manual to evaluate the bias risk, and checked the cross results. If there is any dispute, it shall be resolved through negotiation or agreed by the third researcher (YH).

Data analysis

Meta-analysis was performed using RevMan 5.3 software. Mean variance (WMD) combined effects were used for quantitative data of the same scale; standardized mean variance (SMD) combined effects were used for quantitative data of different scales. Estimates and 95% confidence interval (CI) are given for each effect size point. Heterogeneity was tested for each study. If $P > 0.1$ and $I^2 \leq 50\%$, a fixed-effects model

was used to combine data for analysis; if $P \leq 0.1$ and $I^2 > 50\%$, a random-effects model was chosen to combine effect sizes after analyzing the source of heterogeneity by sensitivity or subgroup analysis. If the source of heterogeneity still could not be determined, descriptive analysis was used. 95% confidence intervals were calculated for all analyses, and $P \leq 0.05$ was considered statistically significant.

Results

Search results summary

Following database searching, 1647 articles were identified for possible inclusion, as per Figure 1. Of these articles, 1325 were duplicates and were subsequently excluded. Upon initial screening of the abstracts of the remaining articles, it was determined that 1319 did not meet the inclusion/exclusion criteria. 56 articles were identified for full-text review. Of these fifty-six articles, only five studies fulfilled the necessary inclusion/exclusion criteria.

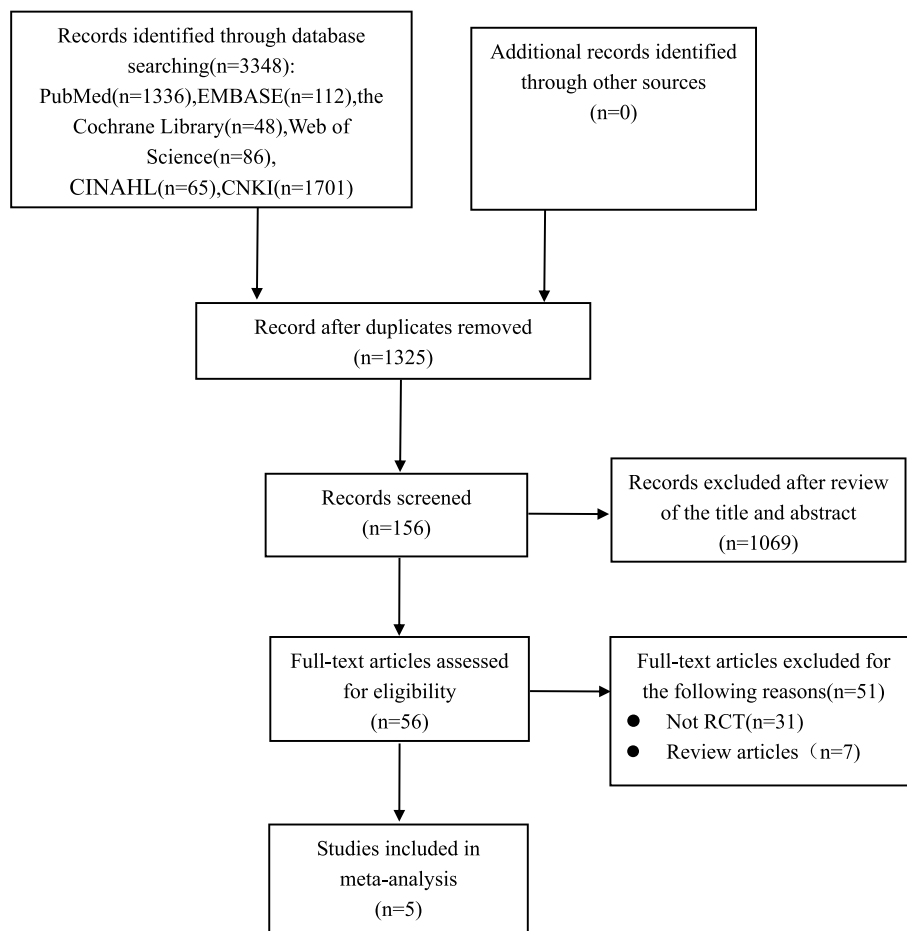


Figure 1. Flow diagram for search and selection of the included studies.

Characteristics of the included studies

Of the five identified articles, there were 482 family caregivers. The sample size ranged from 12 to 203, including caring for the following types of patients: amyotrophic Lateral Sclerosis (Sharbafshaaer et al., 2022), cancer (Köhle et al., 2021), congenital pseudarthrosis of tibia (Ouyang, 2021), and dementia (Pan et al., 2019). One article did not report the type of chronic disease (Vahabi et al., 2022). All studies were randomized controlled and published between 2019 and 2022. Two studies were conducted in China, one in Italy, one in Canada and one in the Netherlands. From the articles included, the caregivers are mainly women. Four studies were caregivers of family members, and one was home caregiver (Vahabi et al., 2022). The summarized characteristics of these studies are shown in Table 1.

Assessment quality of studies

Baseline surveys existed in 6 studies, of which 2 described the method of randomization (Pan et al., 2019; Vahabi et al., 2022), and the remaining studies only mentioned that the randomization bias was small; 1 study explained allocation concealment (Vahabi et al., 2022); In blinded settings, no studies dealt with blinding; All five studies explained or treated cases of loss to follow-up or withdrawals or treated statistically. Five studies reported on prespecified outcomes, no selective reporting of study results and other source biases were identified, and reporting bias was small. See Table 2.

Results of a meta-analysis

All five studies ($n = 482$) reported the mean and standard deviation of Internet based resilience to family caregivers. Because the included studies were evaluated on different

Table 1. Characteristics of the studies included.

Author	Country	Sample size (male/female)	Age (M/range)	Relationship	Type of internet measure used	Resilience measure used	Patient type most involved in care
Sharbafshaaer et al. (2022)	Italy	12(5/7)	56.81	Spouse/child	Individual tele-consults and resilience-oriented sessions	CD-RISC	Amyotrophic Lateral Sclerosis
Vahabi et al. (2022)	Canada	29	38.38	Live-in Caregivers	WE2CARE intervention based on ACT	MSMR-I	Not specified
Köhle et al. (2021)	Netherlands	203(60/143)	27–82 (55.89 ± 10.72)	Spouse/partner	Web-based intervention based on ACT	BRS	Cancer
Ouyang et al. (2021)	China	81(26/55)	30–40	Parent	Internet + follow-up platform	C-FRAS	Congenital pseudarthrosis of tibia
Pan et al. (2019)	China	158(59/99)	30–70 (45.46 ± 5.87)	Spouse/child/other	The Internet + health education	C-CD-RISC	Alzheimer

Table 2. Risk of bias summary in the included literature.

	Vahabi 2022	Sharbatshaer 2022	Ouyang Yaqi 2021	LI Pan 2019	Köhle 2021	
						Random sequence generation (selection bias)
						Allocation concealment (selection bias)
						Blinding of participants and personnel (performance bias)
						Blinding of outcome assessment (detection bias)
						Incomplete outcome data (attrition bias)
						Selective reporting (reporting bias)
						Other bias

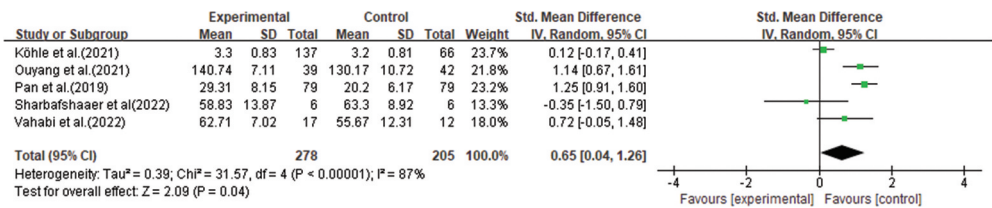


Figure 2. The influence of Internet on the resilience of caregivers.

scales, SMD was used to combine the results, showing huge heterogeneity between the studies [$I^2 = 87\%$, $P < 0.00001$], and a meta-analysis was conducted using a random effect model [SMD = 0.65, 95%CI (0.04, 1.26), $P \leq 0.05$]. The forest plots are shown in Figure 2.

Factors related to the elastic impact of the internet on family caregivers

The Internet has diversified its intervention in the resilience of family caregivers. It includes online learning for caregivers (app search, online video access to disease related care knowledge); Online answers (peer education, professional medical care and professional answers); Online psychological guidance (regular follow-up by medical staff and guidance by professional psychologists to relieve the pressure and burden of care), the results are shown in Table 3.

Online learning

Caregivers lack care skills in actual care (Fernandes et al., 2021). Most of the patients' diseases are chronic diseases, and the possibility of complete recovery is small (El Masry et al., 2013; Subih et al., 2020). Caregivers need more careful care. However, limited education and lack of

Table 3. Factors related to the elastic impact of the Internet on informal caregivers.

Study	Online learning	Online answers	Online psychological guidance
Sharbafshaaer et al. (2022)	Focus on the patient's physical, cognitive and behavioral functions and daily life through group video coaching sessions.	-	Personal remote counseling explores emotional and stress perceptions through caregivers. A practicing psychologist/ psychotherapist provided non directive support to informal caregiver through empathic/ reflective listening and open questioning.
Vahabi et al. (2022)	WE2CARE intervention includes six e-learning modules, which explain the process of ACT.	Every week, participants are invited to complete an online self guidance and interactive experience meeting on ACT strategy (about 1 hour), and participate in a 1.5 hour online video conference (using ACT strategy, including group discussion, peer sharing, questions and answers).	-
Köhle et al. (2021)	Key overview, basic theory, and example exercises for each web-based module.	Web based peer support options: Participants can share answers about the exercise with other participants, they can exchange skills, or they can contact other participants in a private email conversation.	Web based modules include psychological education, psychological and meditation exercises such as inspirational text/poetry, as well as (optional) weekly SMS services and short motivational SMS.
Ouyang et al. (2021)	The contents of the science popularization and education module based on the Internet platform (medical knowledge of diseases, health guidance and related rehabilitation videos for children requiring surgery).	Communication based on the Internet platform (you can consult the doctor in charge and the responsible nurse about the patient's condition and home care precautions through the platform, and learn about the patient's situation through follow-up and give answers).	Based on the Internet platform, give the disabled people optimistic inspirational videos based on narrative education and reduce the pressure through mindfulness training videos, breathing meditation training and other audio.
Pan et al. (2019)	A WeChat group was established, and seven experts and informal caregiver were on duty in turn. Through WeChat, they timely provided relevant knowledge of Alzheimer's disease and the latest effect of current treatment and nursing, and sent basic nursing operation process videos to enable them to correctly master the operation technology.	For caregivers who have related questions, set specific time to answer questions, effectively provide help for caregivers through the network, and timely solve relevant questions of caregivers.	When the caregivers have psychological problems, they should listen to the caregivers patiently online and give different psychological care according to different psychological conditions. They can encourage the caregivers to face the changes of patients' conditions correctly and build confidence by implementing music, supporting psychology, cognitive existence and other therapies.

Note: NR.

professional knowledge and skills make caregivers have low awareness of the patients' diseases and lack of care experience (Köhle et al., 2021; Ouyang, 2021). The five studies all acquired disease related care knowledge through Internet, such as audio, video conference teaching, online search, etc. to achieve the purpose of care.

Online answers

During the period of novel coronavirus, offline medical care has been unable to meet people's needs. With the popularity of smart phones, tablets, etc., it has become normal to use network tools for medical consultation and health education (Vahabi et al., 2022). It can provide efficient health guidance, etc., without location restrictions, with more rich content, and easier channels, and it also helps to help patients with chronic diseases recover quickly (Bajjani-Gebara et al., 2019; Margolis et al., 2013; McManus et al., 2021). Four studies (Köhle et al., 2021; Pan et al., 2019; Vahabi et al., 2022) conducted remote disease consultation and discussion through Internet platform, including video conference and platform communication, and professional medical personnel answered questions and answered questions for them, or obtained nursing experience through peer education to reduce the burden of care, so as to improve resilience.

Online psychological guidance

Due to the lack of proper professional care knowledge and skills, caregivers may encounter many problems and challenges when caring for patients with long-term, chronic and complex problems (Spigelmyer & Schreiber, 2019; Yilmaz et al., 2019). Caregivers are prone to bear some burden on their physiology, psychology, social, economic and other aspects in the process of taking care of patients for a long time, which makes their mental health level and quality of life significantly lower than that of normal people. In the four studies (Köhle et al., 2021; Ouyang, 2021; Pan et al., 2019; Sharbafshaaer et al., 2022), professional psychologists provided psychological education and answered psychological questions through online remote consultation. With online music therapy and mindfulness training as a supplement, it can reduce their psychological burden and pressure of care, thus increasing resilience.

Discussion

With the change of medical model and the support of national policy on Internet medical development, it has become a development trend for family caregivers to obtain care knowledge (Li & Loke, 2014), compared with traditional health education, health education on the Internet mainly enables caregivers to receive targeted health education through the Internet and multimedia in different places and at different times without restriction, guides caregivers to learn relevant skills, and helps caregivers to judge the patient's disease status, thus contributing to the physical and mental health of caregivers (Calvillo-Arbizu et al., 2021; Davidson et al., 2021).

Internet intervention effective in increasing resilience of informal caregivers

The results of this study showed that the Internet intervention had a positive effect on the resilience of informal caregivers compared to the control group (Vahabi et al., 2022), consistent with the findings of Luangphituck (Luangphituck et al., 2023). The likely reason for this is that this intervention highly motivates participants to work together to build a social support network, which in part improves caregiver self-efficacy and mental health and resilience, thereby reducing the burden of caregiving (Cangelosi et al., 2021;

Mieronkoski et al., 2017), and levels of disease knowledge, anxiety and depression are often associated with caregiver burden. Compared to the most recently published systematic evaluation of Internet interventions, our findings show lower levels of resilience among informal caregivers (Dedzoe et al., 2023). This variation may be explained by the characteristics of the care recipient, the duration and intensity of care, the employment status of the caregiver, and the nature of the caregiver's relationship with the care recipient.

The research shows (Ouyang, 2021) that the resilience level of caregivers increases with the progress of the intervention time. The possible reason is that the study used the Internet plus follow-up platform to carry out a three-month continuous psychological intervention on the intervention objects. This process is conducive to helping the intervention objects establish their psychological recovery ability with newer individuals, thus promoting the improvement of family resilience (Page et al., 2021). It is the result of time effect, intervention effect and interaction between the two. A combination of Internet-based use of individual self-directed online learning and group videoconferencing allows for peer-to-peer connections, and online group videoconferencing provides opportunities for marginalized groups, such as temporary foreign workers, to connect and engage in social action to challenge existing exploitative policies and practices and achieve equity (Vahabi et al., 2022).

Factors related to the elastic impact of the Internet on family caregivers

Sharbafshaaer have shown that the level of disease knowledge may be related to the burden of caregivers (Sharbafshaaer et al., 2022), while resilience is negatively related to the burden of care (Duggleby et al., 2019). Compared with offline knowledge acquisition, internet based continuous care can effectively reduce the burden of family caregivers (Vahabi et al., 2022). The reason may be that this method is more comprehensive and personalized through effective education through the Internet (Fitryasari et al., 2018), and caregivers can get timely and effective answers to their problems. Sustainability can consolidate disease related knowledge, so as to more effectively strengthen patient disease management (Deen et al., 2013). Providing targeted health education at anytime and anywhere makes the communication between caregivers and patients more direct and effective, which makes up for the lack of resources in traditional chronic disease management in hospitals and conforms to the needs of the development of the times (Ouyang, 2021). This not only improves the quality and efficiency of medical services, but also promotes the interaction between medical staff and patients and caregivers, which helps to cultivate a harmonious doctor-patient relationship and becomes another important way for patients and caregivers to obtain support (Köhle et al., 2021; Loughnan et al., 2019).

The two studies (Köhle et al., 2021; Vahabi et al., 2022) adopted online ACT intervention model. The results showed that this intervention highly encouraged caregivers to participate in the establishment of social support networks, and improved their mental health and resilience to a certain extent (Vahabi et al., 2022). Compared with the control group, the intervention group increased the absorption and use of mindfulness strategies. Mindfulness is related to the concern and continuous participation in positive and negative experiences, rather than avoiding internal negative experiences. Accepting

a person's life experience is a core action process, which allows people to accept negative thoughts and feelings without being described by them, which in turn promotes their self-esteem and resilience. And research shows that through online ACT, more peer support is obtained, so that participants have the ability to expand their social network, and their resilience and coping ability are improved.

Limitations

There are still some limitations in this study. On the one hand, in terms of search sources, although we attempted to improve the search strategy by searching multiple databases using relevant keywords and consulting academic librarians, we inevitably missed some literature, especially relevant research conference proceedings published by non-governmental organizations. On the other hand, as far as the analytical method of literature search is concerned, this study did not conduct a comparative analysis of the literature across time, which to a certain extent could not comprehensively reveal the technological and socio-cultural influences of Internet interventions on the resilience of informal caregivers. In the future, the introduction of knowledge mapping can be considered to map and analyze the themes of the literature at different stages.

Conclusion

The present study shows that the Internet can significantly improve the adaptive capacity of family caregivers. In addition, our study points out many resources that can be used, such as online learning, online answers and online counseling for caregivers through the Internet can be effective in increasing their resilience and thus reducing their caregiving burden. Therefore, these findings can be used in future development programs and will be effective in increasing the resilience of family caregivers. In addition, future research could focus on the duration and frequency of online learning and communication between caregivers to provide caregivers with more appropriate and individualized interventions to meet the patient's care needs.

Authors' contributions

Wu designed the study. Yan and Wang conducted literature research, selection and quality appraisal. Wu wrote the first draft. Yan and Wang revised it critically for important intellectual content.

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