

WORKSHEET for Evidence-Based Review of Science for First Aid

Worksheet author(s)

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Clinical question.

HYPOTHESIS: In cardiac arrest patients (in-hospital and pre-hospital) [P] does resuscitation [I] produce a good Quality of Life (QoL) for survivors after discharge from the hospital. [O]? Prognosis

Is this question addressing an intervention/therapy, prognosis or diagnosis? Prognosis

State if this is a proposed new topic or revision of existing worksheet: Revision

Conflict of interest specific to this question

Do any of the authors listed above have conflict of interest disclosures relevant to this worksheet? **No**

Search strategy (including electronic databases searched).

Text search parameters used:

Elliott & Brett Search

(Searches completed week May 12th – 18th May)

“Cardiac Arrest” AND “Outcomes”

“Cardiac Arrest” AND “Quality of Life”

“Cardiac Arrest” AND “SF36”

“Cardiac Arrest” AND “EQ5D”

“Cardiac Arrest” AND “Anxiety”

“Cardiac Arrest” AND “Depression”

“Cardiac Arrest” AND “Cognitive Function”

“Cardiac Arrest” AND “Post Traumatic Stress Disorder”

“Cardiac Arrest” AND “Participation”

“Cardiac Arrest” AND “Social Function”

“Cardiac Arrest” AND “Health Utilities Index”

(Searches completed week June 29th – July 3rd 2009)

“Cardiac Arrest” AND “Cardiopulmonary Resuscitation” AND “Outcomes”

“Cardiac Arrest” AND “Cardiopulmonary Resuscitation” AND “Quality of Life”

“Cardiac Arrest” AND “Cardiopulmonary Resuscitation” AND “SF36”

“Cardiac Arrest” AND “Cardiopulmonary Resuscitation” AND “EQ5D”

“Cardiac Arrest” AND “Cardiopulmonary Resuscitation” AND “Anxiety”

“Cardiac Arrest” AND “Cardiopulmonary Resuscitation” AND “Depression”

“Cardiac Arrest” AND “Cardiopulmonary Resuscitation” AND “Cognitive Function”

“Cardiac Arrest” AND “Cardiopulmonary Resuscitation” AND “Post Traumatic Stress Disorder”

“Cardiac Arrest” AND “Cardiopulmonary Resuscitation” AND “Participation”

“Cardiac Arrest” AND “Cardiopulmonary Resuscitation” AND “Social Function”

“Cardiac Arrest” AND “Cardiopulmonary Resuscitation” AND “Health Utilities Index”

Relevant libraries and databases were searched. Abstracts and/or articles were reviewed to determine relevance and match inclusion/exclusion criteria – all searched May 12th – May 18th and June 29th – July 3rd 2009(as above).

EMBASE – 5167 returns (Primary Search)

COCHRANE DATABASE FOR SYSTEMATIC REVIEWS – No relevant returns

CENTRAL REGISTER OF CONTROLLED TRIALS – No relevant returns

AHA ENDNOTE MASTER LIBRARY – 77 returns – 9 relevant articles – all duplicates of primary Embase search

MEDLINE (Pubmed) – 1078 returns – 12 relevant articles – only 1 not duplicate of primary Embase search

Rodgers Search

Utilizing the text search parameters of "Quality of Life" and "Cardiac Arrest," relevant libraries and databases were searched. Note, quote marks were omitted for the search process to allow for a wider return of potentially useful articles. Abstracts and/or articles were reviewed to determine relevance and match inclusion/exclusion criteria.

Electronic databases searched included: AHA EndNote Master Library [241 articles identified], Cochrane database for systematic reviews [No relevant articles], MEDLINE [382 articles identified], Academic Search Premier (including CINAHL, PsycARTICLES, PsycINFO, & Health Source: Nursing/Academic Edition) [281 articles identified], and hand searches of relevant articles.

An additional MEDLINE search was conducted using the MeSH Topic "heart arrest" and the keywords "quality of life." This identified 251 articles. Another MEDLINE search was conducted using the MeSH Topic "cardiopulmonary resuscitation" and the keywords "quality of life." This identified 185 articles

Combined results of both C2005 worksheets.

Rodgers Criteria

Inclusion criteria – Peer-reviewed manuscripts, primary focus was general population (including both out-of-hospital and in-hospital cardiac arrest patients), prospective, retrospective studies, and case series included. Studies must have report on some measurement of Quality of Life beyond survival (such as CPC or OPC score, report of neurological function, or other QoL scoring measurement). Included studies required patients to have Quality of Life assessment done after discharge from the hospital.

Exclusion criteria – Abstract only reports (such as poster abstracts), editorial or comment/discussion articles, special populations (e.g., severely burned, perinatal arrests, hypoxic brain injury), case studies, articles that addressed cardiac arrest survival as a result of ICD devices, articles that only addressed survival rates and did not address quality of life issues, articles that used the same subject group for more than one study, and studies conducted prior to patient discharge.

- Number of articles/sources meeting criteria for further review (Rodgers) :

69 Articles met the inclusion criteria.

• State inclusion and exclusion criteria

Exclusion criteria: No abstract only studies. No editorials, letters/comments. Excluded neonates. Excluded articles that only addressed survival and did not address quality of life issues. Excluded articles that did not follow up patients as far as 6 months post CPA. Excluded studies that use the same populations of patients in multiple studies. Human studies only.

Inclusion Criteria: Prospective and retrospective studies. In hospital and out of hospital cardiac arrests. Follow up to 6 months and beyond. Studies looking at different interventions during and post CPA, utilising the control arm for quality of life data.

- Number of articles/sources meeting criteria for further review:

70 articles met inclusion criteria

Relevant articles from both searches were combined.

Summary of evidence

Evidence Supporting Clinical Question

Good	<p>Van Alem (2004)131. A,C,K,L, EP2 Granja(2002)37. M, EP2 Bunch(2003)60. H, EP5 Nichol(1999)95. A, A15, C. EP5 Stiell(2003)1939 A,A1A5, EP3 Grubb (1996)143. I, A7, EP1 Miranda(1994) 524. K, EP2</p>	<p>Tiainen (2007)2303 A, EP2</p>	<p>Bergner (1984)508. K, EP2 Graf (2008)92. H, EP4 Saner(2002)7. F,Z, A1, EP5 O'Reilly(2003)73. I, A7, EP1 Rien de Vois(1999)249. C,K,L,X, EP1 Horsted(2007)214. C,H, EP2</p>	<p>Cronberg (2009)1119. A, A2, A7, I, A22, A23, A24, EP2 Raina (2008)249. A, A15, L, EP4 Stiell (2009)241. A, A15, EP3 Wernberg (1979)211. E5, EP5 Motzer (1996)287. A29, A30, A31, A32, A33, EP5 Kamphius(2002)417. V,W,X,Y, EP3 Harve(2007)206. A9, EP4 Polo(2000)255. K, EP4 Graves(1997)117. C, EP3 Kuliman(1999)25.M, EP4 Hsu(1996)597. A,A14,C, EP6 Sauve(1995)133. A16,A17,A18,A19, EP5 Lederer(2004)123. A, A20, EP4</p>	
Fair	<p>Lettieri (2009) 569. A, EP3</p>	<p>Longstreth (2002) 506 A, EP1</p>	<p>Bertini (1990) 407 A, A36, EP5 Beuret (1993) 171 A, A36, EP5</p>	<p>Bedell (1983)569. A, EP2 Bottiger (1999)674. A, EP3 Earnest(1980)1298. A9, A34, A35, EP4 Gottschalk(2002)15. A, A25, EP4 Hillis (1993)245. K,A26, EP2 Martin-Castro(1999)121. A, A36, EP2 Roewer(1985)244. A, A36, EP5 Skagvoll(1999)323. A, EP1 Troiano(1989)91. A, EP5 Arrich(2009)876. A, EP2 Dimopoulou(2001) 1408. F, O, EP4 Nunes(2003)287. A, A5, A6, EP2 Eisenberger(1998), 137. A, EP5 Guerot(2001)989. A, EP3</p>	
Poor				<p>Kliegel(2002)301. A, EP5</p>	
	P1	P2	P3	P4	P5
Level of evidence					

Outcomes – Please define outcomes for this question, place them after letters below and use letters to identify studies which evaluate this outcome

A = CPC
 B = NIHSS
 C = MMSE
 D = Functional Independence Measure
 E = Instrumental Activity Measure
 F = Nottingham Health Profile
 G = Fugl Meyer Questionnaire
 H = SF36
 I = Hospital anxiety and depression score (HADS)
 J = Post Traumatic Diagnostic Scale
 K = Sickness Impact Profile
 L = Rankin Scale
 M = EQ5D
 N = Davidson trauma score for PTSD
 O = NYHA
 P = Community Intergration Questionnaire
 Q = Impact Event Scale
 R = Cognitive Failures Questionnaire
 S = Fatigue Severity Scale
 T = Barthel
 U = Frenchay Activities Index
 V = Rand 36
 W = Heart patients psychological questionnaire (HPPQ)
 X = Centre for epidemiological studies depression scale (CES-D)
 Y = State Anxiety Inventory (STAI)
 Z = Psychological general well being index questionnaire
 A1 = Everyday life Questionnaire
 A2 = Global deterioration scale
 A3 = Functional Ambulation categories
 A4 = 6 point Goodglass and Kaplan scale
 A5 = Blessed dementia screen
 A6 = Self rating depression scale
 A7 = Rivermead behavioral memory test
 A8 = Doors and people test
 A9 = Wechsler Memory Scale
 A10 = Auditory –verbal learning test
 A11 = Benton visual retention test
 A12 = Rey’s complex figure test
 A13 = Personal ADL
 A14 = Functional Status Questionnaire
 A15 = Health Utilities Index Mark 3
 A16 = Severity of illness index
 A17 = Health status questionnaire
 A18 = Mental health index
 A19 = Physical functioning index
 A20 = Life Satisfaction questionnaire
 A21 = Barrow neurological institute screen for higher cerebral function
 A22 = Self reported Montgomery and astrand depression rating scale
 A23 = EQ VAS
 A24 = Skane Sleep Index
 A25 = Overall performance category
 A26 = Dementia Rating Scale
 A27 = Neuro behaviour cognitive status examination
 A28 = QALY
 A29 = 15 item Flanagan quality of life scale
 A30 = 7 point delighted-terrible scale
 A31 = 5 item Duke health profile self esteem scale
 A32 = 17 item duke health profile
 A33 = Sense of coherence questionnaire
 A34 = Delayed auditory memory test
 A35 = Trail making test
 A36 = Unspecified questionnaire

Specialized end points were used to identify when QoL assessment was performed. For longitudinal studies, latest date was used for end point.

EP1 = QoL at <6 months

EP2 = QoL at 6 months

EP3 = QoL at 1 year

EP4 = QoL > 1 year

EP5 = QoL measured at varied intervals

EP6 = QoL measurement time not reported

Evidence Neutral to Clinical question

Good	Lundgren-Nilsson (2005)285. B,C,D,E,F,G, EP3		O'Reilly (2004)83. I,J, EP5 Reinhard (2009)73 V, EP5 Ladwig (1999)912. A,I,Q, EP5	Gamper(2004)378 M,N, EP5 Wachelder (2009)517, H,I,O,P,Q,R,S,T,U, EP5 Pusswald(2000)241. A2,A3,A4, EP4 Hofgren(2008) 972 B,C,D,A21, EP4 Drysdale(2000) 27 A7, A8, EP4 Maryniak(2008) 46 A, A10,All,A12, EP2	
Fair		Iwami (2007)2900 A, EP3		Wolftrum (2008)1780. A, EP2 Sunnerhagan (1996)135. C,F,A13, EP5 Engdahl(2001) 17. A, EP5 Gener (1989) 445. A, EP3 Sauve (1996)172. A9, A18, A27, EP2 Sauve (1996)127 A,O, EP2	
Poor					
	P1	P2	P3	P4	P5
Level of evidence					

Outcomes – Please use the same outcomes as defined for the Evidence Supporting table above

Evidence Opposing Clinical Question

Good					
Fair				Mohr(2001)566.A, EP5 Ronco (1995)210. A, EP5 Schindler (1996)1473 A, EP3 Callaham (1996)638. A, EP3	
Poor				Guglin (2004)1072. A Paniagua (2002)6. A28, EP5 Yarnell (1976)279. A, EP5	
	P1	P2	P3	P4	P5
Level of evidence					

Outcomes – Please use the same outcomes as defined for the Evidence Supporting table above

REVIEWER'S FINAL COMMENTS AND ASSESSMENT OF BENEFIT / RISK: (please include implementation considerations including at a minimum training, environment and availability):

The majority of studies included in this review concluded that the provision of resuscitation in cardiac arrest does provide patients with a good quality of life after discharge from hospital.

There was no standard approach amongst the studies in assessing quality of life and this was reflected in study design, number of participants and the large number and variety of different outcomes used. This makes the studies difficult to compare. Some used only the 'Cerebral Performance Category' which is a very gross functional score, but is very easy and simple to use and obtain and undoubtedly gives you some useful information on quality of life. Others conducted interviews either in person or over the phone, sent out questionnaires and used formal instruments and scales. This all contributed to the heterogeneity of the studies.

In addition, quality of life can be thought of as comprising of physical, psychological and social functioning – therefore a large number of variables will impact on it and a deficit/impairment that may be significant for one survivor may not be significant for another. As Ferrans and Powers state 'Quality of life represents a person's sense of well-being that originates from satisfaction or dissatisfaction with the areas of life that are important to that person' – not easy to measure.

When quality of life is assessed the survivors are generally asked to compare their present life situation with the quality of life they had prior to the cardiac arrest – this leads to negativity in responses given. The alternative to their current situation (ie if no resuscitation had been provided) would be the probability of being dead – very few authors/studies address this; however, Saner 2002, 7 reported that 49 of 50 patients judged their situation post resuscitation as worth living and Harve 2007, 206 noted that 9 out of 10 of their cohort were happy with their perceived quality of life. These are important statements with respect to the hypothesis.

What is also interesting is that Pusswald 2002, 241 demonstrates a striking discrepancy between patient reporting and carer reporting of disabilities and ADL rating – the patients estimation tended to be inappropriate indicating a considerable lack of awareness. So, then in those patients that are cognitively impaired should we be considering routinely assessing their primary care giver (if there is one) also?

When assessing the survivors, the authors have differing definitions for a survivor; some eg Bunch 2003, 2626 calls those with a CPC greater than or equal to 3 non-survivors. Saner 2002, 7 excluded those with severe hypoxic brain injury (but does not quantify how many of these there were) and Dimopoulou 2001, 7 excludes the sickest patients post cardiac surgery. In contrast Van Alem 2004, 131 provided a proxy questionnaire for relatives to fill out when the patients are unable to do so secondary to cognitive impairment. Therefore results need to be analysed accordingly, based on which 'survivors' may or may not have been excluded from the studies; excluding those with CPC 3/4 is likely to influence the results in a positive way with respect to quality of life

This worksheet addresses the question: "In cardiac arrest patients (in hospital and pre hospital) does resuscitation produce a good quality of life for survivors after discharge from hospital?" The answer is yes.

There are 46 supportive studies and 7 negative studies – one taken from the general population and one taken from a very specialised population.

There are 7 very supportive and well designed studies (Level P1, good quality). The strongest of these studies include:

Granja 2002, 37 – Granja and her colleagues looked at 19 (small number) survivors 6 months post ICU discharge. They used 2 matched controls for each survivor taken from the general ICU population (not having had a cardiac arrest) with similar APACHE II scores. They assessed all CPC groups. They used a validated QoL tool – EQ-5D and found no significant differences when compared to the control group. Although they did not reach statistical significance cardiac

arrest survivors presented with more extreme problems in 'physical dimensions' such as mobility and self care – it was thought that this corresponded to the small percentage of survivors with anoxic encephalopathy.

Nichol 1999, 95 – This was a substudy of a randomised controlled trial of active compression – decompression CPR. 126 survivors were discharged from hospital, 30 died in the following 6 months and 10 were 'lost to follow-up'; so they assessed 86 survivors. They used HUI3 as their assessment tool along with CPC and MMSE; the control group were age and sex matched samples from the 'national health survey of the Canadian population'. Most patients had no impairment or mild impairment in each contributing attribute of health. 33% survivors had a HUI3 score greater than 0.9. However, there was a significant difference in HUI3 scores when compared with general population – this was even more marked when compared directly with those in the control group whose activity was not limited by chronic disease.

Bunch 2003, 2626 – Bunch and colleagues looked at survivors after VF arrest. They excluded those with CPC greater than or equal to 3 and classed them as non-survivors (5 patients). 50 patients completed SF-36 surveys at long term follow up. They used USA population norms as the control. There was no significant difference between the groups in pain, general health, mental health, physical functioning, emotional role, physical role, social functioning, overall mental component or overall physical component. Only the score for vitality was significantly lower in survivor group – however, 58% of the patients responded to the vitality question were able to return to work. Bunch et al published several studies from the same cohort of patients. This study was the one most related to the hypothesis and the most robust.

Van Alem 2004, 131 – Van Alem's group reviewed 174 patients at 7 months post arrest using the sickness impact profile (SIP), MMSE, CPC and Rankin scale for independence. For those that could not respond to questionnaires because of poor cognitive function - a proxy version of SIP was used to interview close relatives. They used elderly Dutch population and patients who had suffered a stroke as controls. 77% of the patients did not need help from others. Quality of life (using SIP) was slightly to moderately poorer than in the elderly population but better than those who had suffered a stroke.

Stiell 2003, 1939 – Stiell's group had a large cohort – 268 patients who survived out of hospital arrest and were assessed at 1 year post event with the HUI3 (looks at 8 attributes of health – vision, hearing, speech, mobility, dexterity, emotion, cognition and pain). They compared the HUI3 scores with scores from the national population health survey of Canada. At 1 year 86% had CPC 1 and no-one had CPC 4 or 5. Median HUI score 0.8 (range 0.5-0.97), most survivors scored greater than 0.8. A few patients scored less than zero – which equated to a state worse than death!

There are a significant number of studies that we have allocated as 'neutral'. This is because many of the studies demonstrated significant deficits and/or reduction in quality of life through parameters such as social isolation, cognitive impairment, daily functioning, depression and anxiety, but what the authors stopped short of doing was stating whether these issues meant that the patient's quality of life was unbearably poor. Most of these studies could be said to have mixed findings.

The incidence of depression, anxiety and PTSD varied a great deal between studies; depression (assessed with various tools) was quoted anywhere between 14 to 32% in survivors. Similarly signs of anxiety were reported anywhere from 13 to 42% of survivors.

The vast majority of studies assigned to 'neutral' were case series of good quality. A few examples include:

Reinhard 2009, 73 – Retrospective, case controlled study – using population norms and patients who had previously had an MI or angina. 44 survivors were followed up between 16 and 62 months post event. They were assessed with RAND 36 QoL questionnaire (analogue of SF36) - patients had to be able to fill the form independently otherwise they were excluded. The cohort rated their QoL significantly worse than the general population in physical functioning, physical role function, emotional role, social functioning and general health. There were no differences in mental health, vitality or bodily pain. However, when compared with the patients with MI and/or angina who had not had a cardiac arrest there were no significant differences.

Gamper 2004, 378 – Gamper’s group looked at PTSD in long-term survivors. 143 patients completed the study, those with CPC 3 or above were excluded. Survivors were assessed at a mean of 45 months post arrest using EQ-5D and Davidson trauma score for PTSD. 39 patients (27%) fulfilled criteria for PTSD and those same patients had significantly lower QoL scores in all areas measured compared with those without evidence of PTSD. One third of those with ‘good neurological’ outcome had features of PTSD in this study. This study demonstrates why QoL studies are so complex – assessing neurological outcome is not enough as a survivor with an apparently good outcome may be significantly impaired by psychosocial symptoms that may not be immediately apparent unless appropriate assessments are carried out.

Wachelder 2009, 517 – Case Series of 63 survivors of out-of-hospital arrest. They were assessed on average 3 years post event using SF36 and community integration questionnaire; cognitive, physical and emotional impairment, daily functioning and care giver strain were also assessed. The majority of patients remained independent, 74% patients expressed a low participation level in society compared with the general population, 50% reported severe fatigue and 38% expressed feeling anxious or depressed. Overall 24% had decreased quality of life and 1 in 5 had some form of cognitive impairment. Seventeen percent of caregivers reported high care giver strain associated with the patients’ level of functioning. This study demonstrates the difficulty in assigning the evidence to supportive, neutral or negative – clearly the survivors (or at least a proportion of them) are experiencing significant difficulties, but, is that enough to say that resuscitation from cardiac arrest does not produce a good quality of life when the alternative is probable death?

There are only 7 negative studies and these are not good quality studies. Guglin 2004, 1072 do not tell us how they assessed neurological outcomes and Mohr 2001, 566 look at a specialised population only – in a nursing home with only 1 long term survivor. We do not feel these studies should impact on the general consensus that resuscitation after cardiac arrest produces a good QoL.

There are many good quality studies assessing quality of life in long term survivors of cardiac arrest. Obviously there are no RCTs and there are not likely to be any in the future. However, this review demonstrates that it is possible to conduct a good quality prospective study.

The most appropriate controls for QoL studies are from groups such as MI patients (who have not had cardiac arrests), patients who have suffered strokes or from the general ICU population with similar APACHE II scores – which is an approach some of the authors took; rather than population norms. All patients should be included in the quality of life analysis from CPC 1-4, where patients cannot fill out forms, answer questions etc proxy measurements can be taken as some authors (although not many) have demonstrated.

One of the most important/useful things that needs to be achieved is to rationalise the assessment tools that are being used to assess cardiac arrest survivors, as this is the main factor contributing to the heterogeneity of the studies. Ideally an assessment tool needs to be developed that assesses all factors impacting on quality of life – but this is probably unrealistic. Validating and recommending a tool for each of physical, psychological and social functioning post cardiac arrest would have a big impact on the studies and subsequent reviews.

Finally, having a statement sentence such as ‘I believe my life is worth living/ or not worth living’ is simple yet very powerful and would provide investigators with important information that many of the studies failed to establish.

Acknowledgements:

Citation List

ARRICH (2009): Arrich J., Zeiner A. et al. (2009). "Factors associated with a change in functional outcome between one month and six months after cardiac arrest. A retrospective cohort study." Resuscitation **80**(8): 876-880

Comments: Level 4, fair quality. Supporting. Focus of study – assessing changes in neurological status between one month and six months after cardiac arrest. 466 patients (81%) had Cerebral Performance Category (CPC) 1 or 2. 85 patients (14%) CPC 3 or 4.

BEDELL (2003): Bedell, S. E., T. L. Delbanco, et al. (1983). "Survival after cardiopulmonary resuscitation in the hospital." NEJM **309**(10): 569-76.

Comments: LOE P4, Fair quality (Not designed to measure Quality of Life), Supporting. Prospective study that determined 93 percent of survivors (n=41) were neurologically intact six months after discharge.

BERGNER (1984): Bergner, L., M. Bergner, et al. (1984). "Health status of survivors of out-of-hospital cardiac arrest six months later." Am J Public Health **74**(5): 508-10.

Comments: LOE P3, Good quality, Supporting. 424 survivors of cardiac arrest were interviewed and scored with the Sickness Impact Scale. Comparison group selected from general population that was adjusted for age and gender. Despite findings that showed some dysfunction, authors concluded survivors' "level of functioning and use of medical care suggests that many are carrying on their lives as they did prior to the arrest. These results support the value of efforts to resuscitate out-of-hospital cardiac arrest victims (p. 510)."

BERTINI (1990): Bertini, G., C. Giglioli, et al. (1990). "Neuropsychological outcome of survivors of out-of-hospital cardiac arrest." Journal of Emergency Medicine **8**(4): 407-12.

Comments: LOE P3, Fair quality (small number of patients), Supporting. Retrospective study with matched group comparison.

BEURET (1993): Beuret, P., F. Feihl, et al. (1993). "Cardiac arrest: prognostic factors and outcome at one year." Resuscitation **25**(2): 171-9.

Comments: LOE P3, Fair quality, Supporting. Retrospective study with no group comparison. 23 subjects (low number compared to other studies). Long-term survivors had ability to live independently.

BOTTIGER (1999): Bottiger, B. W., C. Grabner, et al. (1999). "Long term outcome after out-of-hospital cardiac arrest with physician staffed emergency medical services: the Utstein style applied to a midsized urban/suburban area." Heart (British Cardiac Society) **82**(6): 674-9.

Comments: LOE P4, Fair quality, Supporting. Retrospective study with no group comparison. 48 subjects. Authors concluded survivors had a "good long term outcomes in patients suffering from out of hospital cardiac arrest (p. 679)." Study used CPC/OPC as measurement tool. Primary goal of study was not QoL.

BUNCH(2003): Bunch T. J., White R.D., et al (2003) "Long-term outcomes of out of hospital cardiac arrest after successful early defibrillation" NEJM **348**(26): 2626-2633

Comments: Level 1, good quality. Supportive. VF out of hospital arrests only. Only assessed survivors CPC 1 and 2 (CPC 3-5 considered non-survivors). 50 long term survivors – no significant difference in quality of life when compared with US population norms except in vitality score. 65% of working age patients returned to work.

The following citations relate to the same cohort of patients. They are all supportive in their quality of life assessments.

Bunch T.J., White R.J., et al (2004) "Long-term subjective memory function in ventricular fibrillation out-of-hospital cardiac arrest survivors resuscitated by early defibrillation" Resuscitation **60**(2): 189-195

Mahapatra S., Bunch T.J., et al (2005) “ Sex differences in outcome after ventricular fibrillation in out-of-hospital cardiac arrest” Resuscitation **65**(2):197-202

Bunch T.J., White R.D., et al (2004) “Impact of age on long-term survival and quality of life following out-of-hospital cardiac arrest” Critical Care Medicine **32**(4):963-967

Bunch T.J., White R.D., et al (2004) “Outcomes and In-hospital treatment of out-of-hospital cardiac arrest patients resuscitated from ventricular fibrillation by early defibrillation” Mayo Clinic Proceedings **79**(5):613-619

Bunch T.J., White R.D., (2004) “Early defibrillation and out-of-hospital cardiac arrest” Cardiology Review **21**(5): 39-43

CALLAHAM (1996): Callaham, M. and C. D. Madsen (1996). "Relationship of timeliness of paramedic advanced life support interventions to outcome in out-of-hospital cardiac arrest treated by first responders with defibrillators." Ann Emerg Med **27**(5): 638-48.

Comments: LOE P4, Fair quality (28 patients), Opposing. Prospective study with no group comparison. Found that while some conditions allowed for good neurological function following discharge after cardiac arrest, larger number of patients had poor neurological outcomes and many expired within the first year. Study used CPC scale. 12 of 28 patients discharged with CPC of 1 or 2. 16 of 28 patients discharged with CPC of 3 or 4. Findings states, “Twenty-one percent of patients regained pulse or blood pressure in the field, 15% were admitted to hospital, and 6% survived to hospital discharge. Twenty-one percent of survivors (n=6) had a CPC score of 1, 21% (n=6) had a CPC of 2, and 57% (n=16) had a CPC of 3 or 4. At 1-year follow-up, 5 patients could not be located, and 15 were alive. Twelve (38%) had died, with a mean survival of 2.5 months (SD, 2.9 months) (p. 641).” .Authors stated, “because 80% had severe neurologic damage, one may debate whether they or their families were benefited by their resuscitation (p.647).”

CRONBERG (2009): Cronberg, T., G. Lilja, et al. (2009). "Long-term neurological outcome after cardiac arrest and therapeutic hypothermia." Resuscitation **80**(10): 1119-23.

Comments: LOE P4, Good quality, Supporting. Prospective study capturing data on 43 of 49 consecutive cardiac arrest survivors at six months. Conducted multiple measures of QoL. No vegetative state patients and only one provided a report of severe cognitive decline. Memory impairment was the most common finding.

DIMOPOULOU (2001): Dimopoulou I, Anthi A, et al (2001) “Functional status and quality of life in long-term survivors of cardiac arrest after cardiac surgery.” Critical Care Medicine **29**(7):1408-1411

Comments: Level 4, good quality. Supportive. Assessed a very specialised population of patients post cardiac surgery using New Heart Association Class(NYHA) and Nottingham Health Profile (NHP). Excluded the sickest patients post op (i.e. Cardiac index <2, those requiring IABP, LVAD or maximal inotropic support). Assessed 16 patients in total – 90% had acceptable functional status and two thirds had a preserved quality of life - 94% were able to look after their own home, 96% had a social life, 63% were sexually active and 81% were actively involved with their hobbies.

DRYSDALE(2000): Drysdale E.E., Grubb N.R., et al (2000) “Chronicity of memory impairment in long-term out-of –hospital cardiac arrest survivors” Resuscitation **47**(1): 27-32

Comments: Level 3, good quality. Neutral. Small group looking at previously identified survivors with memory impairment, controls were patients with MI and no arrest. There was a statistically significant decrease in memory over the 3 years since original assessment, in areas that represented daily functioning arrest survivors were more impaired than the controls.

EARNEST (1980): Earnest, M.P.; Yarnell, P.R.; Merrill, S.L.; Knapp, G.L.. (1980). “Long-term survival and neurologic status after resuscitation from out-of-hospital cardiac arrest.” Neurology. **30**(12):1298-1302.

Comments: LOE P4, Fair quality, Supporting. Retrospective study, small number of patients (20). Relied on three mechanisms for determining QoL: Personal interview, physical examination, or –for patients who had died subsequent to their initial discharge – survey completion by family members. Findings showed that a majority of survivors were able to function independently and many

were able to return to work. However, even among those who were functioning independently, most had some degree of neurologic abnormality.

EISENBERGER(1998): Eisenberger P., List M., et al (1998) “Long-term cardiac arrest survivors of the Vienna emergency medical service” Resuscitation **38**(3): 137-143

Comments: Level 4, fair quality. Supporting. Only looked at survivors with CPC 1-2 at 6 months. Assessed using CPC and their own questionnaire. 92 patients – average quality of life rated as 7 out of 10. Majority of survivors satisfied with quality of life and 84% considered survival a ‘second chance’. 36% reported depressive symptoms.

ENGDAHL (2001): Engdahl, J., A. Bang, et al. (2001). “Factors affecting short- and long-term prognosis among 1069 patients with out-of-hospital cardiac arrest and pulseless electrical activity.” Resuscitation **51**(1): 17-25.

Comments: LOE P4, Fair quality, Neutral. Retrospective study with no matched group comparison. 26 subjects who survived PEA cardiac arrest. At discharge “almost half of the survivors were discharged with no or mild neurological deficit (CPC 1 or 2). 12% were comatose (CPC 4)”. With near event numbers of good and bad neurological outcomes, rated this as neutral.

GAMPER (2004): Gamper G., Willeit M., et al (2004) “Life after death: Posttraumatic stress disorder in survivors of cardiac arrest – Prevalence, associated factors, and the influence of sedation and analgesia.” Critical Care Medicine **32**(2): 378-383

Comments: Level 4, good quality. Neutral. Excluded patients CPC 3-5. 143 patients completed study, mean follow up 45 months. Assessed with Euroqol questionnaire –EQ5D for quality of life measures, Davidson trauma score for PTSD. 39 (27%) patients fulfilled criteria for PTSD and had significantly reduced quality of life in all areas measured.

GENER (1989): Gener, J., J. Moreno, et al. (1989). “[Immediate and 1-year survival after cardiopulmonary resuscitation at an intensive care unit].” Med Clin (Barc) **93**(12): 445-8.

Comments: LOE P4, Fair quality (17 subjects), Neutral. Retrospective study with no group comparison. Abstract only reviewed.

GOTTSCHALK (2002): Gottschalk, A., M. A. Burmeister, et al. (2002). “Influence of early defibrillation on the survival rate and quality of life after CPR in prehospital emergency medical service in a German metropolitan area.” Resuscitation **53**(1): 15-20.

Comments: LOE P4, Fair quality (26 subjects at six months), Supporting. Retrospective study with no group comparison. 73% had a CPC score of 1 or 2 at the six month survival time. CPC/OPC was measurement tool.

GRAF(2008):Graf J., Muhlhoff C., et al (2008) “Health care costs, long term survival, and quality of life following intensive care unit admission after cardiac arrest” Critical Care **12**(4): R92

Comments: Level 3, good quality. Supportive. Assessed 81 patients still alive 5 years post ICU admission. Used SF-36 to assess health related quality of life (HRQL) in addition to collecting data on employment, marital status, dependency, re-hospitalisation, recollection of ICU stay and willingness to undergo critical care again. Used normative health related quality of life data from German population (healthy controls and those with acute and chronic diseases) as control. Did not include patients with GCS equal to or less than 6 in this report. HRQL scores were only slightly lower than age and gender matched apparently healthy German controls.

GRANJA(2002): Granja C., Cabral G., et al (2002) “Quality of Life 6-months after cardiac arrest” Resuscitation **55**(1): 37-44.

Comments: Level 1, good quality. Supportive. Excellent study. Prospective. 19 patients assessed using CPC and EQ5D 6 months post cardiac arrest. Created 2 matched controls for each patient from the general ICU population – matched for age and APACHE II score. A higher percentage of cardiac arrest survivors reported more extreme problems in some dimensions on EQ5D compared with other ICU patients – no significant differences were found. They seem to experience problems with more physical dimensions – which the authors attribute to the small percentage of survivors with anoxic encephalopathy. Overall, good quality of life.

GRAVES(1997): Graves J.R., Herlitz J., et al (1997) “Survivors of out of hospital cardiac arrest: their prognosis, longevity and functional status” Resuscitation **35**(2): 117-121

Comments: Level 4, good quality. Supportive. Large number of subjects – only assessment tool was CPC. Followed up for 1-14 years. 73% of those still alive at 1 year had returned to pre-arrest functioning.

GRUBB (1996): Grubb, N. R., R. O'Carroll, et al. (1996). “Chronic memory impairment after cardiac arrest outside hospital.” BMJ **313**(7050): 143-6.

Comments: LOE P1, Good quality, Supporting. Prospective study with matched group comparison. 35 subjects. 37% had impairment of long-term memory. Short term memory was not impacted.

GUEROT (2001): Guerot, E., N. Deye, et al. (2001). “[Evaluation of outcome of patients hospitalized after pre-hospital cardiac arrest].” Archives des maladies du coeur et des vaisseaux **94**(9): 989-94.

Comments: LOE P4, Fair quality, Supporting. Retrospective study with no matched group comparison. 8 subjects (low number compared to other studies). Eight survivors from group of 89 arrest patients alive at 1 year and living independently. Abstract only reviewed.

GUGLIN(2004): Guglin M.E., Wilson A., et al (2004) “ Immediate and 1-year Survival of Out-of-Hospital Cardiac Arrest Victims in Southern New Jersey:1995-2000” PACE **27**(8): 1072-1076

Comments: Level 4, poor quality. Negative. Large case series. Quotes 1 year survival with favorable neurological outcome as 2.3%, but does not state how neurological outcome is assessed. 19-50% carry the diagnosis of anoxic brain damage. Poor quality study – limited useful information.

HARVE(2007): Harve H., Tiainen M., et al (2007) “ The functional status and perceived quality of life in long-term survivors of out-of-hospital cardiac arrest” Acta Anaesthesiologica Scandinavica **51**(2): 206-209

Comments: Level 4, good quality. Supportive. Subgroup of trial evaluating nimodopine for brain protection. Group of 10 assessed at 1 year and 15 years. All lived at home and were independent, participated in hobbies and exercise. 9 of the patients were happy with their perceived quality of life at one year. Majority of patients had no or mild cognitive impairment.

HILLIS (1993): Hillis, M. , D. Sinclair, et al. (1993). “Prehospital cardiac arrest survival and neurologic recovery.” J Emerg Med **11**(3): 245-252.

Comments: LOE P4, Fair quality (other objectives in study other than QoL, low number of subjects), Supporting. Non-randomized prospective study with no matched group comparison. 14 subjects survived to discharge low number compared to other studies). Utilized Sickness Impact Profile (SIP) and cognitive function using the Dementia Rating Scale (DRS). Study also had other interventions. Concluded survivors had good functional outcomes.

HOFGREN(2008): Hofgren C., Lundgren-Nilsson A., et al (2008) “ Two years after cardiac arrest; cognitive status, ADL function and living situation” Brain Injury **22**(12): 972-978

Comments: Level 4, good quality. Neutral. 22 patients thoroughly assessed on several occasions throughout 2 years following arrest. Only 1 patient had normal cognitive function. 64% were living in own home and the majority of these were independent.

HORSTED(2007):Horsted T.I., Rasmussen L.S., et al (2007) “ Long-term prognosis after out-of hospital cardiac arrest” Resuscitation **72**(2): 214-218

Comments: Level 3, good quality. Supportive. Survival and quality of life 6 months post cardiac arrest assessed using SF36 and MMSE. 33 patients. Median MMSE 29. Role 'physical' and role 'emotional' were significantly worse than national norms on SF36, but, none of the summary scores reached statistical significance.

HSU(1996): Hsu J.W., Madsen C.D., et al (1996) "Quality-of-life and formal functional testing of survivors of out-of-hospital cardiac arrest correlates poorly with traditional neurologic scales" Annals of Emergency Medicine **28**(6): 597-605

Comments: Level 4, good quality. Supportive. Focus of study was demonstrating that CPC was not a good measure of outcomes. 35 survivors – average MMSE28. 68% rated their quality of life as the same or better than prior to the arrest.

IWAMI(2007): Iwami T., Kawamura T., et al (2007) "Effectiveness of Bystander-Initiated Cardiac-Only Resuscitation for Patients With Out-of Hospital Cardiac Arrest" Circulation **116**(25): 2900-2907

COMMENTS: Level 2, fair quality. Neutral. Study looking at cardiac only by-stander CPR. We utilized control arm. Only assessed using CPC and defined CPC 1 and 2 as neurologically favorable. They had a 4.1% survival with favorable neurological outcome at one year. They did not separate out their survivors from non-survivors so we cannot assess favorable neurological outcomes in survivors alone.

KAMPHIUS(2002): Kamphius H.C.M., De Leeuw J.R.J. et al (2002) "A 12-month quality of life assessment of cardiac arrest survivors treated with or without an implantable defibrillator" Europace **4**(4): 417-425

Comments: Level 4, good quality. Supportive. 168 cardiac arrest survivors (ventricular arrhythmias only) followed up for one year and either treated with an ICD or other/medical treatment. Quality of life assessed with Rand 36 item health survey, psychological well-being with the heart patients psychological questionnaire(HPPQ), depression with centre for epidemiological studies depression scale(CES-D) and anxiety with state anxiety inventory (STAI). The 2 groups were compared with each other. Most assessment scores improved with time. No significant differences found in quality of life when compared with population norms. There were however significantly higher levels of anxiety and depression.

KLIEGEL (2002): Kliegel, A., W. Scheinecker, et al. (2002). "Hurrah - We are still alive! A different dimension in post-resuscitative care: The annual gathering of cardiac arrest survivors at a typical Viennese wine tavern." Resuscitation **52**(3): 301-304.

Comments: LOE P4, Poor quality (not meant as a statistical report on QoL), Supporting. Anecdotal reporting of group of cardiac arrest survivors at reunion with caregivers. Article included photograph of group of survivors standing and waving to camera could be construed to demonstrate strong evidence of the value of CPR/ECC.

KUILMAN(1999): Kuilman M., Bleeker J.K., et al (1999) "Long-term survival after out-of-hospital cardiac arrest: an 8-year follow up" Resuscitation **41**(1): 25-31

Comments: Level 4, good quality. Supporting. 132 patients still alive at 7 years. Assessed with EuroQol questionnaire. At one year 73% stated that their state of health in the previous week was comparable with that one year previously.

LADWIG(1999): Ladwig K-H., Schoefinius A., et al (1999) " Long-acting psychotraumatic properties of a cardiac arrest experience" American Journal of Psychiatry **156**(6): 912-919

Comments: Level 3, good quality. Neutral. 21 long term survivors with CPC 1 or 2 assessed at a mean follow up of 39 months post arrest. Used a cohort of MI patients (with no cardiac arrest) as control. They found high level of emotional stability and well being using the HADS (infact anxiety was less prevalent than in controls) – 75% were in normal range. When looking at PTSD they concluded that the cardiac arrest population were at high risk and had impairment in some areas.

LEDERER(2004): Lederer W., Lichtenberger C., et al (2004) " Long-term survival and neurological outcome of patients who received recombinant tissue plasminogen activator during out-of-hospital cardiac arrest" Resuscitation **61**(2): 123-129

Comments: Level 4, good quality. Supportive. Case series looking at the outcomes in cardiac arrest survivors treated with rTPA. Small cohort of 15 survivors. They looked at CPC and QoL measures using a life satisfaction questionnaire. They also surveyed close family members. 13 out of 15 patients judged their own lives to be worth living and 12 patients saw their survival as a second chance. Overall they had excellent life satisfaction.

LETTIERI(2009): Lettieri C, Savonitto S, et al (2009) “Emergency percutaneous coronary intervention in patients with ST-elevation myocardial infarction complicated by out-of-hospital cardiac arrest: Early and medium-term outcome” American Heart Journal **157**(3): 569-575

Comments: Level 1, fair quality. Supportive. Prospectively enrolled all patients with STEMI, compared those who had a cardiac arrest and those who did not. Assessed CPC at 12 months. In cardiac arrest group 87% CPC 1, 3% CPC 2, 4% CPC3 and 6% CPC4. 87% were deemed as having an active life.

LONGSTRETH(2002): Longstreth, W. T., Jr., C. E. Fahrenbruch, et al. (2002). “Randomized clinical trial of magnesium, diazepam, or both after out-of-hospital cardiac arrest.” Neurology **59**(4): 506-14.

Comments: LOE P4, Fair quality (no discussion of assessment tool for QoL), Supporting. Prospective RCT trial evaluating different post-arrest therapies. QoL was measured as an outcome and reported only as independent, dependent, vegetative, or dead. Combined 91 subjects scored with 82.4% (n=75) rated independent, 16.5% (n=15) rated dependent, and 1% (n=1) rated vegetative.

LUNDGREN-NILSSON(2005): Lundgren-Nilsson A., Rosen H., et al (2005) “The first year after successful cardiac resuscitation: Function, activity, participation and quality of life.” Resuscitation **66**(3): 285-289

Comments: Level 1, good quality. Equivocal. Very thorough assessment of 26 cardiac arrest survivors up to one year post event. 7 patients (29%) had cognitive dysfunction. 43% patients dependent in motor performance, 38% dependent in social cognition. Health related quality of life was similar to reference populations. Satisfaction with life as a whole however was only 18%.

MARTIN-CASTRO (1999): Martin-Castro, C., M. Bravo, et al. (1999). “[Survival and the quality of life in extrahospital cardiorespiratory arrest].” Medicina Clinica **113**(4): 121-3.

Comments: LOE P4, Fair quality (small subject number), Supporting. Prospective study with no matched control group. 8 Subjects (very low number compared to other studies). Patient group was somewhat specialized as they all received TPA. Majority reported good overall QoL. Abstract only reviewed.

MARYNIAK (2008): Maryniak M., Bielawska A., et al (2008) “Long-term cognitive outcome in teenage survivors of arrhythmic cardiac arrest” Resuscitation **77**(1): 46-50

Comments: Level 4, good quality. Neutral. Small case series of teenage survivors of cardiac arrest. Assessed up to 6 months (and on-going beyond publication). 2 patients were considered cognitively normal and 2 were severely impaired. 50% of the patients experienced subjective difficulties wrt to cognitive function. They were not found to have increased levels of anxiety or fear; the authors in fact stated that they “did not feel appropriate fear”.

MIRANDA (1994): Miranda, D. R. (1994). “Quality of life after cardiopulmonary resuscitation.” Chest **106**(2): 524-30.

Comments: LOE P1, Good quality, Supporting. Prospective study with matched control group. 69 Subjects. SIP score between CPR group and control group was not significantly different, although the CPR group did have some problems with ability to return to work and psychosocial functions.

MOHR(2001): Mohr M., Bomelburg K., et al (2001) “ Attempted CPR in nursing homes – Life-saving at the end of life?” Anesthesiologie Intensivmedizin Notfallmedizin Schmerztherapie **36**(9): 566-572

Comments: Level 4, fair quality. Negative. Study looking at specialized population of nursing home residents. 71 arrest calls – 10 patients survived to hospital admission. Only one patient survived beyond 6 months – with a CPC 4 (PVS), he died after 10 months.

MOTZER (1996): Motzer, S. U. and B. J. Stewart (1996). "Sense of coherence as a predictor of quality of life in persons with coronary heart disease surviving cardiac arrest." *Research in Nursing & Health* **19**(4): 287-98.

Comments: LOE P4, Good quality, Supporting. Retrospective study with no matched control group. 149 Subjects (high number compared to other studies). Subjects reported a strong score (5.3 out of 7.0) for their QoL.

NICHOL(1999): Nichol G., Stiell I.G., et al (1999) "What is the quality of life for survivors of cardiac arrest? A prospective study" *Academic Emergency Medicine* **6**(2): 95-102

Comments: Level 1, good quality. Supportive. 86 survivors assessed at a mean 9.9 months. Most survivors had an acceptable health related quality of life and had no or only mild impairment in each attribute of health. Those that were impaired tended to be emotion, pain, ambulation and cognition.

NUNES(2003): Nunes B., Pais J., et al (2003) "Cardiac arrest: long-term cognitive and imaging analysis." *Resuscitation* **57**(3): 287-297

Comments: Level 4, fair quality. Supportive. Small group – 11 patients. Assessed on average 21.4 months post arrest. Main thrust of paper was looking at imaging variables. 6 of patients had good performance status

O'REILLY(2003): O'Reilly S.M., Grubb N.R., et al (2003) "In-hospital cardiac arrest leads to chronic memory impairment" *Resuscitation* **58**(1):73-79

Comments: Level 3, good quality. Supportive. In hospital cardiac arrests - 35 patients. Retrospective with 2 historic control groups (survivors of out of hospital cardiac arrest and survivors of MI – no cardiac arrest). Clinically significant impairment in episodic memory in 1 in 4 arrest survivors, but majority of patients have only a mild or moderate memory impairment.

O'REILLY(2004): O'Reilly S., Grubb N., et al (2004) "Long-term emotional consequences of in-hospital cardiac arrest and myocardial infarction" *British Journal of Clinical Psychology* **43**(1): 83-96

Comments: Level 3, good quality. Neutral. Retrospective case controlled study comparing emotional disability 27 patients who had an in hospital arrest with 27 hand picked matched controls who had suffered an MI but not a cardiac arrest. Assessed using hospital anxiety and depression scale (HADS), post traumatic diagnostic scale and structured clinical interview. Mean scores on HADS were higher in cardiac arrest groups, but only statistically significant in depression. 19% patients in the cardiac arrest group and 7% fulfilled diagnostic criteria for PTSD (statistically not more likely in cardiac arrest group)

PANIAGUA (2002): Paniagua, D., F. Lopez-Jimenez, et al. (2002). "Outcome and cost-effectiveness of cardiopulmonary resuscitation after in-hospital cardiac arrest in octogenarians." *Cardiology* **97**(1): 6-11.

Comments: LOE P4, Poor quality (no formal assessment scale for QoL, highly specialized population not typical of the general population – considered excluding), Opposing. Retrospective study with no matched control group. 54 subjects with survival (moderate number compared to other studies). Patient group was specialized (patient age greater than 80). Number needed to treat for long-term survival was 29. Of 54 subjects who survived to discharge, 35 were sent to chronic care facilities. This implies a poor quality of life.

POLO(2000): Polo V., Ardeleani G. et al (2000) "3 year survival and quality of life after out-of-hospital cardiac arrest" *Annali Italiani di Medicina Interna* **15**(4): 255-262

Comments: Level 4, good quality. Supportive. Large cohort, especially when compared with other studies. Assessed survivors at 3 years post event. 64% of patients had a satisfactory quality of life as assessed by the sickness impact profile.

PUSSWALD(2000): Pusswald G., Fertl E., et al (2000) “ Neurological rehabilitation of severely disabled cardiac arrest survivors. Part II. Life situation of patients and families after treatment.” Resuscitation **47(3)**: 241-248

Comments: Level 4, good quality. Neutral. Select group of 12 patients who had all gone in-patient rehabilitation post cardiac arrest (excluded patients in persistent vegetative states, non cardiac arrests and in hospital arrests). All patients had to be CPC 3 or above. Assessed patients and their families. All patients were impaired in at least one cognitive area. They tended to overestimate their own abilities in terms of ADL. 9 of 12 were dependent on others for living. They all had a lack of social support. The families as a whole had experienced a decrease in income and living conditions.

RAINA(2008): Raina, K. D., C. Callaway, et al. (2008). "Neurological and functional status following cardiac arrest: method and tool utility." Resuscitation **79(2)**: 249-56.

Comments: LOE P4, Good quality, Supporting. Retrospective study with no matched control group. 21 Subjects. Primary purpose of study was to compare the CPC score to other measures of QoL.

REINHARD(2009): Reinhard V., Parna K., et al (2009) “Long-term outcome of bystander-witnessed out of hospital cardiac arrest in Estonia from 1999-2002” Resuscitation **80(1)**: 73-78

Comments: Level 3, good quality. Neutral. 57 patients, used patients with a history of cardiac disease and age and sex adjusted Estonian population as controls. Used RAND 36 to assess quality of life. Patients not able to fill in questionnaire independently were excluded – thereby presumably excluding the most severely affected patients. When compared with population norms, survivors rated their quality of life significantly worse – specifically in general health, emotional role functioning, social functioning and physical functioning. However when compared to patients known to have had an MI and/or angina – they rated their quality of life very similarly.

RIEN DE VOIS(1999): Rien de Vois R.N., Hanneke C.J.M., et al (1999) “Quality of Survival After Cardiopulmonary Resuscitation” Archives of Internal Medicine **159(3)**: 249-254

Comments: Level 3, good quality. Supportive. Large group of survivors – 90. Compared them with a cohort of elderly patients visiting the GP and another group of patients that had had a stroke. 75% remained independent after event. In terms of quality of life the post arrest group scored better than the stroke group, but not as good as the elderly population. They also found that patient characteristics prior to the arrest explained quality of life post arrest. 3% patients entered a persistent vegetative state and all died within a several months.

ROEWER (1985): Roewer, N., T. Kloss, et al. (1985). "[Long-term result and quality of life following preclinical cardiopulmonary resuscitation]." Anesthesie, Intensivtherapie Notfallmedizin **20(5)**: 244-50.

Comments: LOE P4, Fair quality, Supporting. Retrospective study with no matched control group. 38 Subjects. 32 of 38 had no deficits. Of 28 survivors interviewed, 68% said meaning of life unchanged and 7% said meaning improved.

RONCO (1995): Ronco, R., W. King, et al. (1995). “Outcome and cost at a children's hospital following resuscitation for out-of-hospital cardiopulmonary arrest.” Archives of Pediatrics & Adolescent Medicine **149(2)**: 210-4.

Comments: LOE P4, Fair quality (small study with only 6 subjects), Opposing. Retrospective study with no matched control group. Specialized population (patients were in cardiac arrest on arrival to Emergency Department) that could be excluded as being too narrow in focus and a population where poor outcomes could be expected. Only one out of six patients who survived to discharge was reported as normal (even though there were still neurological deficits present).

SANER(2002): Saner H., Rodriguez E.B., et al (2002) “ Quality of Life in long-term survivors of out-of-hospital cardiac arrest” Resuscitation **53(1)**: 7-13

Comments: Level 3, good quality. Supportive. Retrospective, matched controls(allocated). Out of hospital arrests only. Excluded those with severe hypoxic brain injury. Assessed 50 patients 5 -68 months post arrest using psychological general well being index questionnaire, Nottingham health profile (NHP) and everyday life questionnaire. Patients judged their well being as unchanged pre and post arrest. NHP revealed significant differences between survivors and controls in emotional reactions, energy levels, physical mobility and sleep. Levels of anxiety and depression, well being and vitality were also significantly different. 49 of 50 patients judged their life as worth living.

SAUVE(1995): Sauve M.J. (1995) "Long-term physical functioning and psychosocial adjustment in survivors of sudden cardiac death" Heart and lung: Journal of Critical Care **24**(2): 133-144

Comments: Level 4, good quality. Supportive. Thorough assessment of 61 survivors. They reported significant decreases in physical functioning and mild to moderate cognitive impairment. However, only a minority of survivors were severely psychologically distressed.

SAUVE(1996): Sauve, M. J., N. Doolittle, et al. (1996b). "Factors associated with cognitive recovery after cardiopulmonary resuscitation." Am J Crit Care **5**(2): 127-39.

Comments: LOE P4, Fair quality (QoL was not measured directly, study focused on cognitive impairments). Neutral. Prospective case series. 38 subjects at 6 months. Half of subjects had normal cognition at 6 months. Of the half that had impairments, half of those were deemed moderate to severe.

SAUVE(1996): Sauve, M. J., J. A. Walker, et al. (1996a). "Patterns of cognitive recovery in sudden cardiac arrest survivors: the pilot study." Heart & Lung: Journal of Acute & Critical Care **25**(3): 172-81.

Comments: LOE P4, Fair quality (QoL was not measured directly, study focused on cognitive impairments. Small subject group.), Neutral. Longitudinal case series. 17 subjects. Results showed improvements in cognitive functions over time. 71% of subjects had no impairments at 6 months. Scored as neutral because authors highlighted "significant minority" with impairments.

SCHINDLER (1996): Schindler, M. B., D. Bohn, et al. (1996). "Outcome of out-of-hospital cardiac or respiratory arrest in children." N Engl J Med **335**(20): 1473-9.

Comments: LOE P4, Fair quality (small number of subjects). Opposing. Prospective case series. 6 subjects in cardiac arrest group survived to discharge. 5 subjects survived to six months. 3 were classified as having moderate deficits and 2 were listed as being in a persistent vegetative state. All patients arrived in ED in cardiac arrest which is a poor prognostic indicator for cardiac arrest survival.

SKOGVOLL (1999): Skogvoll, E., G. K. Sangolt, et al. (1999). "Out-of-hospital cardiopulmonary resuscitation: a population-based Norwegian study of incidence and survival." European Journal of Emergency Medicine **6**(4): 323-30.

Comments: LOE P4, Fair quality (small number of subjects, QoL measured at discharge). Supporting. Retrospective case series. 57 subjects scored on CPC and OPC at discharge from hospital. Most patients had CPC 1 (n=33), but 9 were reported with severe disabilities.

STIELL(2003): Stiell I., Nichol G., et al (2003) "Health-related Quality of Life is Better for Cardiac Arrest Survivors Who Received Citizen Cardiopulmonary Resuscitation" Circulation **108**(16): 1939-1944

Comments: Level 1, good quality. Supportive. Large prospective study using population norms (age and sex matched) as controls. Used health utilities index at one year follow up. Median HUI3 0.80 which compares well with age adjusted values for normal population. Most patients had a score exceeding 0.80. A few patients scored <0 which signifies a fate worse than death.

STIELL(2009): Stiell, I. G., L. P. Nesbitt, et al. (2009). "Comparison of the Cerebral Performance Category score and the Health Utilities Index for survivors of cardiac arrest." Ann Emerg Med **53**(2): 241-248.

Comments: LOE P4, Good quality. Supporting. Retrospective case series. 305 subjects completed Health Utilities Index and were scored with CPC one year after discharge. 87.5% had a CPC of 1 indicating a good QoL. Purpose of study was not to measure QoL but to compare different QoL measurement tools.

SUNNERHAGEN(1996): Sunnerhagen K.S., Johansson O., et al (1996) "Life after Cardiac arrest; a retrospective study" Resuscitation **31**(2): 135-140

Comments: Level 4, fair quality. Neutral. Excluded survivors older than 75 years. Average follow up time 25.5 months. 23% had increased dependency on others, 42% had decreased social contacts. In quality of life measures post arrest group scored worse than the reference population in all areas except pain.

TIAINEN(2007): Tiainen M., Poutiainen E., et al (2007) "Cognitive and Neurophysiological Outcome of Cardiac Arrest Survivors Treated With Therapeutic Hypothermia" Stroke **38**(8): 2303-2308

Comments: Level P2, good quality. Supportive. Assessed consecutive patients after out of hospital VF arrest treated either with normothermia (control arm) or therapeutic hypothermia. We looked at control arm. Thorough assessment at 3 months (which in terms of length of follow up is outside our inclusion criteria). At 6 months assessed only with CPC: 18 patients, 14 CPC 1 or 2, 4 CPC 3. 15 lived at home, 3 in institutional care.

TROIANO (1989): Troiano, P., J. Masaryk, et al. (1989). "The effect of bystander CPR on neurologic outcome in survivors of prehospital cardiac arrests." Resuscitation **17**(1): 91-8.

Comments: LOE P4, Fair quality (only 47.1% of patients were available for interview), Supporting. Retrospective study with no comparison group. 65 subjects. Scored with CPC. 80% reported CPC scores of 1 or 2.

VAN ALEM(2004): Van Alem A.P, Reiner A, et al (2004) "Assessment of Quality of Life and Cognitive Function After Out-of-Hospital Cardiac Arrest With Successful Resuscitation" American Journal of Cardiology **93**(2): 131-135

Comments: Level 1, good quality. Supportive. Very good study. Consecutive out of hospital cardiac arrest patients enrolled. 174 survivors available at 6 months. Quality of life assessed with 136 item sickness impact profile (SIP), cognitive function assessed with MMSE. SIP compared with profiles of open Dutch population (elderly and those who had had a CVA). Also used CPC and Rankin scale for independence. Included all CPC groups – those that could not respond to questionnaires were assessed through interviews with close relatives using a proxy version of SIP (I did not find any other groups who did this and included all CPC classes). 77% patients were independent at follow up. Median CPC 1. 15% impaired physical functions, 13% impaired psychosocial function. Quality of life was slightly to moderately poorer in cardiac arrest patients when compared with normal population – but was deemed acceptable in general.

WACHELDER(2009): Wachelder E.M., Moulart V.R.M.P., et al (2009) "Life after survival: Long term daily functioning and quality of life after an out-of-hospital cardiac arrest" Resuscitation **80**(5): 517-522

Comments: Level 4, good quality. Neutral. 63 survivors of out of hospital arrest –thoroughly assessed on average 3 years post cardiac arrest. Used Community Intergration Questionnaire to assess participation in society and SF36 to assess quality of life as primary end points. They also used the NYHA Classification, fatigue severity scale(FSS), cognitive failures questionnaire(CFQ), hospital anxiety and depression scale (HADS) and Impact Event Scale(IES). 74% experienced a low participation level in society, 50% reported severe fatigue, 38% had feelings of anxiety +/- depression. In comparison with the general population health related quality of life came out just below average. (Also looked at care giver strain using caregiver strain index (CSI) – 1 in 5 showed high levels of strain)

WERNBERG (1979): Wernberg, M. and A. Thomassen (1979). "Long- and short-term mortality rates in patients who primarily survive cardiac arrest compared with a normal population." Acta Anaesthesiologica Scandinavica **23**(3): 211-6.

Comments: LOE P4, Good quality, Supporting. Retrospective study with matched control group. 180 Subjects (very high number compared to other studies). Mixed results that showed mortality at 3 years post event was similar with general population and cardiac function was satisfactory, but only 50% resumed prior level of activity.

WOLFRUM(2008): Wolfrum S., Pierau C., et al (2007) “Mild therapeutic hypothermia in patients after out-of-hospital cardiac arrest due to acute ST-segment elevation myocardial infarction undergoing immediate percutaneous coronary intervention” Critical Care Medicine **36**(6): 1780-1786

Comments: Level P4, fair quality. Neutral. Observational Study assessing therapeutic hypothermia – used a historical control group treated in the 2 year observational period prior to this study commencing. CPC assessed at 6 months – 17 patients, 8 of which had CPC 1 or 2.

YARNELL (1976): Yarnell, P. R. (1976). “Neurological outcome of prolonged coma survivors of out-of-hospital cardiac arrest.” Stroke **7**(3): 279-82.

Comments: LOE P4, Poor quality (Small number of subjects, selective group of subjects who would typically be considered to have poor prognosis and were not typical of the general cardiac arrest population, physical examination and not a formal assessment scale), Opposing. 9 Subjects who all remained comatose after cardiac arrest. All subjects had substantial neurological abnormalities and 4 were in a persistent vegetative state. Considered excluding as this group was not representative of the larger population in question.

EXCLUDED ARTICLES

Abe T., Tokuda Y., Ishimatsu S. (2009). Predictors for good cerebral performance among adult survivors of out-of-hospital cardiac arrest. Resuscitation **80**(4): 431-436

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