**Additional file 1** Malmbrandt and Åhlstöm’s [28] instrument and the Lean in Healthcare Questionnaire (LiHcQ) divided into Liker’s [14] principles and domains.

Items kept in the **LiHcQ** are in boldface text. Items marked \* are newly developed for the present study.

|  |  |  |  |
| --- | --- | --- | --- |
| Items by Malmbrandt and Åhlstöm [28] | Items in the **LiHcQ** | Liker’s principles | Liker’s four domains (4P) |
| Employee commitment  Employee understanding  Management commitment  Management understanding  Time for improvement work | **(1) Employee commitment**  **(2) Management commitment**  **(3) Time for improvement work** | 1  1  1  1  1 | Philosophy  -long-term thinking |
| Value stream mapping  Workplace design for flow  Connecting the processes  Bi-directional information flow | **(6) Value stream mapping** | 2  2  2  2 | Processes  -eliminate waste |
| Pull system | **(10) Pull system** | 3 |
| Proactive planning | **(8) Proactive planning** | 4 |
| Built-in quality | **(9) Built-in quality** | 5 |
| Standardized tasks  Formalization of work standards | **(7) Standardized tasks** | 6  6 |
| Visual signals  Visualization of information  Visualization of improvements | **(11) Visualization of improvements** | 7  7  7 |
| - | **(15) Use reliable technique that supports employees and processes\*** | 8 |
| Change agent | **(4) Change agent** | 9 | People and partners  -respect, challenge and grow them |
| Identification of customer value  Employee training  Multifunctional teams | **(5) Identification of customer value** | 10  10  10 |
| - | **(16) Show respect for partners and suppliers\*** | 11 |
| Structured problem solving | **(13) Structured problem-solving** | 12 | Problem-solving  -continuous improvements |
| - | **(14) Make decisions slowly and by consensus\*** | 13 |
| Employees measure and follow up work  Resources for improvement work  Employee participation in improvement work  Focus of improvement work  Customer involvement  Sustaining improvements | **(12) Employees measure and follow up work** | 14  14  14  14  14  14 |