About half of the adverse events (AEs) among inpatients are associated with surgical procedures\[1,2\]. Surgical AEs are considered preventable in more than half of the cases (54 - 74%)\[1\]. Many interventions to increase perioperative patient safety address the health care process or the health care professional e.g., a surgical safety checklist\[3,4\].

Recently there has been more attention paid to the role patients can play regarding their own safety\[5\]. Patients are the only individuals physically present during every treatment and consultation. This makes them valuable to play a role in increasing the safety in their own care process \[6\]. Many initiatives are developed to promote patient participation aiming to improve their safety, for example “20 tips to prevent medical errors”\[7\] and the “speak up” initiative of the Joint Commission\[8\].

Health Foundation identified five categories of patient focused interventions that could enhance patient safety; viz by involving patients in improving infection-control, increasing adherence to treatment regime, inviting them to report adverse drug events, equipping them for safer healthcare and preventing wrong-site surgery\[5\].

Davis et al.\[9\] tried to identify 1Radboud University Medical Center, Department of Anesthesiology, Nijmegen, Netherlands 2Radboud University Medical Center, Radboud Institute for Health Sciences (RIHS), Scientific Institute for Quality of Healthcare, Nijmegen, Netherlands 3University Medical Center Groningen, Department of Anesthesiology, Pain Center, Groningen, Netherlands

Abstract
Importance: There is a growing interest in enabling ways for patients to participate in their own care to improve perioperative safety, but little is known about the effectiveness of interventions enhancing an active patient role.

Objective: To evaluate the effect of patient participation on perioperative safety.

Evidence review: We conducted a systematic review by searching the Cochrane, PubMed and EMBASE databases without a time limit for publications on the effect of patient-related interventions on perioperative safety. We included randomized controlled trials, quasi-experimental studies and cohort studies. The included studies were analyzed for type of intervention, safety outcomes, effects and quality.

Results: Thirteen studies were included: eight RCT’s, four cohort studies and one quasi-experimental study. All studies concerned a preoperative structured educational intervention on postoperative self-management activities of patients, such as everyday movements, coughing, getting out of bed or exercising. Safety outcomes were complications, in-hospital falls and mortality. Results from eleven studies indicate positive effects of such patient-related interventions.

Conclusion and relevance: Patients appear able to improve their perioperative safety by participating in preoperative structured educational programs about postoperative regimes. Educational programs on self-management activities should be integrated in the preoperative trajectory. Further research should address the most effective components and timing of education, explore other kinds of patient involvement and link the robustness of the intervention, e.g. in terms of behavior change, to perioperative patient safety outcomes.

Background

About half of the adverse events (AEs) among inpatients are associated with surgical procedures\[1,2\]. Surgical AEs are considered preventable in more than half of the cases (54 - 74%)\[1\]. Many interventions to increase perioperative patient safety address the health care process or the health care professional e.g., a surgical safety checklist\[3,4\].

Recently there has been more attention paid to the role patients can play regarding their own safety\[5\]. Patients are the only individuals physically present during every treatment and consultation. This makes them valuable to play a role in increasing the safety in their own care process\[6\]. Many initiatives are developed to promote patient participation aiming to improve their safety, for example “20 tips to prevent medical errors”\[7\] and the “speak up” initiative of the Joint Commission\[8\]. Some have tried to identify the ways for patients to improve their own perioperative safety. For example, the Health Foundation identified five categories of patient focused interventions that could enhance patient safety; viz by involving patients in improving infection-control, increasing adherence to treatment regime, inviting them to report adverse drug events, equipping them for safer healthcare and preventing wrong-site surgery\[5\]. Davis et al.\[9\] tried to identify...
all of the possible interventions for surgical patients that could
enhance their own safety: choosing a health care provider, un-
taking a smoking cessation program, asking questions about
recovery, and notifying staff when their wounds becomes infect-
ed. The timing of the intervention has been studied as well; Gil-
lis et al.[10] demonstrated that there was no significant difference
in complication rate between prehabilitation and rehabilitation.

Although literature demonstrates that there is a huge
interest in the potential for involving patients in promoting
their own safety, the benefits are still unclear[10,11]. Alcohol and
smoking cessation programs for which several systematic re-
views have been performed[12-16] have shown that preoperative
cessation decreases the risk of post-operative complications. We
therefore aimed to review the literature on the effect of other
patient-related interventions that stimulate an active role of the
patient to improve surgical patient safety and to generate rec-
ommendations with respect to the interventions that are proven
effective in increasing perioperative safety.

Methods

Data sources

We searched for English or Dutch published studies, using
the Cochrane Library, EMBASE and PubMed databases,
without publication year limitations. The references of the
included studies were manually checked to identify additional
relevant studies that were missed in the initial database search.
“Appendix 1” and “Appendix 2:” provides a detailed list of
search strings.

Selection of studies

Two authors (LH and HC) independently assessed in-
clusion eligibility of the studies by title and abstract. If there was
no abstract available only the title was assessed. Differences in
inclusion eligibility were solved by discussion. Full text articles
were retrieved for the eligible studies. The initial agreement of
the two authors on full text retrieval was 96.4%. For the fi-
nal selection full text copies were examined to determine wheth-
er they fulfilled the inclusion criteria. Disagreement was settled
by discussion with the third author (AW).

The studies had to meet four inclusion criteria. First,
the participants had to be surgical patients. Second, the study
needed to investigate the effect of interventions regarding ac-
tive involvement of patients, potentially with help of a health
care professional. Third, the outcome had to be related clearly to
safety and should be appropriately reported. Following the IOM
definition we described safety as the prevention of harm to pa-
tients[17]. We thus searched for safety outcomes such as adverse
events, medication errors and complications. Side effects such as
nausea, vomiting and difficulty to swallow were not considered
to be safety related and therefore excluded. Finally, the full text
had to be written in English or Dutch and should be available.
Studies addressing alcohol and smoking cessation programs
were excluded because of the availability of systematic reviews.
After evaluating the full text articles, a manual cross-reference
search of eligible articles obtained for full-text evaluation was
undertaken.

Quality assessment

The included full text articles were assessed for meth-
odological quality by LH and HC, disagreement was settled by
discussion. The Cochrane Groups pre-designed table[18] was
used and modified to ensure standardized scoring for all includ-
ed studies and to summarize their quality. The quality criteria in-
cluded randomization, allocation, blinding, similarity of groups,
and description of inclusion and exclusion criteria, power an-
alysis, and intention to treat analysis and lost to follow up charac-
teristics. Studies scored 1 point for each fulfilled criterion. If a
criterion was not applicable, the item was labeled “NA”. If the
information was unclear or not reported, the item was labeled
“No”, both resulting in zero points.

Data extraction and analysis

Data were extracted from the included studies. First,
descriptive characteristics such as year of publication, design,
country, and type of surgery were collected. Second, the data
for analysis were retrieved. We described the number of partici-
pants, the intervention, the relevant outcome and statistical sig-
nificance.

Results

Search results

In total 1,984 references were retrieved by the search-
ests (Figure 1). Forty-six references were identified as potentially
relevant and 13 studies met the inclusion criteria. Reasons for
exclusion were: inappropriate study design to measure interven-
tion effect (n = 6), the intervention did not involve active patient
participation (n = 8), the outcome was not related to safety (n =
10) or was not clearly described (n = 3) and no possibility for
obtaining a full text copy (n = 6). Checking the references of the
included studies did not yield additional studies.

Figure 1: Flow chart of identification of relevant studies.
Characteristics of the included studies

Background characteristics: Thirteen individual studies were included: eight randomized controlled trials, one quasi-experimental study and four cohort studies (Table 1). The majority of the studies were conducted in North America (six in the USA and two in Canada). All studies concerned adult patients. The sample sizes ranged from 12 to 656 in the intervention group and from 20 to 1,945 in the control group. The majority of the studies included patients undergoing orthopedic surgery and cardiothoracic surgery.

Table 1: Characteristics, intervention and results of included studies.

<table>
<thead>
<tr>
<th>Year, Author (reference)</th>
<th>Design</th>
<th>Country</th>
<th>Type of surgery</th>
<th>Participants, n</th>
<th>Intervention</th>
<th>Results</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Intervention group</td>
<td>Control group</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2013, Mayich D.J. [20]</td>
<td>RCT</td>
<td>Canada</td>
<td>Ankle fracture surgery</td>
<td>20 20</td>
<td>Information package containing an educational handout and a handout about self-administered physiotherapy</td>
<td>Complications</td>
<td>4(20%) 2(10%)</td>
</tr>
<tr>
<td>2012, Clarke H.D. [22]</td>
<td>Cohort study</td>
<td>USA</td>
<td>Total knee arthroplasty</td>
<td>72 172</td>
<td>Pre-operative 15-30 minutes educational program that addresses fall-prevention including a patient educational sheet within 14 days before surgery</td>
<td>In-hospital falls</td>
<td>0(0%) 7 (4.1%)</td>
</tr>
<tr>
<td>2011, Kearney M. [28]</td>
<td>Cohort study</td>
<td>USA</td>
<td>Elective single joint total hip or knee replacement</td>
<td>88 62</td>
<td>Structured pre-operative educational class (face to face class or online)</td>
<td>Complications</td>
<td>4(4.5%) 8(12.9%)</td>
</tr>
<tr>
<td>2009, Lübbeke A. [25]</td>
<td>Cohort study</td>
<td>Switzerland</td>
<td>Primary total hip arthroplasty</td>
<td>656 1945</td>
<td>3 hour educational session including muscle strengthening exercises and post-operative restrictions of range of motion instructions</td>
<td>Dislocation of the hip within 6 months after surgery</td>
<td>5(0.8%) 41(2.1)</td>
</tr>
<tr>
<td>2006, Deyirmenjian M. [29]</td>
<td>RCT</td>
<td>Lebanon</td>
<td>Coronary artery grafting</td>
<td>57 53</td>
<td>Education session and demonstration of leg and respiratory exercises</td>
<td>Complications</td>
<td>13(22.8%) 9(16.98%)</td>
</tr>
<tr>
<td>2005, Blay N. [6]</td>
<td>RCT</td>
<td>Australia</td>
<td>Laparoscopic cholecystectomy</td>
<td>41 52</td>
<td>Verbal education about wound care, diet, activity, bowel management and management of medical complication</td>
<td>Wound infections</td>
<td>1(2.4%) 10(19.2%)</td>
</tr>
<tr>
<td>2005, Siggeirsdottir K. [17]</td>
<td>RCT</td>
<td>Iceland</td>
<td>Total hip replacement</td>
<td>27 23</td>
<td>Pre-operative education and training program about post-operative rehabilitation, information brochure about exercise after the operation and a rehabilitation scheme</td>
<td>Complications</td>
<td>5(18.5%) Patients had 9 complications 11(47.8%) Patients had 12 complications</td>
</tr>
</tbody>
</table>
### Patient-related interventions:

All of the included studies investigated the effect of an educational intervention addressing topics as postoperative self-management, postoperative exercise, and everyday movements after surgery and breathing techniques. Handouts were given in some studies ($n = 3$), in one study the optimum stoma location was determined together with the patient and advice was given about stoma management$^{[19]}$. In most studies education was given in a more or less structured manner, example by providing an educational class or a private session. In one study an additional information package was provided containing two educational handouts$^{[20]}$.

### Outcome measures:

Safety outcomes were mortality or readmission by complications$^{[21]}$ and in-hospital falls$^{[22]}$. In the other studies ($n = 11$) different types of postoperative complications were measured, for example pulmonary complications$^{[23]}$, acute postoperative hypertension$^{[24]}$, dislocation of the hip$^{[25]}$ or wound infections$^{[6]}$. 

---

<table>
<thead>
<tr>
<th>Year</th>
<th>Authors</th>
<th>Type</th>
<th>Design</th>
<th>Setting</th>
<th>Sample Size</th>
<th>Intervention</th>
<th>Outcomes</th>
<th>Early (&lt;1 month)</th>
<th>Late (≥1 month)</th>
<th>Total</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1994</td>
<td>Meeker B.J$^{[26]}$</td>
<td>Quasi-</td>
<td>Experimental</td>
<td>USA</td>
<td>Elective general surgery, urological surgery or colorectal surgery</td>
<td>49</td>
<td>95</td>
<td>Structured pre-operative teaching program</td>
<td>Atelectasis</td>
<td>9 (18.3%)</td>
<td>5 (5%)</td>
</tr>
<tr>
<td>1991</td>
<td>Hanucharumkui S.$^{[27]}$</td>
<td>RCT</td>
<td>Thailand</td>
<td></td>
<td>Pyelolithotomy or nephro-lithotomy</td>
<td>20</td>
<td>20</td>
<td>Nurse led self-care program, patients learned and practiced deep breathing, effective coughing, leg exercises, turning, changing position, getting out of bed and methods of pain relief</td>
<td>Complications</td>
<td>1(5%)</td>
<td>3(15%)</td>
</tr>
<tr>
<td>1987</td>
<td>Anderson E.A.$^{[24]}$</td>
<td>RCT</td>
<td>USA</td>
<td>CABG</td>
<td>Information: detailed information, watch video and listen to audio tape Information and coping: as information group and taught exercises by watching slide show and practicing</td>
<td>20</td>
<td>20</td>
<td>Acute postoperative hypertension</td>
<td>Information: (45%) Information and coping: 8(40%)</td>
<td>15(75%)</td>
<td>Not reported</td>
</tr>
<tr>
<td>1976</td>
<td>Felton G.$^{[21]}$</td>
<td>RCT</td>
<td>USA</td>
<td>Mayor surgery</td>
<td>Experimental: education with films, photo’s, postoperative exercise and breathing techniques instructions Communication group: therapeutic communications session</td>
<td>25</td>
<td>25</td>
<td>Pulmonary or circulatory complications</td>
<td>Experimental: 20 (80%) Communication: 7(50%)</td>
<td>24(92%)</td>
<td>Not reported</td>
</tr>
<tr>
<td>1976</td>
<td>Fortin$^{[21]}$</td>
<td>RCT</td>
<td>Canada</td>
<td>Elective major intra-abdominal or intra-thoracic surgery</td>
<td>37</td>
<td>32</td>
<td>Structured preoperative educational program including respiratory en muscular exercises, techniques of changing position and suggestions of self-care</td>
<td>Re-admission by complication; Death</td>
<td>0 (0%) Readmission or deaths</td>
<td>0(0%) Re-admission or deaths</td>
<td>Not reported</td>
</tr>
</tbody>
</table>

---

*According to the authors 9 of the 49 patients had atelectasis which would sum up to 9.5%  
** According to the authors the difference between the two groups was not significant (P value 0.01)
Quality of the studies

The quality of the studies included was variable (Table 2). Overall, the randomized controlled trials scored higher than the quasi-experimental or cohort studies. In all studies inclusion and exclusion criteria were specified. In three studies the intervention and control group were not comparable at baseline; In one study the ASA-score in the intervention group was higher compared to the controls\(^{26}\). In another study participants in the control group had significantly lower ASA-scores, were more often operated by more experienced surgeons and had better pre-operative function scores\(^{25}\). A third study showed an unequal distribution of stoma types in their study groups\(^{19}\). None of the studies contained a power analysis nor an intention-to-treat analysis on the outcome we were studying.

Table 2: Quality assessment of included studies.

<table>
<thead>
<tr>
<th>Year, Author</th>
<th>Randomization</th>
<th>Allocation concealed</th>
<th>Similarity of groups at baseline(^1)</th>
<th>Inclusion/ exclusion criteria specified(^1)</th>
<th>Assessors blinded to outcome</th>
<th>Attrition rate reported</th>
<th>Characteristics of participants lost to follow up described(^1)</th>
<th>Intention to Treat analysis*</th>
<th>Power analysis calculated**</th>
<th>Total (maximum score)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013, May--[ich DJ]</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>6(9)</td>
</tr>
<tr>
<td>2005, Blay N.</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>5(9)</td>
</tr>
<tr>
<td>2005, Sig--geirsdottir K.</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>5(9)</td>
</tr>
<tr>
<td>1991, Hanucharu--mukui S.</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>NA</td>
<td>No</td>
<td>No</td>
<td>5(8)</td>
</tr>
<tr>
<td>1987, An--derson E.A.</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>5(8)</td>
</tr>
<tr>
<td>1976, Felton G.</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>NA</td>
<td>No</td>
<td>3(8)</td>
</tr>
<tr>
<td>1976, Fortin</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>2006, Dey--[irmenjian M.</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>NA</td>
<td>No</td>
<td>No</td>
<td>5(8)</td>
</tr>
<tr>
<td>1994, Meeker B.J</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>NA</td>
<td>No</td>
<td>No</td>
<td>1(8)</td>
</tr>
<tr>
<td>2012, Clarke H.D.</td>
<td>Na</td>
<td>NA</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>NA</td>
<td>No</td>
<td>NA</td>
<td>No</td>
<td>2(5)</td>
</tr>
<tr>
<td>2011, Kear--ney M.</td>
<td>NA</td>
<td>NA</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>No</td>
<td>2(4)</td>
</tr>
<tr>
<td>2009, Lüb--beke A.</td>
<td>NA</td>
<td>NA</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>NA***</td>
<td>No</td>
<td>3(6)</td>
</tr>
<tr>
<td>1997, Bass E.M.</td>
<td>NA</td>
<td>NA</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>NA</td>
<td>NA</td>
<td>No</td>
<td>1(5)</td>
</tr>
</tbody>
</table>

NA: Not applicable
Unknown or unclear was labeled as No
\(^1\): added quality criteria by authors
* The intention to prevent harm
** Power analyses of outcome of our interest
*** Number needed to treat is calculated

Effects of interventions

Five studies showed significant effects on patient safety by decreasing the number of post-operative complications\(^{19,24,25,27}\) or in hospital falls\(^{22}\) (Table 1). Four of these studies\(^{22,24,25,27}\) concerned an educational intervention regarding self-care or post-operative exercises, measuring effects on hip dislocation, post-operative complications or in hospital falls.

The fifth study\(^{19}\) concerned education about stoma care, the patient learnt what a stoma was and received accurate information about living with a stoma. Together with the patient the optimum location for the stoma was marked. This intervention decreased early and overall complications but not the late complication rate. In two studies\(^{6,23}\) educating the participants in self-care or exercises seemed to improve patient safety, although the significance was not mentioned. In one study\(^{21}\) deaths or readmissions by complication did not occur and there by the effect on safety could not be evaluated.

In four studies no significant improvement in patient safety could be shown, although two of these studies\(^{17,28}\) did demonstrate a non-significant improvement. One study\(^{26}\) demonstrated an unexpected significant decrease in patient safe-
patients in a preoperative teaching program had a higher incidence of atelect as is than the non-participants. The higher ASA-score of the participants compared with the non-participants may be the reason for this.

Discussion

Our systematic review suggests that patients may influence safety outcomes after surgery if they participate in a structured educational program. Teaching patients how to move, self care, breath and exercise after surgery seems to help reduce complications, in-hospital falls and hip dislocations after surgery. All of our studied interventions involved pre-operative educational programs. The measured safety outcomes concerned several kinds of complications. In most of the studies the outcome of increased safety was not defined as a primary outcome and therefore lacked adequate power to demonstrate statistically significant effects. We therefore performed a meta-analysis including 6RCTs (excluding 2 RCTs[21,29], respectively for reasons of no complications in both the intervention and control group in one study, and presenting the number of complications instead of the number of patients with complications in another study). This meta-analysis revealed no robust statistical significance but showed that pre-operative patient education tends to reduce the occurrence of postoperative complications (RR 0.64; 95% CI 0.35 - 1.15; p = 0.08). It must be noted that because of the different types of reported postoperative complications and types of surgery we used a random effect model instead of the default 'fixed effect model' to estimate the single risk ratios and the overall effect. Using a random effect model results in a larger confidence interval of the overall effect[30], there by not revealing a statistical significant effect.

Our results are in line with the results of systematic reviews about smoking and alcohol cessation programs[22-15], which demonstrate that these programs are beneficial in reducing post-operative complications. The educational programs in our review, however, varied in content because of the different surgeries, but shared a focus on aspects of postoperative self-management. Despite a lack of precise insight into the intensity of education and extent of participation of patients, we do know that the educational interventions were given by health care workers in a structured way and patients had the opportunity to practice the exercises, and proceedings were learned under supervision of an expert. Just providing patients with information sheets, without further explanation, does not seem to increase patient safety[20].

Explanations provided for the ineffectiveness of interventions vary and include a possible lack of compliance with the given recommendations[20], inexperienced staff[20], cultural differences where the physician is expected to make the decisions[20] and inappropriate timing of applying the intervention example the day before surgery, when patients are too apprehensive to listen[20]. One study[20] showed an unexpected significant decrease in perioperative safety, but this effect may be attributed to a higher ASA-score in the intervention group. In addition, we found miscalculations and ambiguities in the results and therefore considered this study less reliable.

The evidence identified in our review does not address all potential areas of patient involvement in perioperative safety. For example, we did not find studies on enabling surgical patients to choose their health care worker, patients questioning hand hygiene or patient reporting of adverse drug events, examples of interventions that were suggested by the Healthcare Foundation[5] and Davis et al.[9]. We found some studies investigating other interventions, for example Bergal et al.[31], who studied an intervention to prevent wrong site surgery by patients asking to mark the site of operation with “Yes”. Jangland et al.[32] studied the “Tell-us” card, which patients could use to write down their specific questions and concerns for the day of or before discharge. However, these studies did not evaluate the effect on safety outcomes and were therefore excluded from our review.

A limitation of our review method is that we searched the major databases. We did not search lesser known databases nor did we do a hand search of the journals where the included studies were published. We tried to overcome this limitation by checking the references of included articles for potential relevant studies. Also, no attempts were made at collecting unpublished data nor do we have any information about potential publication bias. On the other hand, strength of our review method is that we did not use a time limit yielding some interesting studies that otherwise would not have been included. Another limitation is that we did not systematically collect data from the included studies about behavior change, extent of participation of patients or process measures about the extent of success of the educational intervention reflecting the robustness of the intervention. Using this kind of information would have been more precise in assessing the impact on the safety outcomes of our interest.

To our knowledge, outside alcohol and tobacco cessation, no previously study has reviewed the effects of patient participation on perioperative patient safety. Based on these results, we recommend that patients should be active in their own care trajectory which can be encouraged by inviting and stimulating them to join a structured educational program self-management activity. In this way, patients may contribute to improve their own perioperative safety.

Conclusion

Active patient participation in education programs on how to manage the postoperative situation can improve patient safety. The potential difficulties with daily activities and breathing compared to the situation before surgery should be explained. In line with the proven beneficial results of smoking and alcohol cessation program, these educational interventions may be most effective when given in a structured way, resulting in fewer in-hospital falls, hip dislocations and other post-operative complications. Future studies should address the most effective components and timing of education, explore the effects of other patient-related interventions, for example the use of patient safety cards aimed at helping patients to safeguard their perioperative care trajectory, and should link the robustness of the intervention, example in terms of behavior change, to safety outcomes, such as complications, mortality, medication errors or other adverse events.

Conflicts of Interest: Authors declare no conflicts of interest.
References


Appendix 1: Search strings by Database

PubMed:
### Appendix 2: Overview of systematic reviews on smoking and alcohol cessation programs.

<table>
<thead>
<tr>
<th>Author, Year, [reference]</th>
<th>Number of included studies</th>
<th>Number of participants</th>
<th>Included studies</th>
<th>Participants</th>
<th>Intervention</th>
<th>Outcome</th>
<th>Conclusion</th>
<th>Statistical significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Möller AM. 2009 [12]</td>
<td>4</td>
<td>627</td>
<td>RCT’s</td>
<td>Smokers scheduled for elective surgery</td>
<td>Any pre-operative smoking cessation intervention at least 48 hours before surgery</td>
<td>Smoking cessation, morbidity and mortality</td>
<td>Smoking cessation intervention is beneficial for reducing the incidence of complications</td>
<td>Not reported</td>
</tr>
<tr>
<td>Oppedal K. 2013 [13]</td>
<td>2</td>
<td>69</td>
<td>RCT’s</td>
<td>Hazardous drinkers scheduled for surgery</td>
<td>All pharmacological and psychological preoperative alcohol cessation interventions, given in relation to a surgical procedure, that aimed to stop or reduce alcohol consumption preoperatively</td>
<td>Primary: Postoperative complications and mortality Secondary: Length of stay and alcohol consumptions</td>
<td>Intensive preoperative alcohol cessation interventions may significantly reduce postoperative complication rates. No effect on mortality rates was found.</td>
<td>Decrease post-operative complication rate: Odds ratio 0.22 95CI 0.08-0.61, p = 0.004</td>
</tr>
<tr>
<td>Tönnesen, 2009 [14]</td>
<td>9</td>
<td>Unknown</td>
<td>Systematic review, RCT’s, clinical controlled trials, descriptive studies, experts and medical textbooks</td>
<td>Smokers and hazardous drinkers scheduled for surgery</td>
<td>6 Smoking and 3 alcohol cessation intervention studies</td>
<td>Postoperative complications</td>
<td>Intervention programs starting 3-8 weeks before surgery will significantly reduce the incidence of postoperative complications</td>
<td>Not reported</td>
</tr>
<tr>
<td>Thomsen 2009 [15]</td>
<td>11</td>
<td>1194</td>
<td>RCT’s</td>
<td>Smokers scheduled for elective surgery</td>
<td>Interventions could include the five A’s (ask, advise, assess, assist, arrange), behavioral counseling or other methods of counseling and/or pharmacotherapy</td>
<td>Postoperative complications</td>
<td>Preoperative smoking cessation interventions significantly reduced the occurrence of postoperative complications after surgery</td>
<td>Decrease post-operative complication rate: RR 0.56 95%CI 0.41-0.78, P &lt; 0.001</td>
</tr>
</tbody>
</table>

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