Additional file 1 - Results of single studies

Abbreviations: i=intervention; c=control, t1=time point 1, t2=time point 2, +=positive effect, -=negative effect, o=neutral effect, +/- =ambivalent effects

Authors/Year	Technology sub-category /Specific technology	Study type & size	Target Setting	Target group for effect	+,-, o, +/-	Effect	Level of Evi-dence
1. Studies on ICT							
1.1. Studies on Health Institution Information System (HIS)							
Angst, Devaraj et al. 2012 [37]	HIS (hospital)	Cross-Sectional (n=2.179 hospitals)	Hospital	Person in need of care	+/-	Complex outcomes: cardiology IT has positive effect on mortality, administrative IT has negative effect on interpersonal care, positive results if hospitals have very much or very few cardiology IT, negative results if hospitals have very much or very few administrative IT	4
Appari, Johnson et al. 2014 [27]		Cross-Sectional (n=3.002 hospitals)	Hospital	Person in need of care	+	Positive effect on patient safety indicators (moderate)	4
McKenna, Dwyer et al. 2017 [36]		Cohort Study (n= 1.248 hospitals)	Hospital	Person in need of care	+	Reduction in severity adjusted mortality rate (small)	3
Restuccia, Cohen et al. 2012 [35]		Cross-Sectional (n=401 hospitals)	Hospital	Person in need of care Formal Caregiver Organisation	+	Positive effects on patient mortality and patient satisfaction; not statistically significant positive effect on adherence to the composite Hospital Compare process of care; High HIS-level has positive effect on care quality (perceived by carers)	4
Steurbaut, Colpaert et al. 2012 [41]	HIS (ICU)	Case study (n=2 institutions)	ICU	Formal Caregiver Organisation	+	Positive effect on data extraction of medical procedures	4
Alexander, Pasupathy et al. 2014 [38]	HIS (nursing home)	Mixed Methods (Cross-Sectional (n=5 nursing homes), qualitative, social network analysis)	Inpatient long-term care	Organisation	+/-	Less interaction (communication) intensity in institutions with high HIS-levels	4
Alexander, Steege et al. 2015 [39]		Case study (n=2 nursing homes)	Inpatient long-term care	Organisation	+	Positive effect on communication (more robust and integrated communication strategies)	4
Munyisia, Yu et al. 2012 [40]		Case study (n=2 institutions)	Inpatient long-term care	Organisation	+/-	Percentage of time spent on documentation by cares decreased at 3 months, increased at 6 months, decreased at 23 months	4
Patmon, Gee et al. 2016 [42]	HIS (subsystem/ patient engagement)	Qualitative (n=38)	Hospital	Person in need of care Formal Caregiver	+	Positive effects on patient distraction and patient education (perceived by nurses) Positive effect on care delivery (perceived by nurses)	4

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1.2. Studies on Electronic Health Records/Electronic Medical Records							
Hitt and Tambe 2016 [56]	EMR in long-term care	Cross-Sectional (n=304)	Inpatient long-term care	Organisation	+	Neutral effect on quality of care indicators, small increases in productivity	4
Meehan 2017 [57]		Qualitative (n=20)	Inpatient long-term care	Organisation	+	Positive effect on quality of care (perceived by nurses), better readability of records, improved accessibility of information	4
Rantz, Alexander et al. 2011 [58]		Qualitative (n=5 focus groups with 120 participants in total)	Inpatient long-term care	Organisation	+/-	Positive effects on communication between caregiver and doctor, follow-up care, access to information, safety of care delivery Negative effects on time spent with patient (reduced) and on documentation (increased), double documentation, negative effect on accuracy of care information	4
Mitchell and Yaylacicegi 2012 [43]	EMR in hospitals in general	Cross-Sectional (n=252 hospitals)	Hospital	Person in need of care	+	Positive effects on patient safety in medium sized hospitals, positive effect on post-operative safety and mortality in large hospitals	4
Bradley 2011 [44]		Qualitative (n=18)	Hospital	Person in need of care Formal Caregiver	+	Positive effect on patient safety and patient trust (perceived by nurses) Positive effect on nurse-patient relationship	4
Takian, Sheikh et al. 2012 [45]		Case study (interviews n=48, observations 26 hours, document analysis: n=65	Hospital	Organisation	+	Positive effect on data and information sharing, faster communication, reduced patient risk for poor treatment (but implementation very challenging)	4
Yusof 2015 [46]		Case study (interviews n=7, observations: n=33, document analysis: n=34	ICU	Organisation	+	Reduced documentation and data access time, positive effect on clinical workflow, positive effect on work effectiveness	4
Lo, Lee et al. 2014 [165]	Decision support/Data results management	Quasi-Experiment (i: n=120, c: n=120)	Hospital	Organisation	+	Reduced time spent on surveillance work	2
Seibert, Maddox et al. 2014 [47]	Medication Administration	Quasi-Experiment (pre/post-design n=10 units in 1 hospital)	Hospital	Organisation	+	Increased medication administration accuracy, reduced number of target errors	2
Appari, Carian et al. 2012 [27]		Cross-Sectional (n=2.603 hospitals)	Hospital	Organisation	+	Positive effect on adherence to medication guidelines (no effect of implementation of CPOE alone)	4
Chanyagorn, Kungwannarongkun et al. 2016 [49]		User study (n=50)	Hospital	Person in need of care	+	Errors down to almost zero	4
Ching, Williams et al. 2014 [50]		Case study (n=1 hospital)	Hospital	Organisation	+	Reduced numbers of medication errors, safe practice violations, unsafe administration practices	4

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Huang and Lee 2011 [51]	Medication Administration	Case study (interviews: n=6, observations: n=86	Hospital	Organisation	+	Positive effects on nursing workflow, medication safety, encountering operational difficulties, reduced time spent with indirect patient care and medication administration (all perceived by nurses)	4
Clarke, Patel et al. 2017 [53]	Patient handoff/health information exchange	Quasi-Experiment (i: n=271, c: n=203)	Cross sectoral care	Formal Caregiver Organisation	+	Positive effect on handoff compliance, reduced communication errors, positive effect on trainee workflow	2
Oakley and Hunter 2017 [52]		Quasi-Experiment (pre/post-design n=1 hospital)	Hospital	Formal Caregiver Organisation	+	Reduced workload for caregivers, reduced handover-list errors	2
Yeaman, Ko et al. 2015 [28]		Quasi-Experiment (pre/post-design n=5 institutions)	Cross sectoral care	Person in need of care	+	Positive effect on patient 30 days readmission rate, reduced emergency department return visits	2
Meyer-Delpho and Schubert 2014 [29]		Case study (n=1 institution, survey: n=26)	Cross sectoral care	Organisation	+	Reduced number of incomplete documentations, reduced treatment/handling time	4
Lear and Walters 2015 [38]	Patient information administration/ Nurse reminding system	Quasi-Experiment (pre/post-design n=32)	Hospital	Formal Caregiver	o	No statistically significant effect on documentation compliance; nurses expressed discomfort with system	2
Paranilam 2013 [55]		Quasi-Experiment (pre: n=95, post: n=103)	Hospital	Person in need of care Organisation	o	No effect on pain intensity for patients No effect on frequency of pain measurements	2
1.3. Studies on Computerised Decision Support Systems							
Lapane, Hughes et al. 2011 [62]	Risk assessment	RCT (i: n=12 nursing homes, c: n=13 nursing homes)	Inpatient long-term care	Person in need of care	+	Positive effect on delirium, other results not statistically significant, but some positive trends	1b
Dykes, I-Ching et al. 2012 [63]		Case-control (case: n=48, c: n=144)	Hospital	Person in need of care	+	Reduced number of falls	2
Lang 2012 [64]	Care Decisions	Quasi-Experiment (pre/post-design n=331)	Hospital	Formal caregiver	+	Positive effect on guideline compliance	2
Salinas, Chung et al. 2011 [65]		Quasi-Experiment (i: n=32, c: n=39)	ICU	Person in need of care	+	Positive effects on mortality, resuscitation volume, total fluid volume, crystalloids post-ICU admission, urinary output, ventilation free days, no effect on ICU free days	2
1.4. Studies on Telecare							
van der Heide, Willems et al. 2012 [75]	Video-Telecare	Quasi-Experiment (pre/post-design pre: n=130, post: n=85)	Outpatient long-term care	Person in need of care	+/-	Positive effect on social and emotional loneliness, ambivalent effect on feeling of safety	2
Cady 2012 [78]		Mixed Methods: Cognitive Ethnography & quantitative time-motion work-flow analysis (n=3 nurses; n=57 children/families)	Hospital/Home	Organisation	o/-	Negative effect on required time for tasks caused by technical problems in triage office Neutral effect in care coordination office	4

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Cady and Finkelstein 2014 [72]	Video-Telecare	Mixed Methods : Cogni-tive Ethnography & quan-titative time-motion work-flow analysis (n=1 nurse)	Hospital/Hom e	Organisation	o	No effect on workflow Neutral effect on required time of video versus telephone coordinated care	4
Bowles, Hanlon et al. 2011 [69]	Video Telecare incl. remote monitoring	RCT (i: n=27, c: n=26)	Outpatient long-term care	Person in need of care	+	Positive effect on hospital readmission (not statistically significant) secondary outcomes: positive effects on access to care and patient satisfaction (significant)	1b
Steventon, Bardsley et al. 2013 [73]	Remote health-monitoring	RCT (i: n=1276, c: n=1324)	Primary Care/Home	Person in need of care	o	Not statistically significant positive effect on hospital admissions (within 12 month) No effect on mortality, social care use, contact with GPs, admissions to residential or nursing care;	1b
Wakefield and Vaughan-Sarrazin 2017 [74]		Cross-Sectional (n=123)	Primary Care/Home	Person in need of care Informal caregiver	o	No differences between home-telehealth users and non-telehealth user identified	4
Paré, Poba-Nzaou et al. 2013 [70]		Quasi-Experiment (pre/post-design n=95)	Outpatient long-term care	Person in need of care	+	Reduction in number of hospitalisations, reduced length of hospital stays, fewer emergency room visits	2
Chiang and Wang 2016 [76]	Telecare per Instant-Messaging	Qualitative (n=17)	Outpatient long-term care	Formal caregiver Organisation	+/-	Reduction in workload and stress/ disturbances in personal life Reduction in medical service consumption, facilitating improvement in quality of care, positive effect on nurse-patient relationship, problems in data protection, usability in emergencies restricted	4
Göransson, Eriksson et al. 2017 [71]	Telecare/ App supported	Qualitative (n=29)	Outpatient long-term care	Person in need of care	+	Positive effect on self-confidence, positive effect on self-perceived “sense of security”	4
Hicken, Daniel et al. 2017 [77]	Telecare/ Internet- vs. telephone-based support	RCT (i1: n=77, c: n=78; i2: N=30, c: n=44)	Primary Care/Home	Informal caregiver (dementia)	+/o	No differences in majority of comparative effectiveness outcomes, but some positive effects for subgroup of experienced internet users (positive effect on grief/isolation)	1b
1.5. Studies on Communication Support Technologies							
1.5.1. Communication Support between professionals							
Chuang, Liu et al. 2015 [82]	Cloud based smartphone nurse-call system	Quasi-Experiment (pre/post-design n=5)	Hospital	Organisation	+	Reduction of response time of nurses	2
Pemmassani, Paget et al. 2014 [83]	Hands free communication	Quasi-Experiment (pre/post-design n=12)	Hospital	Formal caregiver	+	Reduced walking distance	2
Tielbur, Rice Cella et al. 2015 [84]	Discharge huddle with mobile technology	Quasi-Experiment (pre-post-design; pre: n=226, post: n=188)	Hospital	Person in need of care	+	Reduced length of stay, reduced number of patients going out without service, increased number of discharges to affiliated partners (care institutions)	2

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White, McIlfatrick et al. 2015 [85]	Tele-conferencing for remote training of health care providers	Quasi-Experiment (pre/post-design n=28)	Outpatient long-term care	Formal caregiver	+	Positive effect on knowledge and skills; positive effect on self-efficacy score (communication skills, assessment and care planning, wellbeing, symptom management, advanced care planning)	2
Blakey, Guy et al. 2012 [86]	Wireless call handling and task management system (out of hours)	Case study (n= 1 hospital)	Hospital	Person in need of care Formal caregiver Organisation	+	Reduced length of stay, positive effect on cardiac arrest calls, reduced number of untoward incidents related to handover and medical response Positive effect on user satisfaction (staff) Coordination time for care-coordinator reduced	4
Melby, Brattheim et al. 2015 [87]	Hospital-home care collaboration by electronic messaging	Qualitative (n=41)	Cross sectoral care	Organisation	+	Positive effects on efficiency of communication, information content, safer patient transitions (perceived by nurses)	4
Wu, Rossos et al. 2011 [90]	Smartphone use in clinical communication	Mixed methods (interviews (n=31), ethnographic observa-tions, frequency analysis of e-mails and smartphone calls)	Hospital	Organisation	+/-	Improvement in efficiency compared to pagers, increase of mobility and multitasking abilities for residents; Increase of interruptions, worsening of interprofessional relationships (perceived by nurses), discordances between nurses and doctors with respect to what is considered urgent	4
1.5.2. Communication support between professionals and patient/relatives							
Rodriguez 2016 [88]	Communication between formal caregiver and patient/ for suddenly speechless patients	Quasi-Experiment (i: n=52, c: n=63)	Hospital	Person in need of care	+	Reduced mean frustration, increased satisfaction with communication method (perceived by patients)	2
Wieck, Blake et al. 2017 [89]	Communication between professionals and relatives /intraoperative communication	Case study (n=50 families, n=29 nurses, n=19 surgeons)	Hospital	Informal caregiver Organisation	+	Positive effect on family satisfaction with intraoperative communication Positive effect on intraoperative communication, increased ease in finding relatives post-op	4
1.6. Studies on Specific Software/Apps							
1.6.1. Care support for professionals							
Webster and Hanson 2014 [104]	Provision of informa-tion about residents	User study (n=44)	Inpatient long-term care	Organisation	+	Positive effects on caregivers' knowledge about patients and engagement with patients	4
Yi-Sheng, Hsin-Ju et al. 2014 [105]	Point of care documentation	User study. (i: n=11 measurements, c: n=31 measurements)	Hospital	Organisation	+	Reduced time needed for measurement, positive effect on process efficiency	4
Florczak, Scheurich et al. 2012 [106]	Point of care wound documentation	Case study (n=9)	Inpatient long-term care	Organisation	+	Positive effect on wound management effectiveness scale	4

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Vowden and Vowden 2013 [107]	Wound monitoring and remote support	Case Study/Pilot RCT (i: n=17, c: n=9)	Inpatient long-term care	Person in need of care	+	Two case studies show improved patient outcomes, main benefit: positive effect on ease of monitoring progress of wounds	4
1.6.2. Care support for informal caregivers							
Mierlo, Meiland et al. 2015 [102]	Dementia specific digital social chart	RCT (i: n=41 caregiver, n=13 case manager; c: n=32 caregiver, n=14 case manager)	Home	Person in need of care (dementia) Informal caregiver	+/-	No significant differences for persons in need of care with respect to needs assessment, QoL, Neuropsychiatric Inventory at 6 months, more needs and unmet needs reported for intervention group at 12 months; Increase in sense of competence at 12 months	1b
1.6.3. Patient support for everyday life							
Nijhof, van Gemert-Pijnen et al. 2013 [103]	Personal assistant for dementia	Qualitative (n=16)	Home	Person in need of care (dementia) Informal caregiver	+	Positive effects on well-being, structuring the day, doing things independently for some patients (perceived by others) No effect on burden on the family, some positive effects mentioned by single caregivers	4
1.6.4. Therapeutic support for patients/persons in need of care							
Zaccarelli, Cirillo et al. 2013 [96]	Cognitive stimulation	RCT (i: n=174, c: n=174)	undefined	Person in need of care (dementia)	+	Improved cognitive functions (mainly memory and executive functions)	1b
Zhuang, Fang et al. 2013 [97]		RCT (i: n=19, c: n=14)	Inpatient long-term care	Person in need of care (dementia)	o	Neutral effect on cognitive examination score, but tendencies for improvements in intervention group (for memory, language and visuospatial ability)	1b
Berenbaum, Lange et al. 2011 [98]		Case study (n=80)	Inpatient long-term / day care	Person in need of care (dementia)	+	Positive comments on mood an QoL while using the programme	4
Nordheim, Hamm et al. 2015 [99]		Case study (n=14)	Inpatient long-term care	Person in need of care (dementia) Organisation	+	Positive effects on cognitive abilities; small positive effects on well-being; positive effect on neuropsychiatric symptoms; also, some negative developments during study period (small negative effect on Barthel-Index, mental status, agitation) Positive effect on communication with caregivers, easier access to patients	4
Subramaniam and Woods 2016 [166]	Digital life story books	Case study (n=6)	Inpatient long-term care	Person in need of care (dementia) Informal Caregiver	+/-	Positive effect on QoL, negative effect on geriatric depression score, positive effect on autobiographic memory Positive effect on quality of relationship between informal caregiver and patient	4
Portela, Correia et al. 2011 [101]	Serious Games (Wii)	Quasi-Experiment (3-armed, i: n=20, c1: n=23, c2: n=22	Inpatient long-term care	Person in need of care	+/-	Positive effects on physical functioning and vitality, negative effect on emotional performance	2

Authors/Year	Technology sub-category / Specific technology	Study type & size	Target Setting	Target group for effect	+,-, o, +/-	Effect	Level of Evi-dence
Chen, Huang et al. 2012 [100]	Serious Games (Xbox Kinect)	Quasi-Experiment (i: n=22, c: n=39)	Inpatient long-term care	Person in need of care	+	Positive effects on general health, physical functioning, role physical, body pain, social functioning	2
1.7. Studies on Process Planning/Work Process Management							
Pare, Sicotte et al. 2011 [24]	Software for planning and optimizing nursing processes	Mixed methods (qualitative interviews: n=57, survey: n=101, document analysis: pre: n=77, post: n=73, patient-questionnaire: n=223	Outpatient long-term care	Person in need of care Organisation	+	Positive effect on patient education Positive effects on completeness and quality of nursing notes, quality of care, assessment of patient's condition (all perceived by caregivers), positive effect on understanding the patient (perceived by caregivers and patients)	4
Valerie, Choy et al. 2016 [95]	Intelligent performance assessment system	Case study (n=1 home care service)	Outpatient long-term care	Person in need of care Organisation	+	Positive effect on patient satisfaction Positive effects on quality of care and complaints per week	4
1.8. Studies on Target Group Specific Interfaces							
Olchanski, Dziadzko et al. 2017 [108]	Electronic Medical Record Interface for ICU-use	Quasi-Experiment (pre/post-design, pre: n=983, post: n=856)	ICU	Person in need of care	+	Reduced overall and ICU mortality, reduced length of stay, reduced costs of hospitalisation	2
Lazar, Demiris et al. 2016 [110]	Interface for people with memory impairment/dementia	Qualitative (n=16)	Inpatient long-term care	Person in need of care (dementia) Informal Caregiver	+	Qualitatively described positive effects (i.e. enjoyment, mental stimulation) Facilitated interactions with informal caregiver	4
Schall, Cullen et al. 2017 [109]	Dashboard design within an electronic health record	User study. (n=7)	Hospital	Organisation	+	Positive effects on task completion time and task accuracy	4
2. Studies on Robotic Technologies							
Ranasinghe, Dantanarayana et al. 2014 [17]	Physical assistance (robotic lifting device)	User study. (n=60)	Inpatient long-term care	Formal caregiver	+	Reduced force required to handle robotic device compared to a standard hoist	4
Wang, Gorski et al. 2011 [124]	Physical assistance (robotic wheelchair)	User study. (n=6)	Inpatient long-term care	Person in need of care (with cognitive limitations)	-/+	Positive effect on mobility and independent distance travelled, but technological reliability not sufficient for safe usage	4
Summerfield, Seagull et al. 2011 [123]	Physical assistance/ Transport (pharmacy delivery robot)	Case study (n=3 pharmacies)	Hospital/ICU	Organisation	+	Decreases in time from fax to label, time for order preparation and idle time for medications to be delivered, increased satisfaction of nurses with pharmacy	4
Broadbent, Orejana et al. 2015 [121]	Social/service robot (Cafero)	Quasi-Experiment (i: n=85, c: n=48)	Hospital	Organisation	+	Reduced consultation length (robot measures vital signs prior to consultation)	2
Bettinelli, Lei et al. 2015 [122]	Social/telepresence robot	Quasi-Experiment (20 nurses performing 68 robot rounds vs. 78 telephone rounds)	ICU	Formal Caregiver	o	Not statistically significant positive effect on Collaboration and Satisfaction about Care Decision (CSACD) Scores of Caregivers	2

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Broadbent, Kerse et al. 2016 [18]	Socially interactive robot (Guide robot, Cafero)	Quasi-Experiment (i: n=29 staff, n=27 residents; c: n=24 staff, n=25 residents)	Inpatient long-term care / Hospital	Person in need of care Formal caregiver	o o	No significant effects on depression score, QoL, mobility, activities of daily living, behavioural scores No significant effects on QoL and Job morale (positive effect on job satisfaction of control group)	2
Gustafsson, Svanberg et al. 2015 [114]	Social/therapeutic robot (JustoCat)	Case study (n=4 patients); interviews (n=14 relatives/prof. caregiver)	Inpatient long-term care	Person in need of care (dementia)	+	Positive effects on interaction, communication, relaxation based on qualitative statements of caregivers	4
Baisch, Kolling et al. 2018 [117]	Social/therapeutic robot (Paro, Pleo)	Qualitative (n=73 interviews)	Inpatient long-term care	Person in need of care	+	Positive short-term psycho-social effects based on qualitative statements	4
Moyle, Jones et al. 2017 [120]	Social/therapeutic robot (Paro)	RCT (i: n=138, c1: n=140, c2: n=137)	Inpatient long-term care	Person in need of care (dementia)	o/+	Positive effects in Paro group on verbal and visual engagement and agitation (based on observational data), no effects on Cohens-Mansfield Agitation Inventory-Short Form	1b
Petersen, Houston et al. 2017 [119]		RCT (i: n=35, c: n=26)	Inpatient long-term care	Person in need of care	+	Positive effects on Rating of Anxiety in Dementia scale, Cornell Scale for Depression in Dementia, Skin response, pulse oximetry, pulse rate, reduced pain and psychoactive medication	1b
Robinson, MacDonald et al. 2013 [11]		RCT (i: n=20, c: n=20)	Inpatient long-term care	Person in need of care	+	Positive effect on loneliness, no effect on depression, no effect on QoL	1b
Jøranson, Pedersen et al. 2015 [118]		RCT (i: n=27, c: n=26)	Inpatient long-term care	Person in need of care (dementia)	+	Positive effects on Brief Agitation Rating Scale (BARS), brief version of Cornell Scale for Symptoms of Depressions and Dementia (CSDD) Scores	1b
Jøranson, Pedersen et al. 2016 [12]		RCT (i: n=27, c: n=26)	Inpatient long-term care	Person in need of care (dementia)	+	Positive effects on Quality of Life in Late Dementia (QUALID) scores and medication for subgroup with severe dementia	1b
Bemelmans, Gelderblom et al. 2015 [167]		Quasi-Experiment (pre/post-design n=71)	Inpatient long-term care	Person in need of care (dementia) Caregiver	+ o	Positive effect on Individually Prioritized Problems Assessment (IPPA), mood No significant effect on facilitation of care	2
Liang, Piroth et al. 2017 [168]		Pilot-RCT (t1 i: n=14, c=13; t2: i: n=13, c: n=11)	Day care/ home	Person in need of care (dementia)	+	Positive effects on facial expressions (smiling), communication with staff for day care group	2
Moyle, Cooke et al. 2013 [169]		Pilot-RCT (i: n=9, c: n=9)	Inpatient long-term care	Person in need of care (dementia)	+	Positive effects on QoL in Alzheimer's Disease scale, Rating Anxiety in Dementia Scale and some sub-dimensions of Observed Emotion Rating Scale	2
Bennett, Grasso et al. 2015 [170]		Case Study (n=8)	home	Person in need of care	+	Positive effect on depressive symptom scores (PHQ9)	4

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Birks, Bodak et al. 2016 [171]	Social/therapeutic robot (Paro)	Qualitative (n=3)	Inpatient long-term care	Person in need of care Formal and informal Caregiver	+ +	Positive effects on emotional state and challenging behaviours (perceived by caregivers) Facilitation of social interactions with patients	4
Šabanović, Bennett et al. 2013 [172]		Qualitative (n=7)	Inpatient long-term care	Person in need of care (dementia)	+	Positive effects on interaction with other people, attention and activity	4
Wagemaker, Dekkers et al. 2017 [173]		Case study (n=5)	Inpatient long-term care	Person in need of care (dementia)	o	No effects on alertness and mood (positive effects on mood and alertness for 1 of 5 subjects)	4
Iacono and Marti 2016 [174]		User study. (n=6)	Inpatient long-term care	Person in need of care (dementia)	+	Positive effects on narrative activity, quality of life in terms of relaxing, socializing, smiling, participating (perceived by caregivers after sessions)	4
Wada, Takasawa et al. 2014 [175]		User study. (n=64)	Inpatient long-term care	Person in need of care	+	Positive effects on 25 of the inhabitants (reduced anxiety and irritation and depression, increase in speech); few negative cases described (7 disliked Paro, 1 neg. reaction)	4
Valenti, Aguera-Ortiz et al. 2015 [116]	Social/therapeutic robot (Paro) / humanoid socially assistive robot (NAO)	Pilot RCT, Nursing home: 3-armed, Phase 1: i1: n=22, i2: n=30, c: n=38; Phase 2: i1: n=42, i2: n=36, c: n=32, Day Care Center: pre/post design: n=37	Inpatient long-term care / Day care	Person in need of care (dementia)	+/-	Selective outcomes: positive effects on apathy for Paro- and NAO-group, positive effects on QoL-in-late stage-dementia-Score, negative effects on irritability for both groups, negative effects on delusions for NAO-group. Decrease in quality of life for Paro-group compared to conventional therapy, In Day care: positive effects on irritability and neuro-psy-chiatric symptoms of Nao-group compared to Paro-group	2
Shukla, Barreda-Ángeles et al. 2017 [115]	Social/therapeutic robot: humanoid socially assistive robot (NAO)	Case study (n=5)	undefined	Formal caregiver	+	Positive effect on subjective workload, no effect on time spent on patient attention	4
3. Studies on Sensors / Monitoring							
van der Lende, Cox et al. 2016 [131]	Behaviour Analysis / Emergency detection	Quasi-Experiment (pre/post-design n=41)	Inpatient long-term care	Organisation	+	Positive effect on detecting seizures (but not considered cost-effective)	2
Hardin, Dienemann et al. 2013 [130]	Behaviour Analysis / fall prevention	RCT (i: n=5, c: n=5 medical surgical units)	Hospital	Person in need of care	o	No significant difference in fall rate per 1.000 patient days (primary outcome), but positive effect in fall rate per 1.000 admissions	1b
Sahota, Drummond et al. 2014 [127]		RCT (i: n=918, c: n=921)	Hospital	Person in need of care	o	No significant effect on fall incidence; no difference for time to first bedside fall, positive trend to early bedside falls risk (not significant)	1b
Shee, Phillips et al. 2014 [128]		Quasi-Experiment (pre/post-design t1: n=34, t2: n=34, t3: n=19)	Hospital	Person in need of care (dementia)	+	Positive effect on fall rates (but maybe caused by other reasons due to study limitations)	2
Tchalla, Lachal et al. 2013 [129]		Quasi-Experiment (i: n=49, c: n=47)	Home	Person in need of care (dementia)	+	Reduced number of falls in intervention group	2

Authors/Year	Technology sub-category / Specific technology	Study type & size	Target Setting	Target group for effect	+,-, o, +/-	Effect	Level of Evi-dence
Pickham, Berte et al. 2018 [125]	Behaviour Analysis / pressure ulcer prevention	RCT (i: n=659, c: n=653)	ICU	Person in need of care Formal caregiver	+	Reduced number of hospital-acquired pressure injuries, secondary outcome: increase in total time with turning compliance according to guidelines	1b
Marra, Sampaio Camargo et al. 2014 [126]	Behaviour Analysis of Carers/Hand hygiene	Quasi-Experiment (i: n=1 unit, c: n=1 unit)	Hospital	Formal caregiver	+	Increase in dispensing episodes per patient day, increased handrub consumption	2
Jousselme, Vialet et al. 2011 [139]	External risk detection /noise sensor	Quasi-Experiment (pre/post-design n=1 care unit)	ICU	Formal caregiver	+	Reduction in noise level when device was present (no difference if device turned on or off)	2
Lexis 2013 [132]	General Behaviour Analysis/ Decision support	Quasi-Experiment (pre/post-design n=19 clients, n=16 informal caregivers)	Outpatient long-term care	Informal caregiver Person in need of care	+	Informal caregiver: decrease of time spent on patient, decreased subjective burden Care recipient: no statistically significant changes	2
Rantz, Phillips et al. 2017 [133]		RCT (i: n=86, c: n=85)	Inpatient long-term care	Person in need of care	+	Positive effect on walking speed, step distance and risk of falling, no differences in health care costs	1b
Lazarou, Karakostas et al. 2016 [134]		User study. (n=4)	Home	Person in need of care (dementia)	+	Positive improvements in several test scales (20 different scales were used), positive improvement in sleep patterns, reduced anxiety	4
Pot, Willemse et al. 2012 [140]	Tracking /GPS-Device	Quasi-Experiment (pre/post-design n=28)	Home	Informal caregiver (dementia)	+	Positive effect on worrying (small), positive effect on letting the patients go outside alone, no effect on Self-Perceived Pressure from Informal Care scale	2
Osaimi, Kadi et al. 2017 [141]	Tracking/RFID-Identification	Case study (n=190)	Hospital	Organisation	+/-	Positive effect on identifying infants, ambivalent effect on workflow (both perceived by caregivers)	4a
Brown, Terrence et al. 2014 [135]	Vital sign monitoring (patient)	Quasi-Experiment (i: n=2314, c: n=5329)	Hospital	Person in need of care Organisation	+ o	Positive effect on average length of stay in ICU, positive effect on total ICU days for transfers per 1.000 patients in the medical-surgical unit, No effect on number of transfers from surgical unit to ICU	2
Zhou, Liu et al. 2012 [136]		Case Studie (n=14)	Home	Informal caregiver	+	Time savings due to reduced number of hospital visits	4
Kuroda, Noma et al. 2013 [137]		User study. (n=24)	Hospital	Organisation	+/-	Reduction of time for input of vital sign measurements in hospital information system, higher efficiency (perceived by nurses), but technical error rate is too high for clinical use	4
Pigini, Bovi et al. 2017 [138]		User study. (n1=15, n2=17, n3=3)	Home	Person in need of care	+	Positive effects on health status monitoring (remembering measurements), safety at home (self-perceived), reduced stress compared to day hospital visit (self-perceived)	4

Authors/Year	Technology sub-category / Specific technology	Study type & size	Target Setting	Target group for effect	+,-, o, +/-	Effect	Level of Evi-dence
4. Studies on Assistive Devices							
Miller, Rodger et al. 2011 [149]	Care support (multi-modal distraction)	RCT (i: n=20, c: n=20)	Hospital	Child in need of care Organisation	+ +	Less pain reported by children, pain reduction reported by parents, reduced stress levels reported by nurses, reduced pulse rates, reduced healing time Reduced treatment time	1b
Orto, Hendrix et al. 2015 [148]	Care support with treatment focus (smart pumps)	Quasi-Experiment (pre/post-design n=approx. 600 nurses)	Hospital	Person in need of care	+	Positive effect on adverse drug events	2
Vadiei, Shuman et al. 2017 [147]		Cross-Sectional (n=5 hospitals)	Hospital	Formal Caregiver	+	Positive effects on effective alerts, dosing errors and proportional doses	4
Zimmermann, Zeilfelder et al. 2017 [150]	Care support for Acti-vities of Daily Living (Drink monitoring)	User study. (n=15)	Inpatient long-term care	Person in need of care	+	Increased drinking amount and frequency	4
Marek, Stetzer et al. 2013 [144]	Reminder System (medication dispenser)	RCT (3-armed, i1: n=98, i2: n=102, c: n=101)	Outpatient long-term care	Person in need of care	o	No additional benefit by medication dispenser	1b
Akiyama and Sasaki 2013 [145]		Case study (n=17 people in 10 homes)	Outpatient long-term care	Person in need of care Formal Caregiver	+/-	40% of care recipient says “frequency of forgetting medicine is reduced” increased workload in medication support	4
Suzuki, Yokoishi et al. 2011 [146]		User study. (n=3)	Home	Person in need of care	+	Positive effect on missed medication rate	4
5. Studies on Ambient Assisted Living Solutions							
Hattink, Meiland et al. 2016 [15]	AAL at home	Quasi-Experiment (i: n=11, c: n=13)	Home	Person in need of care (dementia) Informal Caregiver	o	No significant differences (perceived autonomy, care needs, QoL, performance of daily activities), no effect on sense of competence for informal caregivers	2
Nijhof, van Gemert-Pijnen et al. 2013 [16]		Qualitative (n=14)	Home	Person in need of care (dementia) Informal caregiver	+ +	Positive effect on sense of safety and security for care (perceived by caregiver) Positive effect on anxieties and concerns (self-perceived), increased time for restorative activities	4
Trukeschitz B. 2018 [14]	AAL at home incl. formal care	Quasi-Experiment (i: n=59, c: n=59)	Outpatient long-term care	Person in need of care	+	Positive effect on personal safety (small), no effect on QoL, no effect on independency	2
6. Studies on Virtual Reality							
Kipping, Rodger et al. 2012 [152]	Virtual Reality for distraction/pain reduction	RCT (i: n=20, c=21)	Hospital	Person in need of care	+	Positive effect on pain scale during dressing removal, less medication needed, no differences in treatment times	1b
Mazzacano, McSherry et al. 2016 [153]		Quasi-Experiment (pre/post-design n=18)	Hospital	Person in need of care	+	Lower number of “breakthrough pain events during dressing changes, less medication needed, no differences in pain and anxiety	2
Patterson, Soltani et al. 2012 [154]		RCT (3-armed, i1: n=23, i2: n=15, c: n=17	Hospital	Person in need of care	o	No statistically differences in pain reduction	1b

Abbreviations: i=intervention; c=control; t1=time point 1; t2=time point 2; +=positive effect; -=negative effect; o=neutral effect; +/- =ambivalent effects

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(Numbering refers to main text and table)

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