**Table S2: Overview of the included studies.**

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| **Author** | **Study** | **Time** | **Group** | **Subject** | **Conclusion** |
| Alexandrou et al. 2012 (40) | Comparative CohortRetrospective | 12 months | 760 catheters. NP on ICU and 3 nurse specialists in 3 hospitals observed | Pneumothorax,Arterial puncture,Catheter bloodstream infection | Pneumothorax 1%Arterial Puncture 1%Bloodstream infection 1%  |
| Alexandrou et al. 2014 (41) | Comparative CohortRetrospective | 13 years | 4560 catheters/ 3 ACNPs | All complications,Catheter bloodstream infection | Pneumothorax 0,4%Arterial puncture depending on site, Bloodstream infections 0,1-0,8 per 1000 catheter days |
| Bevis et al. 2008 (42) | Comparative CohortRetrospective | 6 months | 51 patients, placement of thoracotomies/ advanced practice providers from ICU versus surgeons, in the ICU and emergency dept. | All complications, placement quality indicators | No difference between complications or quality indicators between advanced practice providers and surgeons |
| Burns et al. 2003 (33) | Comparative CohortProspective interventioncompared to retrospective data | 12 months prospective, 18 months retrospective | 510 patients protocolled weaning and sedation supervised by advanced practice nurses compared to 595 controls | Ventilator daysICU LOSHospital LOS,General mortality rate and costs | Ventilator days reduced 10 to 9 (p =.0001)ICU LOS reduced 15 to 12 (p=.0008)Hospital LOS reduced 22 to 20 (p=.00001) Lower mortality rate 38% to 31% (p=.02), cost savings > 3 million |
| Butler et al. 2011 (49) | Comparative CohortProspective | 36 months | 3 ICU’s 1-year collection 2004 ICU admissions adequate charge capture after implementation of educational program and documentation. Execution by 33 advanced practice providers and PAs in ICU | Adequate charge capture | 48% increase in adequate charge capture with extension of 3 beds during this period |
| Christmas et al. 2005 (35) | Comparative CohortProspective | 36 months | Three time periods compared (2 Physician extenders were implemented in the trauma team)2001 Before2002 During2003 AfterSample size unknown | Hospital length of stay, ICU length of stay,Patient mortality | Significant decrease in Hospital length of stay (12 vs 9 days), ICU length of stay (18 vs 12 days) and general care LOS (7 vs 3 days)Mortality and costs per patient remained unchanged |
| Collins et al. 2014 (36) | Comparative CohortRetrospective | 12 months | Team with NP implemented in trauma service (n= 3053 in 2012) compared with two years before.(2010: n= 2559 and 2011: n= 2671) | Hospital length of stay, costs | Data from 2010 and 2011 were averaged and the mean LOS for the entire trauma service was 7.2 days. After adding an experienced ACNP, the average LOS decreased to 6.4 days, a 0.8 day reduction. Per patient, there was a $ 9,111.50 savings in hospital charges, for a reduction of $27.8 million dollars in hospital charges over the 12-month pilot program. |
| Costa et al. 2014 (32) | Comparative CohortRetrospective | 12 months compared to previous 12 months | Teams with NP and PA participation in 29 mixed medical-surgical ICU’s, 39541 patients | Difference in mortality between groups treated by a team with and without a physician assistant | No difference in mortality |
| Dubaybo et al. 1991 (27) | Comparative CohortRetrospective | 24 months | 2 years of 2 PAs on an ICU compared with 2 years house officers.Sample size unknown  | Difference in monthly mortality, occupancy and complications | No differences in mortality, occupancy and complications |
| Gershengorn et al. 2011 (25) | Comparative CohortRetrospective | 12 months | 590 medical ICU admissions, 288 to the ICU with physician residents and 302 to ICU with NP and PAs.  | Difference in hospital mortality, ICU LOS, hospital LOS and discharge facility | No difference in Mortality, LOS or sort of discharge facility |
| Gershengorn et al. 2016 (37) | ComparativeCohortRetrospective | 9 months | Critical care outreach teams in two hospitals 3099 patients.One hospital with and one hospital without Critical Care trained PA (without n= 839 patients, with n= 1114 patients)Two: Normal outreach team (n= 1387 patients) | Difference in hospital mortality, hospital length of stayTime to transfer to ICU | No difference in hospital length of stay or hospital mortality19.2% reduction in transfer time to the ICU (p=0.002) |
| Gillard et al2011 (28) | Comparative CohortRetrospective | 26 months | Period before adding midlevel practitioner in a trauma center (2004-2005 n= 1216 patients)Period after adding midlevel practitioner (2005-2006 n= 1585 patients) | Difference in hospital mortality, hospital length of stay, ICU length of stayOccurrence of complications | No differences in hospital length of staySignificant decrease in ICU LOS from 4.08 ± 0.27 days (Pre intervention) to 3.28 ± 0.28 days (Post intervention) (p= 0.019) |
| Gracias et al. 2008 (45)  | Comparative CohortProspective | 12 months | 1380 surgical intensive care admissions. Two teams, one with and one without a PA | Difference in adherence to clinical practice guidelines: venous thrombosis prophylaxis, stress ulcers prophylaxis and anemia management | Thrombosis prophylaxis prescription improvement with ACNP: 93% to 98% (p<.001), stress ulcers prophylaxis prescription improvement with ACNP 51% to 91%(p<.001), improvement with anemia management 67% to 93%(p<.001) |
| Hoffman et al. 2003 (47) | Comparative CohortProspective | 19 months | 2 groups of ACNP with increasing experience (6 vs. 12 months) compared with physicians in training scored with the clinicians activities tool | Clinicians’ activity tool: time in routine patient management, coordination of care, non-unit activities. 5 and 10 minutes observation intervals were used  | No difference between two groups of ACNP’s in all endpoints, No difference time spent on routine patient management, ACNP spent more time in activities related to coordination of care (p<.001) and less in non-unit activities(p<.001) |
| Hoffman et al. 2005 (22) | Comparative CohortProspective  | 28 months | 526 admissions in a medical subacute ICU. (ACNP n= 250, fellows n= 276). 28 months, (total study time 31 months)7 months care by physician and ACNP and 7 months care by physician and fellow intermittently. | Rate of readmission, mortality, duration of mechanical ventilation, length of stay, limitations in treatment, reintubation and time allocated to direct patient care | No difference in readmission, mortality, length of stay, duration of mechanical ventilation. Higher acute physiology score day 1 with ACNP, more direct patient care with ACNP, more reintubations in fellow care. |
| Hoffman et al. 2006 (29) | Comparative CohortProspective  | 28 months | 192 patients on mechanical ventilation with tracheostomy. 7 months care by physician and ACNP and 7 months care by physician and fellow intermittently | LOS, days on mechanical ventilation, discharge weaning status, readmission and deaths. | No differences in LOS, days on mechanical ventilation, discharge weaning status, readmissions and death. |
| Jefferson et al. 2018 (50) | Comparative CohortProspective | 2 weeks | 81 patients (41 in comparison and 40 in intervention group. NP addressing necessity for lab orders | Number of laboratory test, number of adverse events | Significant increase lab tests (mainly specific individual tests), significant decrease in costs; no adverse events |
| Kapu et al. 2014 (39) | RetrospectiveSingle Cohort | 24 months | 5 NP led inpatients teams: Neuro ICU, SICU, CVICU,MICU and trauma stepdown | LOS, financial impact | Gross collections and expenses for 4 teams were 62%, 36%, 47% and +32%. And absolute estimated reduction of 9111 per case and a total of 27.8 million dollars for the stepdown unit.LOS decreased after adding NP and also resource usage decreased |
| Kawar et al. 2011 (23) | Comparative CohortRetrospective | 36 months | 5346 patients admitted to either a unit supported by physician residents (n= 3971) or a unit supported by PAs (n= 1375) | Hospital LOS and ICU LOS. Mortality ICU and hospital and 28 day | No differences in LOS or mortality |
| Landsperger et al. 2016 (21)  | Comparative CohortProspective | 12 months | 9066 ICU admissions in 2 years care for by either an ACNP team (n= 2366) or a physician resident team (n= 6700) | 90 day mortality, ICU mortality, LOS ICU and LOS hospital | ICU mortality lower with ACNP (OR 0.77 p<0.001) LOS hospital lower ACNP (OR 0.87 p<.001).No difference in hospital mortality or ICU LOS |
| Matsushima et al. 2016 (31) | Comparative CohortProspective | 8 months | 289 patients, Implementation of NPs during four night shifts.  | Lactate clearance, transfusions, mortality; Hospital length of stay, ICU length of stay,  | Median lactate clearance rate within 24 hours of admission was similar between study groups (10.0% vs 9.1%; P = .39). Advanced practitioners and RPs transfused patients requiring massive transfusion with a similar blood product ratio (packed red blood cells fresh frozen plasma) (2.1:1 vs 1.7:1; P = .32). In a multiple logistic regression analysis, AP coverage was not associated with any clinical outcome differences |
| Pirret 2008 (38) | Comparative cohort prospective with retrospective control | 12 months | Implementation of a NP led critical care outreach service for referral patients (n= 133)  | Prevention of (re)admission to ICU | Reduction in readmissions of patients staying < 72h (28 vs 9) and a reduction in ICU LOS (5 vs 3 days) No increase in complications. |
| Rayo et al. 2014 (44) | Comparative CohortProspective | 12 months | Analysis of 133 patient handovers of physician residents, attending physicians, registered nurses and ACNPs. | Communication interactions between experienced and not experienced group: | Less interjections of experienced clinicians (also ACNP)( 3.1/min vs. 1/min, p<.001), less explain requests with experienced clinicians (62,9% vs. 24%, p<.001) More collaborative cross-checks with experienced clinicians (6,5% vs. 27%, p<.001) |
| Rudy et al. 1998 (26) | Comparative CohortProspective | 14 months | Analysis of activities of 16 ACNPs or PAs, and 50 physician residents. And analysis of 389 patients cared for by either ACNPs/PAs (n= 187) or physician residents (n= 202). | Daily activities of care takers and ICU LOS, Hospital LOS and hospital mortality. | Significant difference between ACNPs/PAs and physician residents in the activities: Conference, administration, off-unit activities, communication, discharge and daily activities of living. Non-significant difference between ACNPs/PAs and physician residents in hospital LOS (10.5 days vs. 10.0 days), in ICU LOS (8.2 days vs. 6.7 days) and hospital mortality (9 deaths vs. 17 deaths) |
| Russell et al. 2002 (34) | Comparative CohortProspective with ACNP compared to retrospective without ACNP | 6 months ACNP and 12 months without ACNP | 524 patients total, 402 patients admitted under the care of ACNP (outcome mangers) on a neurosurgical intensive care with identification of clinical pathways compared to random retrospective admissions without ACNP and without identification of clinical pathways | Clinical parameters: incidence of urinary tract infections, skin breakdown and pneumonia, tracheostomy placement and removal, duration mechanical ventilation, duration to placement from the ICU after written order to do so. Financial parameters, ICU and hospitalLOS | With ACNP: Less skin breakdown (0% vs. 2% p<.05) less urinary tract infection (2% vs. 6% p<.05), LOS ICU shorter (8 vs. 11, p<.005), Savings of 2.47 million dollar. No differences in tracheostomy placement and de-cannulation, pneumonia, discontinuation of Foley catheter, |
| Scherzer et al. 2017 (24) | Comparative cohortRetrospective | 12 months | NP-MICU vs. physician resident-MICU. 1157 admissions.NP: n= 221, physician resident: n= 936 | ICU-mortality, in hospital mortality, ICU-LOS, hospital LOS | No differences in outcomes, ICU LOS in the NP run ICU longer due to disease severity of patients |
| Sidani et al. 2005 (46) | Comparative CohortProspective questionnaireRetrospective baseline situation | Duration unknown | ACNP vs. physician residents.123 patients ACNP: n= 78, physician residents n= 45 | Satisfaction of care, functional status, symptom resolution, sense of well-being  | Satisfaction and functional status higher with ACPNSymptom resolution and sense of well-being no significant difference. |
| Sirleaf et al. 2014 (43) | Comparative CohortRetrospective | 12 months | 1 year retrospective review of invasive procedures (arterial and venous lines, tracheostomy, Broncho alveolar lavage and percutaneous gastrostomy) in 1404 patients; comparison between ACNP and physician residents, both under supervision | Complications, LOS ICU and hospital, mortality | No differences in complications |
| Skinner et al. 2013 (30)  | Comparative CohortProspective | 24 months | Change in working hour directive: situation on cardiac intensive care before: 8 resident doctors and 7 NP during 1 year vs. situation after 5 resident doctors who were non-resident at night and 7 full-shift NP during 1 year | Acceptable situation if no mortality differences, no increase in adverse outcomes, same management of cardiac arrests and no delay in support of doctors was present when they were called Measurement of surgical trainee attendance in theatre and costs | Non-significant decrease in mortality with NP on watch, cardiac arrests same outcome, no delay in doctor attendance.Theatre attendance before 69% vs. after 80% p<.0001Cost before: £933344 after £764691. |
| Van Vught et al 2018 (48) | Comparative Cohort Prospective | 12 months | 11 PAs compared to 10 physician residents. Filmed patient scenarios with performance measurements of the scenario scores. | Performance of skills | No difference in performance of PAs and physician residents. |

ACNP=acute care nurse practitioner, APP = advanced practice provider, LOS=length of stay, ICU=intensive care unit, NP nurse practitioner, PA=physician assistant.