that affect chronic diseases occurrence include lifestyles such as lifestyles such as WHO’s publication on global health risks, behavioral risk factors prevented and treated by managing lifestyles [2,4 important to prevent and manage chronic diseases.

Introduction

According to 2008 statistics released by WHO, noninfectious diseases account for 63% of all causes of death in the world. In particular, chronic diseases such as cardiovascular diseases (48%), cancers (21%), chronic respiratory diseases (12%), and diabetes (3.5%) are the main culprits [1]. Chronic diseases such as these are costly to manage [2]. As a result, it is becoming increasingly important to prevent and manage chronic diseases.

A number of studies have shown that chronic diseases can be prevented and treated by managing lifestyles [2,4–6]. According to WHO’s publication on global health risks, behavioral risk factors that affect chronic diseases occurrence include lifestyles such as smoking, lack of physical activity, unhealthy diets, and excessive alcohol consumption [7]. Clinical practice guidelines for chronic diseases such as obesity, hyperlipidemia, hypertension, and diabetes, also include lifestyle changes as an indispensable part of the primary treatment [8,9].

Work continues to be done in search of effective intervention methods that can bring about lifestyle changes [10]. Tailored interventions—defined as “any combination of strategies and information intended to reach one specific person, based on characteristics that are unique to that person, related to the outcome of interest, and derived from an individual assessment” [11]—are one such method. In tailored interventions, the needs and abilities of the client can be assessed through preliminary evaluation of individual characteristics, and tailored feedback can be provided based on the primary evaluation. In turn, the clients can be motivated if they perceive the tailored feedback is appropriate for them, and the efficacy of the intervention is increased as they perceive that they are participating in the process of intervention [12,13].

Purpose: The transtheoretical model (TTM) was used to provide tailored nursing for lifestyle management such as diet, physical activity, and smoking cessation. The present study aims to assess the provision of intervention delivery methods, intervention elements, and stage-matched interventions, in order to identify ways in which information technology is used in the TTM-based research.

Methods: The relevant literature was selected by two researchers using inclusion criteria after searching for “TTM (transtheoretical or stage of change)” and “nursing” from the databases PubMed and CINAHL. The selected studies were categorized in terms of study characteristics, intervention delivery method, intervention element, and use and level of stage-matched intervention.

Results: A total of 35 studies were selected including eight studies that used information communication technology (ICT). Nine different intervention delivery methods were used, of which “face-to-face” was the most common at 24 times. Of the 35 studies, 26 provided stage-matched interventions. Seven different intervention elements were used, of which “counseling” was the most common at 27 times. Of all the intervention elements, tailored feedback used ICT the most at seven instances out of nine, and there was a significant difference in the rate of ICT usage among intervention elements.

Conclusions: ICT is not yet actively used in the TTM-based nursing interventions. Stage-matched interventions and TTM concepts were shown to be in partial use also in the TTM-based interventions. Therefore, it is necessary to develop a variety of ways to use ICT in tailored nursing interventions and to use TTM frameworks and concepts.

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interventions are increasingly researched and used, in line with the recent developments in information technology and related theories [14].

The collection of client information necessary for tailored interventions and the provision of interventions themselves have expanded from face-to-face interactions and telephone conversations to computer programs, websites, email, and short message service (SMS) [15,16]. Web sites and mobile applications allow automated collection of client information which can then be used to formulate more personalized interventions [17]. In addition, the use of information communication technology (ICT) in intervention provision makes it possible to apply multiple intervention elements, such as education, feedback, and self-monitoring at once [18]. It also increases the deliverability of information by providing the content in various media such as sound, video and animation, and promotes the efficacy of attention and understanding by repeatedly conveying the same information [15,17]. The effectiveness of tailored interventions using ICT has been established by various studies [18,19].

Many health behavior theory concepts, such as stages of change from the transtheoretical model (TTM), self-efficacy from social cognitive theory, perceived susceptibility from the health belief model, and attitudes, social norms, and behavioral intentions from the theory of reasoned action and planned behavior, are used as strategies for tailoring in order to determine the direction of assessment and intervention [10,14,20]. Of these, the stages of change from the TTM are the most frequently used in tailored interventions targeting lifestyle change [20].

The core concepts of the TTM are stages of change, processes of change, decisional balance, and self-efficacy [21]. “Stages of change” is the process in which the individual adopts positive behavior in five stages, precontemplation, contemplation, preparation, action, and maintenance. The individual’s cognitive and behavioral levels differ from stage to stage. TTM-based tailored interventions are delivered by first identifying the individual’s stage of change regarding willingness to change lifestyle and the degree of lifestyle changes, during the assessment process. Based on the assessment results, the concepts of the processes of change, decisional balance, and self-efficacy are differently arranged so that stage-matched interventions can be delivered [22]. TTM-based tailored interventions have been used for smoking cessation, physical activity, and recovery from drug addiction, and studies continue to be published demonstrating their positive effects [23–25].

As can be seen, tailored interventions using the ICT and various behavioral theories, especially the TTM, are in wide use as well as studied and published. However, there have been no studies published regarding the use of tailored interventions that take both ICT and the TTM into account. With this background, it is necessary to understand the use and type of ICT in TTM-based tailored interventions, what intervention elements are used, and whether it affects level of stage-matched interventions according to use of ICT.

Thus, in the present study, we aim to conduct a systematic review of TTM-based nursing interventions used for diet, physical activity, and smoking cessation management. We would like to determine whether or not ICT was used as an intervention delivery method, which intervention elements were used, whether or not each intervention qualifies as a stage-matched intervention, and the relationships of use of ICT with stage-match and intervention elements.

Methods

Design

We conducted a systematic review according to the guidelines of the Centre for Reviews and Dissemination [26] to perform a descriptive synthesis of TTM-based nursing interventions that were applied to diet, physical activity, and smoking cessation management.

Study process

The study process consisted of four steps, including search strategy, study selection, data extraction, and data synthesis.

Search strategy

We searched from the two most popular literature databases (PubMed, CINAHL) for literature in nursing from February to March 2013. The search keywords used to retrieve articles on TTM-based nursing interventions were “nursing”, “transtheoretical model”, “stage of change” and “TTM” based on the works of Spencer et al. [24], Ficke and Farris [27]. Language was limited to English, but publication date was not limited.

Study selection

Two researchers reviewed all searched literature using inclusion and exclusion criteria. First, in total, 250 studies were identified from the search. Second, studies that did not use randomized controlled trials or quasi-experimental studies, or those that were not involved with lifestyle changes (diet, physical activity, and smoking cessation) were excluded. This left 43 studies. Third, two researchers reviewed the full text of the 43 studies selected during the first step, and found that eight research groups had published two papers from the same intervention studies at different times on different clients. As the main focus of the present study is the interventions used, we decided to include the eight most recently published papers from the same study groups and exclude the eight older papers. For this study, 35 papers were finally identified as shown in Figure 1.

Data extraction

Two researchers reviewed the full text of 35 papers. They collected and coded the information on target lifestyle problem, study subject, study design (number of groups), year of publication, intervention delivery method, use of stage-matched intervention and intervention element. Any discrepancies during the coding process were resolved by reaching a consensus between the two researchers.

Data synthesis

Descriptive analysis was performed on the data extracted from each study. First, we categorized the intervention studies by study characteristics such as target lifestyle problem, study subject, study design and year of publication. Second, we categorized the intervention studies by intervention delivery methods used and further categorized whether ICT was used as an intervention delivery method. Third, we categorized the intervention studies according to whether the stage of change was identified during the assessment phase, whether tailored intervention was provided based on identified stage of change during the intervention phase, and whether the stage of change was assessed during the evaluation phase. In addition, we categorized the intervention studies by the types of the other TTM concepts used rather than the stages of change during the intervention phase. Fourth, we categorized the intervention studies by the intervention elements used in each study based on the criteria used in the previous study [18] (Table 1). Lastly, we examined the relationships of use of ICT as an
intervention delivery method with stage-match and intervention elements. The results were presented either in tables or figures.

**Results**

We analyzed the 35 selected studies in terms of study characteristics, intervention delivery method, use of stage-matched intervention, and intervention element (Table 2).

**Study characteristics**

Of the 35 studies, the most popular target problem was smoking cessation with 15 interventions followed by physical activity with 12 interventions. Eighteen interventions targeted adults (one pregnant woman), 5 targeted students, and 12 targeted patients. Of the studies targeting patients, two were for endocrinology, three for cardiovascular, three for respiratory, and four for musculoskeletal patients. Fourteen studies were conducted as randomized controlled trials, and 21 were conducted as quasi-experimental studies. All 35 studies were published between 2000 and 2013, with the highest number of 11 published in 2008 (31.4%) (Table 3).

**Intervention delivery method**

We categorized intervention delivery methods used in the studies into websites, computer programs, SMS, email, face-to-face, phone, etc. (Table 1).

<table>
<thead>
<tr>
<th>Intervention element</th>
<th>Definition</th>
<th>Instance in present study</th>
</tr>
</thead>
<tbody>
<tr>
<td>Education</td>
<td>Providing information related to improving lifestyle management concerning diet, exercise, and smoking cessation</td>
<td>Interventions already planned for each stage of change; clients who fall under each stage are provided with the same information</td>
</tr>
<tr>
<td>Tailored feedback</td>
<td>Providing personalized information based on data collected from the individual</td>
<td>Client’s stage of change is measured during initial assessment phase; relevant information on lifestyle management is provided</td>
</tr>
<tr>
<td>Self-monitoring</td>
<td>Making regular records of the type and amount of food eaten, the type and amount of physical activity performed, and the amount of tobacco smoked</td>
<td>Tailored information is provided according to collected information other than the stage of change</td>
</tr>
<tr>
<td>Goal setting</td>
<td>Setting goals for oneself regarding lifestyle management</td>
<td>Information provided differs according to conversation with the client</td>
</tr>
<tr>
<td>Personalized program service</td>
<td>Providing personalized diet and physical activity programs appropriate to the client’s circumstances</td>
<td></td>
</tr>
<tr>
<td>Counseling</td>
<td>Getting one-on-one counseling on lifestyle management with a medical expert or researcher</td>
<td></td>
</tr>
<tr>
<td>Community</td>
<td>Fostering communication among clients with the same problem</td>
<td></td>
</tr>
<tr>
<td>No.</td>
<td>Author</td>
<td>Target problem</td>
</tr>
<tr>
<td>-----</td>
<td>--------</td>
<td>----------------</td>
</tr>
<tr>
<td>1</td>
<td>McNeill et al. [44]</td>
<td>Physical activity</td>
</tr>
<tr>
<td>2</td>
<td>Aveyard et al. [29]</td>
<td>Smoking</td>
</tr>
<tr>
<td>3</td>
<td>Hahn et al. [45]</td>
<td>Smoking</td>
</tr>
<tr>
<td>4</td>
<td>Kim &amp; Kang [46]</td>
<td>Physical activity, dietary</td>
</tr>
<tr>
<td>5</td>
<td>Cornacchione &amp; Smith [47]</td>
<td>Smoking</td>
</tr>
<tr>
<td>6</td>
<td>Huang et al. [31]</td>
<td>Physical activity</td>
</tr>
<tr>
<td>7</td>
<td>Fritz et al. [48]</td>
<td>Smoking</td>
</tr>
<tr>
<td>8</td>
<td>Frenn et al. [49]</td>
<td>Physical activity, dietary</td>
</tr>
<tr>
<td>9</td>
<td>Pantaewan et al. [50]</td>
<td>Smoking</td>
</tr>
<tr>
<td>10</td>
<td>Perry &amp; Butterworth Karatay et al. [52]</td>
<td>Physical activity, smoking</td>
</tr>
<tr>
<td>11</td>
<td>Beckie &amp; Beckstead [53]</td>
<td>Physical activity</td>
</tr>
<tr>
<td>12</td>
<td>Paradis et al. [54]</td>
<td>Physical activity, dietary</td>
</tr>
<tr>
<td>13</td>
<td>Daley et al. [55]</td>
<td>Physical activity</td>
</tr>
<tr>
<td>14</td>
<td>Ergul &amp; Temel [56]</td>
<td>Smoking</td>
</tr>
<tr>
<td>15</td>
<td>Fernandez et al. [57]</td>
<td>Physical activity, dietary, smoking</td>
</tr>
<tr>
<td>16</td>
<td>Resnick et al. [58]</td>
<td>Physical activity</td>
</tr>
<tr>
<td>17</td>
<td>Erol &amp; Erdogan [38]</td>
<td>Smoking</td>
</tr>
<tr>
<td>18</td>
<td>Leonhardt et al. [59]</td>
<td>Physical activity</td>
</tr>
<tr>
<td>19</td>
<td>Wilson et al. [28]</td>
<td>Smoking</td>
</tr>
<tr>
<td>20</td>
<td>Andersson [60]</td>
<td>Smoking</td>
</tr>
<tr>
<td>21</td>
<td>Clouinard &amp; Robichaud-Ekstrand Niederhauser et al. [61]</td>
<td>Smoking</td>
</tr>
<tr>
<td>22</td>
<td>Fahrenwald et al. [62]</td>
<td>Physical activity, dietary, smoking</td>
</tr>
<tr>
<td>23</td>
<td>Jonsdottir et al. [63]</td>
<td>Physical activity</td>
</tr>
<tr>
<td>24</td>
<td>Dejong &amp; Veltman [64]</td>
<td>Physical activity</td>
</tr>
<tr>
<td>25</td>
<td>Purath et al. [32]</td>
<td>Physical activity</td>
</tr>
<tr>
<td>26</td>
<td>Ott et al. [40]</td>
<td>Physical activity</td>
</tr>
</tbody>
</table>
group, phone calls, mail and written materials. In the 35 studies, such methods were used for a total of 69 times. Face-to-face interventions were the most frequently used at 24 times, then phone calls at 13, then written materials at 11 (Table 4). There were 23 cases with two or more delivery methods used, and there was a study with a maximum of four delivery methods used.

According to the criteria proposed by Lau et al. [15], we categorized the intervention studies as use of ICT if websites, computer programs, SMS, or emails were used at least once. Of the 35 interventions, 8 were shown to have used ICT. Four of these eight also used non-ICT methods (face-to-face, phone calls, written materials) in conjunction (Table 2). ICT used for different targeted lifestyle is presented in Table 4.

**Use of stage-matched intervention**

Of the 35 studies, 34 identified the client's stage of change information during the assessment phase. Of the 34 studies that identified the stage of change, 26 provided tailored interventions based on identified stage of change during the intervention phase and 8 provided the same interventions regardless of stage of change. Of the 26 studies that provided tailored intervention, 19 evaluated the effect of intervention by reassessing the stage of change and 7 did not. Of the eight studies that provided the same interventions regardless of stage of change, seven evaluated the effect of intervention by reassessing the stage of change and one did not. One study did not identify the stage of change either in the assessment or evaluation phases. However, it provided intervention using the concept "process of change" during the intervention phase. We classified interventions as stage-matched interventions if the stage of change was identified during the assessment phase, then tailored intervention was provided according to the identified stage. There were 26 stage-matched interventions (Figure 2).

If a stage-matched intervention was planned for all five stages—precontemplation, contemplation, preparation, action, and maintenance, then we categorized it as an all stage-matched intervention. If it was only planned for certain stages, we categorized it as partially stage-matched. Of the 26 stage-matched interventions, 24 were all stage-matched and 2 were partially stage-matched (Table 4). If the same intervention was provided regardless of the stage of change, we categorized it as no stage-matched. There were nine no stage-matched interventions.

Of the 26 stage-matched interventions, 12 made reference to the use of other TTM concepts (processes of change, decisional balance, and self-efficacy) rather than the stages of change. Of the 12 studies that used other TTM concepts, 3 used self-efficacy, 1 used process of change, 1 used decisional balance, 6 used self-efficacy as well as decisional balance, and 1 used self-efficacy, decisional balance and process of change.

**Intervention element**

The intervention elements provided by the 35 selected studies were categorized with the modified seven key elements of intervention used by Kuijpers et al. [18]. Counseling was the most frequently used intervention element at 27 times followed by education at 21 times, goal setting at 10 times and tailored feedback at 9 times. Intervention elements used for different targeted lifestyle are presented in Table 4.
Relationships of stage-match and intervention elements with use of ICT

We found that the 8 intervention studies used ICT as intervention delivery methods, and 27 did not. Of the eight studies that used ICT, five qualified as all stage-matched interventions, one as partially stage-matched intervention, and two were no stage-matched. Of the 27 cases that did not use ICT, 19 were all stage-matched interventions, 1 was a partially stage-matched intervention, and 7 were no stage-matched.

Table 5 shows intervention elements by use of ICT. Of all the intervention elements, tailored feedback used ICT the most at 7 instances out of 9, then education at 7 out of 25. This shows a significant difference in the rate of ICT usage among intervention elements.
elements. Tailored feedback showed the highest rate at 77.8%, then education, self-monitoring, goal setting, and community at between 16% and 28%, and personal training and counseling at 0%.

Interventions using websites were used in a variety of intervention elements such as education, tailored feedback, self-monitoring, and goal setting, but computer programs, email, and SMS were limited as auxiliary delivery methods for education and tailored feedback. ICT was not used for counseling and education. Goal setting, self-monitoring, and community interventions were primarily delivered face-to-face, through written material, or community methods (Table 5).

Discussion

There were 35 TTM-based nursing intervention studies for lifestyle management. Most frequent target lifestyles were smoking cessation management and physical activity management, with 15 and 12 instances of each, respectively. There were also five interventions for both physical activity and diet management and two for combined physical activity, diet, and smoking cessation management.

Use of ICT as intervention delivery method

Of the intervention delivery methods shown in the 35 studies, interventions with use of ICT include websites, computer programs, email, or SMS. Interventions without using ICT include group, face-to-face, phone calls, mail, or written materials.

Only 8 of the 35 studies (22.9%) used ICT, and there were more TTM-based interventions that did not use ICT than those using it. In studies on the efficacy of tailored interventions, such as Kuijpers et al. [18] and Lustria, Noar et al. [20] ICT was used frequently as intervention delivery methods. However, in the present study which limited its scope to the TTM-based interventions, methods that involve direct interaction between the researcher and the client such as face-to-face and phone calls were preferred instead. In particular, the face-to-face method was most frequently used for interventions aiming for more than one lifestyle management. As the number of target lifestyle increases, the use of ICT decreased.

Use of stage-matched intervention

Of the 35 TTM-based interventions studies, only 26 (74.3%) identified the stage of change during the assessment phases and provided stage-matched interventions accordingly in the intervention phase. In 8 of the 35 studies, the stage of change was identified during assessment phase but the intervention provided was not tailored by the stage of change. In the one remaining study, the stage of change was not identified during assessment or evaluation phases, however an intervention plan was formulated using other TTM concepts rather than stage of change. There were six studies comparing the outcome of the stage-matched intervention with that of no stage-matched intervention [28-33]. Findings from all of the studies except one [28] showed that the stage-matched intervention is more effective than no stage-matched intervention. For an intervention study to be qualified as a transtheoretical model-based intervention, it is not required either to identify the stage of change during assessment phase or to provide stage-matched interventions during intervention phase. However, it is recommended to follow the framework to maximize the effect of TTM-based intervention.

Although there were 26 studies that identified the stage of change before and after intervention, none of these studies reassessed the stage of change or provided new interventions based on the reassessed stage of change. In a study by Lustria et al. [20], there was no significant difference in the efficacy of multiple interventions provided after reassessment and of a single intervention. However, we need further studies on reassessing the stage of change regularly, providing new interventions, and measuring the outcomes.

Intervention elements

We categorized intervention elements according to the seven key elements of web-based physical activity intervention defined by Kuijpers et al. [18]. Counseling, education, goal setting, and tailored feedback appeared to be the most frequently used, at 77.1%, 60.0%, 28.6%, and 25.7%, respectively.

For smoking cessation management, counseling was the most frequently used, and personalized program service and self-monitoring were not used at all. However, Meeussen et al. [34] state that although self-monitoring has no significant relationship with successful smoking cessation, clients reported higher satisfaction when asked to record the amount of tobacco smoked, as well as when, where, and why smoking occurred. Therefore, self-monitoring may be considered positively as an intervention element for smoking cessation.

There were not many studies dealing with diet management alone, but interventions that include diet management as well as other lifestyles show that education is a frequently used intervention element, alongside counseling, tailored feedback, and self-monitoring. In recent studies on diet management, interventions using tailored feedback and counseling was reported to be effective in lifestyle management [35,36]. In particular, Hamel and Robbins [37] demonstrated in their review study that it is effective to provide tailored interventions using a theoretical

---

**Table 5** Intervention Element by Use of Information Communication Technology (ICT).

<table>
<thead>
<tr>
<th>Variable delivery method</th>
<th>Use of ICT</th>
<th>Education</th>
<th>Tailored feedback</th>
<th>Self-monitoring</th>
<th>Goal setting</th>
<th>Personal program service</th>
<th>Counseling</th>
<th>Community</th>
</tr>
</thead>
<tbody>
<tr>
<td>Website</td>
<td>4</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Computer program</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Email</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>SMS</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Subtotal</td>
<td>7</td>
<td>7</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>No use of ICT</th>
<th>Group</th>
<th>8</th>
<th>0</th>
<th>0</th>
<th>0</th>
<th>0</th>
<th>2</th>
<th>1</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Face-to-face</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>8</td>
<td>3</td>
<td>24</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Phone call</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>12</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Mail</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Written material</td>
<td>10</td>
<td>1</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Subtotal</td>
<td>18</td>
<td>2</td>
<td>3</td>
<td>8</td>
<td>5</td>
<td>37</td>
<td>5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. SMS — short message service.
frameworks. In the future, we could study the effectiveness of dietary programs providing tailored feedback and counseling using the TTM.

For physical activity management, counseling and education were the most frequently used, but other interventions were also variously used.

Relationships of stage-match and intervention elements with use of ICT

Stage-matched interventions were provided in 75.0% of the studies that used ICT in intervention delivery, and 74.1% of those that did not. ICT is more frequently used in the tailored feedback intervention element, but other elements hardly use ICT. Education and counseling intervention elements which uses interpersonal and interactive delivery methods such as face-to-face and phone calls were more popular in the TTM-based interventions.

Strategies for introducing ICT in the TTM-based interventions are as follows. In the TTM-based interventions, counseling was often conducted as a conversation with the intervention provider asking questions and the intervention recipient answering them, and many studies had pre-planned strategies and frameworks that determined the direction of the conversation according to the answers [38–40]. Therefore, converting the conversation strategies and frameworks into algorithms could bring about computer-based counseling, which would make cost-effective counseling possible [10].

For tailored feedback and self-monitoring, use of ICT would improve the convenience of input and speed of feedback. Lim et al. [41] have already demonstrated the efficacy of tailored information using SMS in chronic disease management, while Carter et al. [42] have shown that self-monitoring using mobile apps is more effective in adherence and weight management than using websites or paper. This presents a possibility of developing TTM-based interventions using mobile devices.

Pearson [43] has shown in a review study that goal setting is effective as an intervention element in obesity management. Therefore, it may be worthwhile considering the use of ICT in lifestyle management that allows the client to set goals and easily determine whether they have reached the goal.

As for the community intervention element, the recent popularity of social network service can facilitate awareness of health problems, seeking new information, and receiving the support and encouragement from those around the client. This promotes use of TTM concepts such as process of change and self-efficacy, and allows for a much greater effect than face-to-face intervention.

Although in the present study ICT was less often used in TTM-based interventions, ICT can be used in the future in tailored nursing interventions. If ICT is used for data collection in the assessment and evaluation phases, data will be collected in a more timely fashion. Also, the intervention can be tailored easily based on the data and provided timely. Also, use of ICT communication features such as video and animation will improve not only attention but also understanding of the learners [15,17].

In particular, intervention elements such as tailored feedback, self-monitoring, goal setting, and community may benefit greatly in TTM-based tailored intervention when mobile devices are used.

This study had several limitations. First, we limited literature search to studies published in the peer-reviewed journals from the two most popular health and nursing literature databases. Thus, the generalizability of our findings is limited due to exclusion of grey literature. Second, we focused on the TTM-based intervention itself and did not analyze the outcomes of TTM-based interventions in the study. Therefore, we recommend that future studies include grey literature and outcomes of TTM-based interventions.

Conclusion

The present study conducted a systematic review of TTM-based nursing interventions for lifestyle management in order to determine whether each study provides stage-matched interventions and what intervention types and delivery methods are being used. With this study we would like to identify how the TTM is being used in tailored nursing interventions for lifestyle management and seek directions for further development. As a result, we found that ICT is not yet widely used in TTM-based interventions. In addition, TTM-based interventions do not always provide stage-matched interventions.

In order to maximize the effect of tailored interventions in lifestyle management, we must identify the stage of change of the individual, provide interventions based on the stage of change. Furthermore, in order to collect client information and provide tailored interventions in a timely fashion, use of ICT, especially the use of mobile technology is recommended.

Conflicts of Interest

No potential conflict of interest relevant to this article was reported.

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References


